# Orthodontic Assistant Program

## A staff training course to achieve the orthodontic assistant permit.

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ORTHODONTISTS

# Acknowledgements

**Our thanks to the following orthodontists for their immense contributions to this Orthodontic Assistant training curriculum:**

***Module 1***

**Introduction to Orthodontics**

*Written by BJ Runquist; Edited by Susan Zand*

***Module 2***

**Orthodontic Banding**

*Written by Michael Payne; Edited by Earl Johnson*

***Module 3***

**Removal of Orthodontic Bands & Cement**

*Written by Matt Molitor; Edited by Gerald Nelson*

***Module 4***

**Preparing Teeth for Bonding**

*Written by Michael Payne; Edited by Doug Jaul*

***Module 5***

**Bracket Placement & Removal**

*Written by Greg Nalchajian; Edited by Wanda Claro*

***Module 6***

**Archwire Characteristics & Properties**

*Written by Greg Adams; Edited by Earl Johnson*

***Module 7***

**Removal of Cement with Ultrasonics**

*CDA Course Tom Chin*

***Module 8***

**Updates in Orthodontics**

*Written by Rita Chuang, Doug Jaul, Melanie Parker and Mark Rashidi; Edited by Jeff Kwong*

The first seven modules were authored in 2010 with a comprehensive review in 2020 to ensure continued accuracy and relevance. The eighth module, Updates in Orthodontics, was added in 2020 to further supplement the assistant's knowledge level and understanding of newer concepts now routinely used in orthodontic settings.

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# Orientation

## Outline

1. Description of course
2. Review Dental Board of California Infection Control Regulations as it applies to orthodontic practice. See California Code of Regulations Title 16 Section 1005 – Minimum Standards for Infection Control included as a supplement for this orientation.
3. Review of laboratory and clinical training site emergency protocol
4. Patient requirements/criteria for clinical requirements at dental facility
5. Examination requirements
6. Procedures for handling dental patients during clinical practice
7. Supplies/equipment use
8. Demonstration of equipment within facility

# Dental Board of California Infection Control Regulations

**CALIFORNIA CODE OF REGULATIONS TITLE 16 SECTION 1005**

*California Code of Regulations Title 16 §1005.*
*Minimum Standards for Infection Control*

**a. Definitions of terms used in this section:**

1. "Standard precautions" are a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed infection status, in any setting in which healthcare is delivered. These include hand hygiene, use of gloves, gown, mask, eye protection, or face shield, depending on the anticipated exposure, and safe handling of sharps. Standard precautions shall be used for care of all patients regardless of their diagnoses or personal infectious status.
2. "Critical items" confer a high risk for infection if they are contaminated with any microorganism. These include all instruments, devices, and other items used to penetrate soft tissue or bone.
3. "Semi-critical items" are instruments, devices and other items that are not used to penetrate soft tissue or bone, but contact oral mucous membranes, non-intact skin or other potentially infectious materials (OPIM).
4. "Non-critical items" are instruments, devices, equipment, and surfaces that come in contact with soil, debris, saliva, blood, OPIM and intact skin, but not oral mucous membranes.
5. "Low-level disinfection" is the least effective disinfection process. It kills some bacteria, some viruses and fungi, but does not kill bacterial spores or mycobacterium tuberculosis var bovis, a laboratory test organism used to classify the strength of disinfectant chemicals.
6. "Intermediate-level disinfection" kills mycobacterium tuberculosis var bovis indicating that many human pathogens are also killed. This process does not necessarily kill spores.
7. "High-level disinfection" kills some, but not necessarily all bacterial spores. This process kills mycobacterium tuberculosis var bovis, bacteria, fungi, and viruses.
8. "Germicide" is a chemical agent that can be used to disinfect items and surfaces based on the level of contamination.
9. "Sterilization" is a validated process used to render a product free of all forms of viable microorganisms.
10. "Cleaning" is the removal of visible soil (e.g., organic and inorganic material) debris and OPIM from objects and surfaces and shall be accomplished manually or mechanically using water with detergents or enzymatic products.
11. "Personal Protective Equipment" (PPE) is specialized clothing or equipment worn or used for protection against a hazard. PPE items may include, but are not limited to, gloves, masks, respiratory devices, protective eyewear and protective attire which are intended to prevent exposure to blood, body fluids, and OPIM, and chemicals used for infection control. General work attire such as uniforms, scrubs, pants and shirts, are not considered to be PPE.
12. "Other Potentially Infectious Materials" (OPIM) means any one of the following:
    A. Human body fluids such as saliva in dental procedures and any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.
    B. Any unfixed tissue or organ (other than intact skin) from a human (living or dead).
    C. Any of the following, if known or reasonably likely to contain or be infected with HIV, HBV, or HCV:
        1. Cell, tissue, or organ cultures from humans or experimental animals;
        2. Blood, organs, or other tissues from experimental animals; or
        3. culture medium or other solutions.
13. "Dental Healthcare Personnel" (DHCP) are all paid and non-paid personnel in the dental health-care setting who might be occupationally exposed to infectious materials, including body substances and contaminated supplies, equipment, environmental surfaces, water, or air. DHCP includes dentists, dental hygienists, dental assistants, dental laboratory technicians (in-office and commercial), students and trainees, contractual personnel, and other persons not directly involved in patient care but potentially exposed to infectious agents (e.g., administrative, clerical, housekeeping, maintenance or volunteer personnel).

**b. All DHCP shall comply with infection control precautions and enforce the following minimum precautions to minimize the transmission of pathogens in health care settings mandated by the California Division of Occupational Safety and Health (Cal/OSHA).**

1. Standard precautions shall be practiced in the care of all patients.
2. A written protocol shall be developed, maintained, and periodically updated for proper instrument processing, operatory cleanliness, and management of injuries. The protocol shall be made available to all DHCP at the dental office.
3. A copy of this regulation shall be conspicuously posted in each dental office.

***Personal Protective Equipment:***

4. All DHCP shall wear surgical facemasks in combination with either chin length plastic face shields or protective eyewear whenever there is potential for aerosol spray, splashing or spattering of the following: droplet nuclei, blood, chemical or germicidal agents or OPIM. Chemical-resistant utility gloves and appropriate, task specific PPE shall be worn when handling hazardous chemicals. After each patient treatment, masks shall be changed and disposed. After each patient treatment, face shields and protective eyewear shall be cleaned, disinfected, or disposed.
5. Protective attire shall be worn for disinfection, sterilization, and housekeeping procedures involving the use of germicides or handling contaminated items. All DHCP shall wear reusable or disposable protective attire whenever there is a potential for aerosol spray, splashing or spattering of blood, OPIM, or chemicals and germicidal agents. Protective attire must be changed daily or between patients if they should become moist or visibly soiled. All PPE used during patient care shall be removed when leaving laboratories or areas of patient care activities. Reusable gowns shall be laundered in accordance with Cal/OSHA Bloodborne Pathogens Standards (Title 8, Cal. Code Regs., section 5193).

***Hand Hygiene:***

6. All DHCP shall thoroughly wash their hands with soap and water at the start and end of each workday. DHCP shall wash contaminated or visibly soiled hands with soap and water and put on new gloves before treating each patient. If hands are not visibly soiled or contaminated an alcohol based hand rub may be used as an alternative to soap and water. Hands shall be thoroughly dried before donning gloves in order to prevent promotion of bacterial growth and washed again immediately after glove removal. A DHCP shall refrain from providing direct patient care if hand conditions are present that may render DHCP or patients more susceptible to opportunistic infection or exposure.
7. All DHCP who have exudative lesions or weeping dermatitis of the hand shall refrain from all direct patient care and from handling patient care equipment until the condition resolves.

***Gloves:***

8. Medical exam gloves shall be worn whenever there is contact with mucous membranes, blood, OPIM, and during all pre-clinical, clinical, post-clinical, and laboratory procedures. When processing contaminated sharp instruments, needles and devices, DHCP shall wear heavy-duty utility gloves to prevent puncture wounds. Gloves must be discarded when torn or punctured, upon completion of treatment, and before leaving laboratories or areas of patient care activities. All DHCP shall perform hand hygiene procedures before donning gloves and after removing and discarding gloves. Gloves shall not be washed before or after use.

***Needle and Sharps Safety:***

9. Needles shall be recapped only by using the scoop technique or a protective device. Needles shall not be bent or broken for the purpose of disposal. Disposable needles, syringes, scalpel blades, or other sharp items and instruments shall be placed into sharps containers for disposal as close as possible to the point of use according to all applicable local, state, and federal regulations.

***Sterilization and Disinfection:***

10. All germicides must be used in accordance with intended use and label instructions.
11. Cleaning must precede any disinfection or sterilization process. Products used to clean items or surfaces prior to disinfection procedures shall be used according to all label instructions.
12. Critical instruments, items and devices shall be discarded or pre-cleaned, packaged or wrapped and sterilized after each use. Methods of sterilization shall include steam under pressure (autoclaving), chemical vapor, and dry heat. If a critical item is heat-sensitive, it shall, at a minimum, be processed with high-level disinfection and packaged or wrapped upon completion of the disinfection process. These instruments, items, and devices, shall remain sealed and stored in a manner so as to prevent contamination, and shall be labeled with the date of sterilization and the specific sterilizer used if more than one sterilizer is utilized in the facility.

13. Semi-critical instruments, items, and devices shall be pre-cleaned, packaged or wrapped and sterilized after each use. Methods of sterilization include steam under pressure (autoclaving), chemical vapor and dry heat. If a semi-critical item is heat sensitive, it shall, at minimum, be processed with high level disinfection and packaged or wrapped upon completion of the disinfection process. These packages or containers shall remain sealed and shall be stored in a manner so as to prevent contamination, and shall be labeled with the date of sterilization and the specific sterilizer used if more than one sterilizer is utilized in the facility.
14. Non-critical surfaces and patient care items shall be cleaned and disinfected with a California Environmental Protection Agency (Cal/EPA)-registered hospital disinfectant (low-level disinfectant) labeled effective against HBV and HIV. When the item is visibly contaminated with blood or OPIM, a Cal/EPA-registered hospital intermediate-level disinfectant with a tuberculocidal claim shall be used.
15. All high-speed dental hand pieces, low-speed hand pieces, rotary components, and dental unit attachments such as reusable air/water syringe tips and ultrasonic scaler tips, shall be packaged, labeled and heat-sterilized in a manner consistent with the same sterilization practices as a semi-critical item.
16. Single use disposable items such as prophylaxis angles, prophylaxis cups and brushes, tips for high-speed evacuators, saliva ejectors, air/water syringe tips, and gloves shall be used for one patient only and discarded.
17. Proper functioning of the sterilization cycle of all sterilization devices shall be verified at least weekly through the use of a biological indicator (such as a spore test). Test results shall be documented and maintained for 12 months.

***Irrigation:***

18. Sterile coolants/irrigants shall be used for surgical procedures involving soft tissue or bone. Sterile coolants/irrigants must be delivered using a sterile delivery system.

***Facilities:***

19. If non-critical items or surfaces likely to be contaminated are manufactured in a manner preventing cleaning and disinfection, they shall be protected with disposable impervious barriers. Disposable barriers shall be changed when visibly soiled or damaged and between patients.
20. Clean and disinfect all clinical contact surfaces that are not protected by impervious barriers using a California Environmental Protection Agency (Cal-EPA) registered, hospital grade low- to intermediate-level germicide after each patient. The low-level disinfectants used shall be labeled effective against HBV and HIV. Use disinfectants in accordance with the manufacturer's instructions. Clean all housekeeping surfaces (e.g. floors, walls, sinks) with a detergent and water or a Cal-EPA registered, hospital grade disinfectant. Products used to clean items or surfaces prior to disinfection procedures shall be clearly labeled and DHCP shall follow all material safety data sheet (MSDS) handling and storage instructions.
21. Dental unit water lines shall be anti-retractive. At the beginning of each workday, dental unit lines and devices shall be purged with air or flushed with water for at least two (2) minutes prior to attaching handpieces, scalers, air water syringe tips, or other devices. The dental unit lines and devices shall be flushed between each patient for a minimum of twenty (20) seconds.
22. Contaminated solid waste shall be disposed of according to applicable local, state, and federal environmental standards.

***Lab Areas:***

23. Splash shields and equipment guards shall be used on dental laboratory lathes. Fresh pumice and a sterilized or new rag-wheel shall be used for each patient. Devices used to polish, trim, or adjust contaminated intraoral devices shall be disinfected or sterilized, properly packaged or wrapped and labeled with the date and the specific sterilizer used if more than one sterilizer is utilized in the facility. If packaging is compromised, the instruments shall be recleaned, packaged in a new wrap, and sterilized again. Sterilized items will be stored in a manner so as to prevent contamination.
24. All intraoral items such as impressions, bite registrations, prosthetic and orthodontic appliances shall be cleaned and disinfected with an intermediate-level disinfectant before manipulation in the laboratory and before placement in the patient's mouth. Such items shall be thoroughly rinsed prior to placement in the patient's mouth.

**c. The Dental Board of California and the Dental Hygiene Committee of California shall review this regulation annually and establish a consensus.**

Note: Authority cited: Section 1614, Business and Professions Code. Reference: Section 1680, Business and Professions Code.

**HISTORY**

1. New section filed 6-29-94; operative 7-29-94 (Register 94, No. 26).
2. Repealer and new section filed 7-8-96; operative 8-7-96 (Register 96, No. 28).
3. Repealer of subsection (a)(5) and subsection renumbering, amendment of subsections (b)(7), (b)(10), (b)(18)-(19) and (b)(23) and repealer of subsection (c) and subsection relettering filed 10-23-97; operative 11-22-97 (Register 97, No. 43).
4. Change without regulatory effect amending subsection (b)(4) filed 12-7-98 pursuant to section 100, title 1, California Code of Regulations (Register 98, No. 50).
5. Amendment of subsections (b)(11), (b)(13) and (b)(15) filed 6-30-99; operative 7-30-99 (Register 99, No. 27).
6. Amendment filed 3-1-2005; operative 3-31-2005 (Register 2005, No. 9). 9.
7. Amendment operative 8-20-2011.

# Module 1

## Introduction to Orthodontic Practice

*By: BJ Runquist*

**PERFORMANCE OBJECTIVES**

**After completing the didactic study in Introduction to Orthodontic Practice, students will be able to:**

1. Demonstrate a basic understanding of orthodontic procedures including the necessary armamentarium and the role of the dental assistant
2. Describe the role of the auxiliary in patient treatment and patient education
3. Demonstrate patient instruction in appliance wear/care
4. Describe the design of a typical orthodontic practice
5. Define, spell and pronounce key words and concepts
6. Demonstrate general knowledge of eruption and exfoliation of teeth
7. Identify and classify the different types of malocclusion
8. Describe a habit and its effect on the dentition
9. Discuss the biggest differences between adult and adolescent treatment.
10. Differentiate between interceptive and corrective phases of orthodontic treatment
11. Describe the types of diagnostic records used in orthodontic treatment planning
12. Demonstrate knowledge of the OAP scope of practice guidelines within the California Dental Practice Act

# Outline

**DIDACTIC SESSION**

***8 Hours***

1. Introduction
    a. The orthodontic specialty practice
    b. The orthodontic assistant
    c. The orthodontic office
    d. Key words and concepts
2. Facial and Dental Discrepancies
    a. Eruption and exfoliation of teeth
    b. Classification of malocclusions
    3. Review Tooth Morphology and Oral Anatomy
    a. Primary vs. adult
    b. Shape, color and size
    c. Common terminology for soft and hard tissues
4. Treatment Sequencing
    a. Diagnostic records
    b. Preventative Treatment
    c. Interceptive Treatment
    d. Comprehensive Treatment
5. Role of the Auxiliary
    a. Diagnostic records
    b. Patient treatment
    c. Patient education
    d. Appliance wear/care instruction
6. Dental Practice Act
    a. Scope of Practice
    b. Requirements for licensing
    c. DA, OAP Duties included and NOT included
7. Infection Control
    a. Basic Infection Control
    b. Cross contamination

**WRITTEN FINAL EXAMINATION**

***1 Hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

# Didactic Material

**INTRODUCTION TO ORTHODONTICS AND PATIENT INFORMATION**

This section introduces you to the specialty practice of orthodontics. Much of this material is available in patient education brochures and *Orthodontics: A Patient Education Guide* made available by the American Association of Orthodontists. Many orthodontists are also making informative material available online, some with accompanying photos or videos. The wealth of information available and its easy access has helped patients become more educated and informed regarding their options, care and the benefits of seeking such care. You will need to have a working knowledge of this information to assist the orthodontist both in treating and informing patients.

**Definition of Orthodontist**

An orthodontist is a specialist in the diagnosis, prevention and treatment of dental and facial irregularities. They limit their practice to orthodontic treatment only. A general dentist may provide orthodontic services, just as they can perform the procedures of any other dental specialty, but without the additional training they cannot call themselves orthodontists.

All orthodontists are dentists, but only about six percent of dentists are orthodontists. Admission to orthodontic training programs is extremely competitive and selective. It takes many years to become an orthodontist, and the educational requirements are demanding. An orthodontist must complete college requirements before starting a three to five year graduate program at a dental school accredited by the American Dental Association (ADA).

After dental school, at least two or three academic years of advanced specialty education in an ADA-accredited orthodontic program are required to be an orthodontist. (The majority of accredited training programs are now three years in length.) The program includes advanced education in biomedical, behavioral and basic sciences and results in a master's degree, a certificate of training, or both. The orthodontic student learns the complex skills required to manage tooth movement (orthodontics) and guide facial development (dentofacial orthopedics). Only dentists who have successfully completed these advanced specialty education programs may call themselves orthodontists.

**The Orthodontic Assistant**

For assistants looking for an area of dentistry with greater autonomy, orthodontics is the specialty of choice. The orthodontic assistant is able to participate in many hands-on procedures. Depending upon the level of training (see section on The Dental Practice Act), the duties the orthodontic assistant is allowed to perform vary. They can include the taking of diagnostic records (intraoral and extraoral photos, intraoral 3D scans or impressions, study models, bite registrations, facebow transfers, digital or conventional x-rays); procedures during preliminary appointments (fitting of bands, preparing teeth for bonding); appliance adjustments (tying and untying archwires); appliance removal (aiding with debonding and debanding procedures, removing cement and adhesive materials by hand or with the aid of ultrasonics); retention (checking fit and condition of retainers); and patient education (reviewing instructions on the wear and care of various active and retentive orthodontic appliances, oral hygiene, etc.) and motivation (wearing elastics, being on time for appointments, cooperating with headgear, appliance wear, etc.).

**The Orthodontic Office**

Orthodontic offices are routinely designed differently than a general dental office. An open bay floor plan is typically used (meaning few separating walls and individual treatment rooms or operatories) and is geared for accommodating a large number of patients at the same time.

The office may have various treatment areas designed for certain procedures to be taking place simultaneously. For example, diagnostic study models may be taken in one area, diagnostic x-rays in another, a treatment consultation may be occurring in another area, patients may be in an "on-deck" waiting area, waiting to use the toothbrushing room or to be seen for their periodic adjustment appointment, while adult patients may have their treatment in a more secluded treatment room (similar to the separate dental treatment rooms in a general dental office).

The schedule can be quite busy, especially in the afternoon, as the bulk of the patients will be of school age and most parents try to have their children miss as little school as possible. For this reason the longer appointments like the placing of the orthodontic appliances (braces) and the removal (debanding and debonding) often take place in the morning, while the shorter appointments (adjustments, reties, retainer checks, emergencies) take place in the afternoon.

Most orthodontic offices have a sizable dental lab and may employ their own lab technician as diagnostic study models and appliances (e.g. retainers) are often made "in house".

**Orthodontic Terminology**

Throughout this course you will be exposed to terms and concepts that you will need to understand. This list is by no means exhaustive (see subsequent modules), and a good introductory textbook on orthodontics is highly recommended reading. See the glossary at the end of this module for a summary of key words and concepts covered in the module.

**Chronology of Emergence and Exfoliation**

It is important to have a general idea of what teeth you should expect to see in a patient's mouth at any given age. As you will come to learn, there can be a large age variation between individuals as far as when their deciduous teeth emerge, when they exfoliate and when the permanent teeth erupt.

Primary teeth – lateral and anterior views (see figures 1, 2)

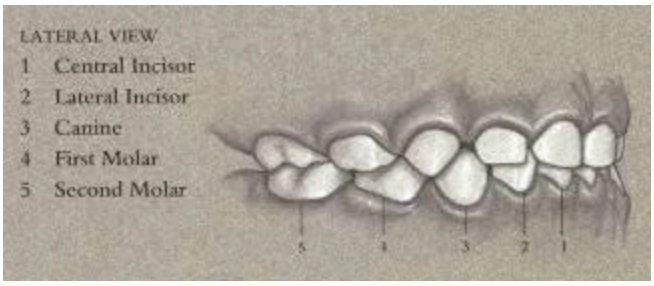



*Figure 1*

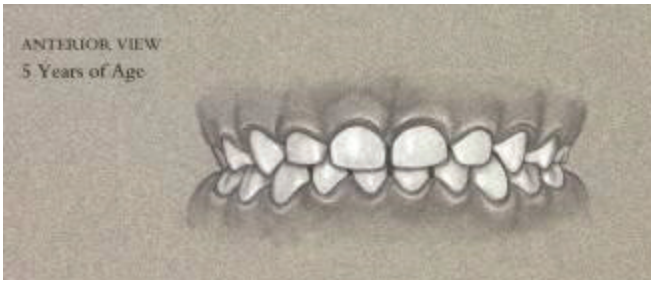



*Figure 2*

Maxillary arch – eruption (see figure 3)

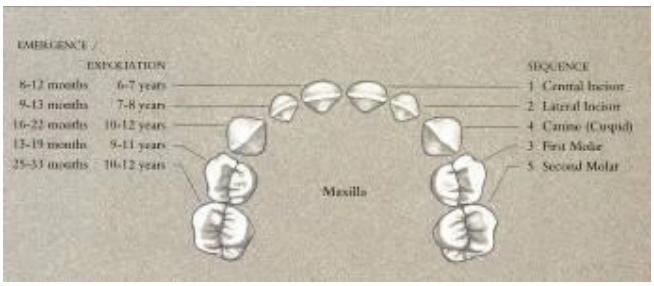



*Figure 3*

Mandibular arch – eruption (see figure 4)

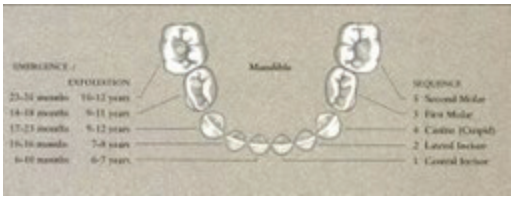



*Figure 4*

Permanent teeth – lateral and anterior views (see figures 5, 6)

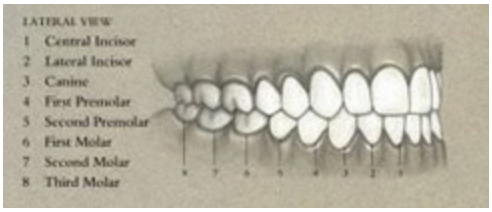



*Figure 5*

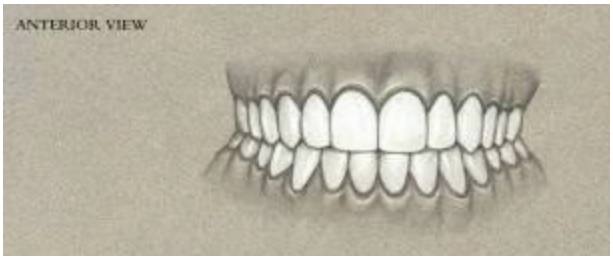



*Figure 6*

Maxillary arch – eruption (see figures 7, 8)

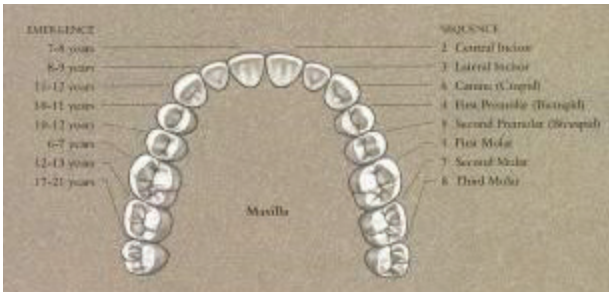



*Figure 7*

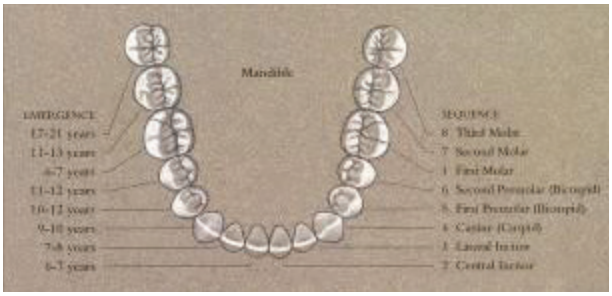



*Figure 8*

**Tooth Numbering Systems**

The orthodontic office will be communicating with many different general dental offices (as many offices may refer patients for specialty care), oral and maxillofacial surgery offices, as well as offices of other dental specialties. Referral forms will vary from office to office, but it is imperative that accurate information is being transmitted, especially when that information deals with the request for specific care, or perhaps removal of a specific tooth.

Numbering systems are used as a simplified means of identifying the teeth for charting and descriptive purposes. Three basic numbering systems are used, and the dental assistant must be familiar with each system.

***Universal/National System***

The system most often used in the United States is the Universal/National System, which was approved by the ADA in 1968. In this system the teeth are numbered from 1 to 32. Numbering begins with the upper right third molar (tooth #1), proceeds forward towards the central incisors and then works its way posteriorly to the upper left third molar (tooth #16). It then continues with the lower left third molar (tooth #17) and proceeds anteriorly and works back around to the lower right third molar (tooth #32).

The primary teeth are lettered with capital letters from A to T. Lettering begins with the upper right second primary molar (tooth A) and proceeds in the same fashion anteriorly and works around to the upper left deciduous second molar (tooth J). It then drops down to the lower left deciduous second molar (tooth K), comes forward and works back around to the lower right deciduous second molar (tooth T) (see figures 9a & 9b).

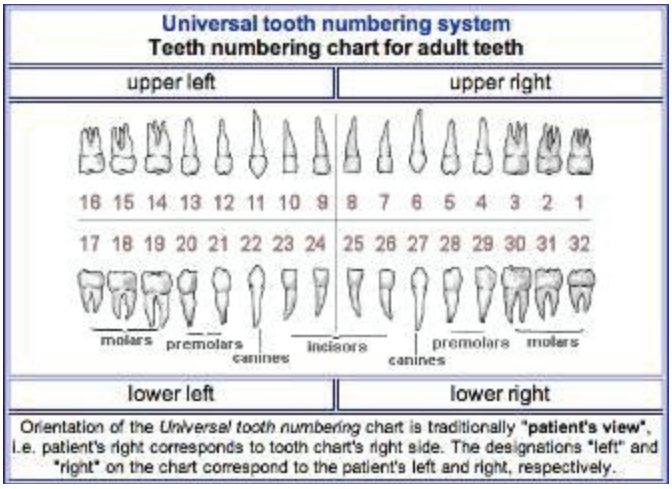



*Figure: 9a*

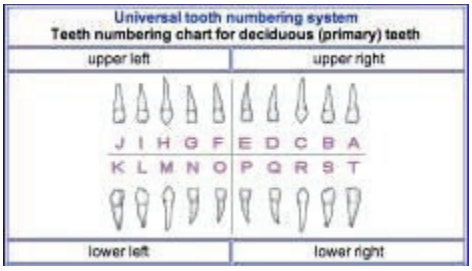



*Figure: 9b*

***International Standards Organization (ISO) System***

In 1996, the ADA also accepted the ISO system in addition to the Universal/National System. The ISO System is based on the Federation Dentaire Internationale (FDI) System and is used in most other countries (see figure 10).

**FDI Two-Digit Notation**

| Permanent teeth | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| upper right | | | | | | | | upper left | | | | | | | |
| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
| lower right | | | | | | | | lower left | | | | | | | |
| **Deciduous teeth (baby teeth)** | | | | | | | | | | | | | | | |
| upper right | | | | | | | | upper left | | | | | | | |
| | | | 55 | 54 | 53 | 52 | 51 | 61 | 62 | 63 | 64 | 65 | | | |
| | | | 85 | 84 | 83 | 82 | 81 | 71 | 72 | 73 | 74 | 75 | | | |
| lower right | | | | | | | | lower left | | | | | | | |

*Figure: 10*

The ISO/FDI system uses a two-digit tooth-recording system. The first digit indicates the quadrant, and the second digit indicates the tooth within the quadrant, with the numbering from the midline toward the posterior.

Permanent teeth are numbered as follows:

- The maxillary right quadrant is digit 1 and contains teeth #11 to #18
- The maxillary left quadrant is digit 2 and contains teeth #21 to #28
- The mandibular left quadrant is digit 3 and contains teeth #31 to #38
- The mandibular right quadrant is digit 4 and contains teeth #41 to #48

Primary teeth are numbered as follows:

- The maxillary right quadrant is digit 5 and contains teeth #51 to #55
- The maxillary left quadrant is digit 6 and contains teeth #61 to #65
- The mandibular left quadrant is digit 7 and contains teeth #71 to #75
- The mandibular right quadrant is digit 8 and contains teeth #81 to #85

The digits should be pronounced separately. For example, the permanent canines are teeth #1-3 ("number one-three"), #2-3 ("number two-three"), #3-3 ("number three- three"), and #4-3 ("number four-three").

***Palmer Notation System***

In the Palmer Notation System, each of the four quadrants is given its own tooth bracket made up of a vertical line and a horizontal line (see figure 11). The Palmer method is a shorthand diagram of the teeth presented as if one is viewing the patient's teeth from in front of them. The teeth in the right quadrant would have the vertical midline bracket to the right of the tooth numbers or letters, just as when one is looking at the patient. The midline is to the right of the teeth in the right quadrant.

**Palmer notation**

| Permanent Teeth | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| upper right | | | | | | | | upper left | | | | | | | |
| 8⌋ | 7⌋ | 6⌋ | 5⌋ | 4⌋ | 3⌋ | 2⌋ | 1⌋ | L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 |
| 8⌝ | 7⌝ | 6⌝ | 5⌝ | 4⌝ | 3⌝ | 2⌝ | 1⌝ | ⌜1 | ⌜2 | ⌜3 | ⌜4 | ⌜5 | ⌜6 | ⌜7 | ⌜8 |
| lower right | | | | | | | | lower left | | | | | | | |

| Deciduous teeth (baby teeth) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| upper right | | | | | | | | upper left | | | | | | | |
| | | | E⌋ | D⌋ | C⌋ | B⌋ | A⌋ | LA | LB | LC | LD | LE | | | |
| | | | E⌝ | D⌝ | C⌝ | B⌝ | A⌝ | ⌜A | ⌜B | ⌜C | ⌜D | ⌜E | | | |
| lower right | | | | | | | | lower left | | | | | | | |

*Figure: 11*

For example, if the tooth is a maxillary tooth, the number or letter should be written above the horizontal line of the bracket, thus indicating an upper tooth. Conversely, a mandibular tooth symbol should be placed below the line, indicating a lower tooth.

The number or letter assigned to each tooth depends on its position relative to the midline. For example, central incisors, the teeth closest to the midline, have the lowest number, 1, for permanent teeth and the letter A for primary teeth. All central incisors, maxillary and mandibular, are given the number 1. All lateral incisors are given the number 2, all canines are given the number 3, first premolars are the number 4 and second premolars 5, first molars are 6, second molars are 7, and third molars are number 8.

**Orthodontic Records and Treatment Planning**

Prior to initiating a course of treatment certain information must be obtained. The first step in determining a treatment plan is for the orthodontist to learn as much about the orthodontic condition as possible. The patient's first orthodontic appointment is devoted to obtaining records. These records are needed for the orthodontist to make a diagnosis and devise a treatment plan.

***Medical and Dental History***

Careful medical and dental histories are necessary to provide a comprehensive understanding of the physical condition and to evaluate specific orthodontically related concerns. Typically, there is a chief complaint, either from the patient, his or her parents or the referring dentist, specialist or other health care provider.

***Physical Growth Evaluation***

Because orthodontic treatment in children is closely related to growth stages, it is necessary to evaluate a child's physical growth status. Questions are asked about how rapidly the child has grown recently and about signs of sexual maturation. In general, females tend to have their adolescent growth spurt one to two years earlier than males. This can easily be detected with height measurements and the acceleration can be seen as early as nine and a half years old for females (typically ten and a half or eleven) or ten and a half for males (but, again, typically a bit later, closer to twelve and a half or thirteen (see figure 12).

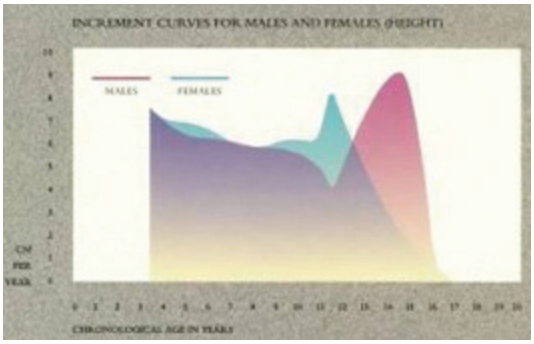



*Figure: 12*

You will note in this chart that the mean age for the fastest increase in height is approximately at 11.5 years of age for girls and 14.5 for boys. As the child develops their mandibles go through a series of three growth spurts or accelerations (see figures 13, 14).

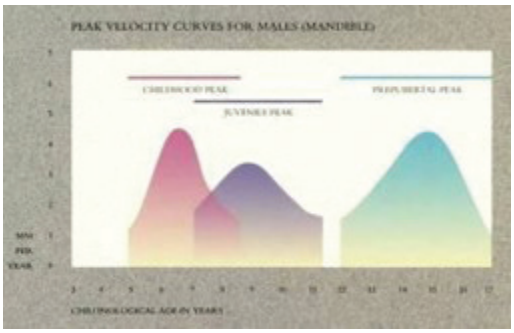



*Figure: 13*

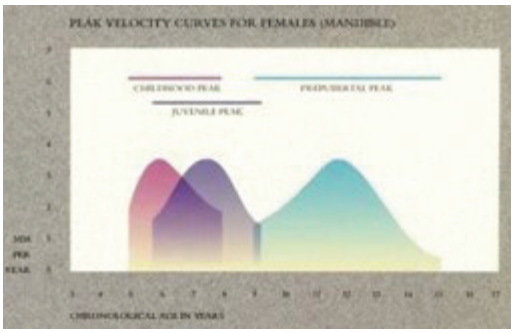



*Figure: 14*

As orthodontists are attempting to improve both facial balance as well as dental alignment, they frequently try to take advantage of this. However, due to the individual variations that exist in the timing, amount and number of these accelerations, it is quite difficult to predict mandibular growth in any one specific patient. It is for this reason that it is beneficial for a child to see an orthodontist as soon as a problem is recognized. This allows for corrective treatment to be initiated at the age that is best for that child.

***Social and Behavioral Evaluation***

Motivation for seeking treatment is very important. What does the patient expect as a result of treatment? How cooperative or uncooperative is the patient likely to be? A major motivation for orthodontic treatment for children is the parent's desire for treatment; however, it is essential that the child be willing and cooperative. The typical child accepts orthodontic treatment in a positive way.

Adults tend to seek orthodontic treatment for themselves for other reasons, including the need to improve personal appearance or function of the teeth. It is important to explore the reasons why an adult patient seeks treatment.

**Clinical Examination**

The purpose of the orthodontic clinical examination is to document, measure, and evaluate the facial aspects, the occlusal relationship, and the functional characteristics of the jaws. At the initial evaluation visit, the orthodontist decides which diagnostic records are required for the patient.

***Evaluation of Facial Esthetics***

A reasonable goal for orthodontic treatment is to recognize and improve facial symmetry by correcting disproportion.

In frontal evaluation, the face is examined for the following:

- Bilateral symmetry
- Size and proportion of midline to lateral structures
- Vertical proportionality

In the profile evaluation, their profile relationship is analyzed for the following reasons:

- To determine whether the jaws are proportionally positioned
- To evaluate lip protrusion (excessive lip protrusion most often is caused by protrusion of the incisors)
- To evaluate the vertical facial proportions and the mandibular plane angle

***Evaluation of Oral Health***

A thorough hard and soft tissue examination, as well as an oral hygiene assessment and prophylaxis, must be completed before any orthodontic treatment can begin. Charting of periodontal pockets must be noted. If necessary, the patient is referred for the treatment of these problems before orthodontic treatment is started.

***Evaluation of the Jaw and Occlusal Function***

The orthodontist examines the patient's occlusion and palpates the TMJ to evaluate function. Lateral or anterior shifts of the mandible on closure are of special interest for orthodontic purposes as many practitioners feel the TMJs are the foundation of the occlusion.

**Diagnostic Records**

Before the treatment plan can be completed, diagnostic records are required in the form of photographs, radiographs and diagnostic study models.

***Photographs***

Photographs capture the color, shape, texture, and characteristics of intraoral and extraoral structures. Photography also is useful as an aid in patient identification, treatment planning, case presentation, case documentation and patient education. Some offices may use computer programs that can morph pre-treatment photos to give a reasonable estimate of what the face may look like after treatment. This is most commonly done when the malocclusion is so severe that both tooth movement and jaw movement (surgery) will be required.

***Radiographs***

The type of radiograph that is exposed most commonly for an orthodontic patient is the cephalometric radiograph. This extraoral radiograph makes it possible to evaluate the anatomic bases for malocclusion: skull, bones and soft tissue (see figure 15).

*Figure: 15*

Serial cephalometric radiographs taken at intervals before, during and after treatment can be superimposed to study changes in jaw and tooth positions, due both to the growth that has occurred as well as the treatment that was rendered. They can also be used to determine when jaws have completed growth and subsequently when it is permissible to proceed with orthognathic surgery (in patients where excessive jaw growth is the concern).

Advances in radiology have led to newer techniques (e.g. cone beam imaging) and many offices are taking advantage of the benefits of 3-dimensional images. From a single exposure any number of diagnostic images can be generated.

***Cephalometric Analysis***

Cephalometric analysis is not completed on the radiograph but instead is performed as a tracing or a computerized drawing that emphasizes the relationships among selected points. Cephalometric landmarks are represented as a series of points, making it possible for the orthodontist to compute mathematical descriptions and measurements of the status of the skull. From these measurements the orthodontist can analyze growth patterns and use this information to help determine which type of treatment should be provided for the patient.

***Diagnostic Study Models***

Diagnostic study models are used for the diagnosis and case presentation of the orthodontic patient. The diagnostic study model for orthodontics is commonly made from plaster or stone and is constructed in a precise and finished manner. Some offices routinely mount these models in an articulator which mimics the hinge axis of the patient's TMJ and orients their occlusion with respect to their jaw joints. It involves a facebow transfer and interocclusal bite registration, typically taken in dead soft wax or via quick setting registration putty.

**Case Presentation**

The orthodontist reviews the information gathered and develops a treatment plan and cost estimate for the patient in preparation for the case presentation. Approximately one hour is reserved for the case presentation visit. If the patient is younger than 18 years of age, an adult who is responsible for the child should also be present. At this visit, the orthodontist uses the photographs, radiographs, cephalometric tracing, diagnostic models and other aids to present the diagnosis and treatment plan. The treatment presentation is sometimes done at the first visit and also can be done as a separate appointment. The presentation includes the approximate length of treatment and a clear statement of the responsibility of the patient in helping to ensure successful completion.

Once treatment has been accepted, the adult or the legal guardian signs a consent form. This consent form clearly states the information delineated during the case presentation. It covers risks, benefits and alternatives, and the risks and benefits of those alternatives as well.

**Understanding Occlusion**

To comprehend the importance of occlusion, it is necessary to understand differences among individuals in the size and shape of the jaw, occlusions, and the reasons why some teeth become crowded. In most cases, malocclusion and dentofacial deformities result from moderate distortions of normal development. The orthodontic problems of most people result from the interaction of developmental, genetic, environmental, and functional influences.

***Development Causes***

Disturbances of dental development can accompany major congenital defects however they occur more frequently as isolated findings. The most commonly encountered developmental disturbances include the following:

Congenitally missing teeth – teeth never develop (patient is born without the tooth bud which forms a tooth)

Malformed teeth – irregular formation of the teeth with defects in shape or color

Supernumerary teeth – extra teeth develop in the jaws

Interferences with eruption – an impaction in which eruption is blocked or the tooth is forced to erupt into an abnormal position)

Ectopic eruption – teeth erupt in an unusual location in the jaws

***Genetic Causes***

Genetic causes are responsible for malocclusion when there are discrepancies in the size of the jaw and/or the size of the teeth. This happens more commonly when the child inherits a small jaw from one parent and larger teeth from the other parent. If you have a congenitally missing tooth, it is likely that one of your parents or grandparents has the same missing tooth.

***Environmental Causes***

**Birth Injuries:** Injuries can occur at birth in two major categories—fetal molding and trauma during birth. Fetal molding occurs when an arm or leg of the fetus is pressed against another part of the body, such as when an arm is abnormally pressed against the mandible. This pressure can lead to distortion of rapidly growing areas. Trauma during birth such as an injury to the jaw, may occur during the actual birth, particularly from the use of forceps in delivery.

**Injury Throughout Life:** Trauma to the teeth can occur at any time. Dental trauma can lead to the development of malocclusion in three ways:

- Damage to permanent tooth buds when an injury to primary teeth has occurred
- Movement of a tooth or teeth as a result of premature loss of a primary tooth
- Direct injury to permanent teeth

**Angle's Classification of Occlusion**

Occlusion is defined as the relationship between the maxillary and mandibular teeth when the upper and lower jaws are in a fully closed position. Occlusion related problems could affect the teeth, joints and muscles of the head and neck and can lead to periodontal trauma.

Occlusion develops in a child as the primary teeth erupt. Habits such as thumb-sucking or improper swallowing patterns can affect the occlusion. Proper occlusion of erupting permanent teeth depends on the occlusion of the primary teeth as they exfoliate or are shed. Correction of improper occlusion is one of the goals of orthodontic treatment.

Angle's classification system was developed by Dr. Edward H. Angle (1855-1930; the founder and father of modern orthodontics) to describe and classify occlusion and malocclusion.

The basis of this system is that the permanent maxillary first molar is the key to occlusion. Angle's system assumes that the patient is occluding in a centric position. He classified the dentition into four groups: Normal occlusion and Class I, II and III malocclusion.

Normal occlusion – has the same first molar relationship of the Class I malocclusion, but the rest of the teeth are properly aligned (see figure 16).

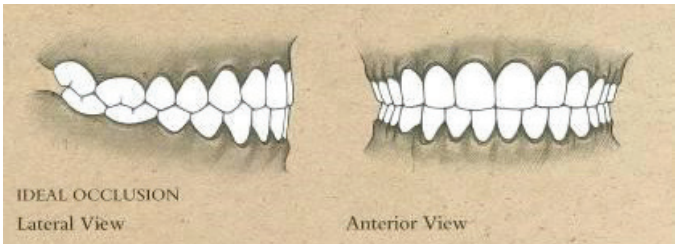



*Figure: 16*

Class I malocclusion (neutroclusion) – the mesiobuccal cusp of the permanent maxillary first molar occludes with the mesiobuccal groove of the mandibular first molar but there is malalignment e.g. crowding (see figure 17) or spacing (see figure 18).

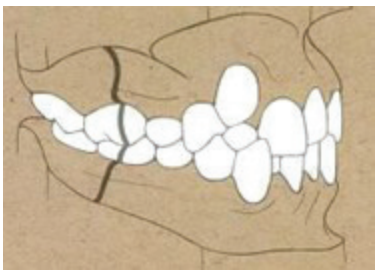


*Figure: 17*

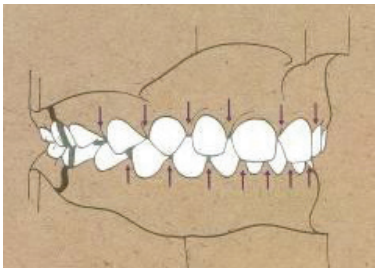


*Figure: 18*

Class II malocclusion (distoclusion) – the mesiobuccal cusp of the first maxillary molar occludes mesial to the mesiobuccal groove of the mandibular first molar (e.g. the mandibular molars are posterior to the maxillary molars).

Divisions are as follows:

Class II Division 1. Distoclusion in which the maxillary incisors are typically in extreme labioversion (see figure 19).

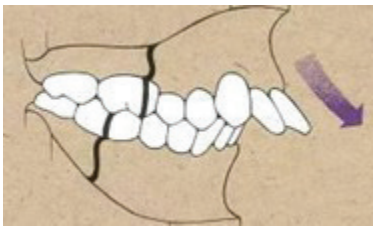


*Figure: 19*

Class II Division 2. Distoclusion in which the maxillary central incisors are near normal anteroposteriorly or slightly in linguoversion, whereas the maxillary lateral incisors have tipped labially and mesially (see figure 20).

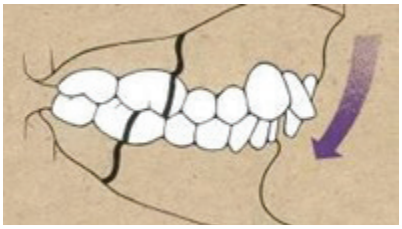


*Figure: 20*

Subdivisions – When the distoclusion occurs on only one side of the dental arch, it is referred to as a subdivision of its division (e.g. Class II Div 2, subdivision right if the distoclusion exists only on the right).

Class III malocclusion (mesioclusion) – The mesiobuccal groove of the mandibular first molar occludes mesial to the mesiobuccal cusp of the maxillary first molar (see figures 21, 22).

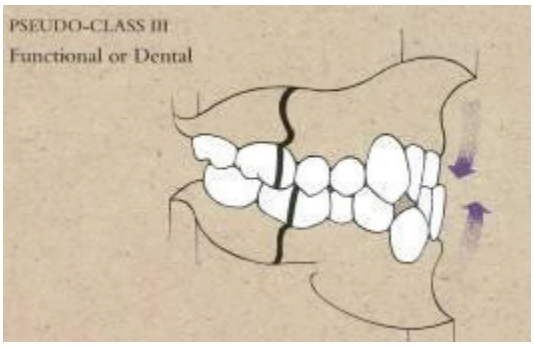



*Figure: 21*

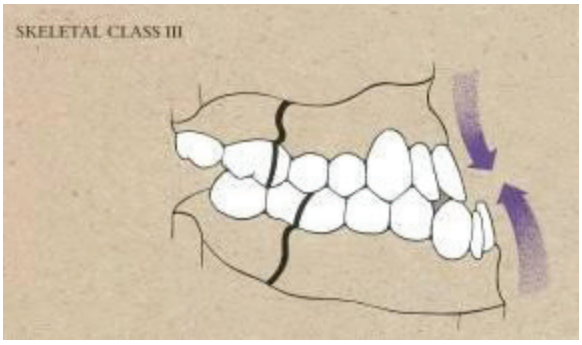



*Figure: 22*

When recording the dental classification, the orthodontists may state in millimeters the amount by which the molar relationship deviates from class I. The extent to which the cuspid occlusion deviates as well may be noted at the same time, again, possibly with the addition of millimeter measurements.

**Compromised Occlusions**

When a posterior tooth, such as a permanent first molar, is extracted and is not replaced, deterioration of the entire bite may occur:

- Adjacent teeth drift into the extraction space; contacts between these teeth are lost; spaces develop, and food becomes lodged between the teeth.
- The mandibular dentition collapses; a deep overbite occurs; proper contact with the maxillary teeth is lost, and the mandibular incisors impinge on the palatal mucosa (impinging overbite).
- The opposing maxillary molar overerupts and extrudes into the extraction space; the contacts between adjacent maxillary teeth are lost, and food becomes lodged between these teeth.
- These conditions can result in periodontal disease and further loss of teeth.
- With the occlusion now totally disrupted, cusp interferences may create a functional displacement of the mandible, resulting in possible involvement of the temporomandibular joint (see figure 23).

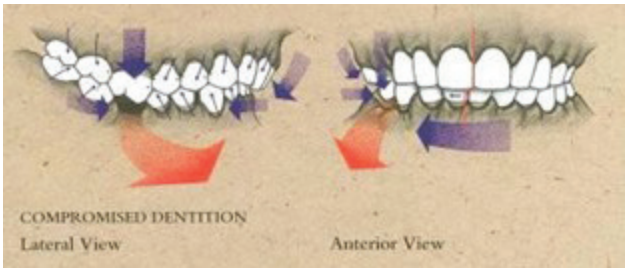



*Figure: 23*

The following are possible adult conditions, some of which could have a negative impact on their occlusion.

- discoloration of teeth – age related
- occlusal wear – possibly from parafunction (e.g. grinding or bruxing) or from age
- uneven wear – tipped teeth interproximal wear – large contact areas abrasion
- recession
- gingival inflammation caries
- root caries recurrent caries abscesses extracted teeth drifting teeth tipped teeth
- open contact areas food impaction
- periodontal degeneration bone loss
- injured teeth
- discoloration of teeth - devitalized root canal restorations
- porcelain veneer restorations osseointegrated implants
- porcelain fused to metal crowns (PFM) amalgam restorations
- composite resin restorations bridges
- excessive overbite
- congenital absence of third molars
- supra-eruption of third molars
- functional interferences
- temporomandibular disorders

**Crowding of Teeth**

Crowding is the most common contributor to malocclusion. One or many teeth can be involved.

***Hereditary Factors***

The following are examples of tooth-size and jaw-size discrepancies that result in crowding that may require the extraction of certain permanent teeth for correction:

Premature exfoliation of one primary mandibular canine resulting in a dental midline discrepancy (see figure 24).

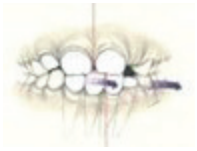


*Figure: 24*

*Figure: 25*

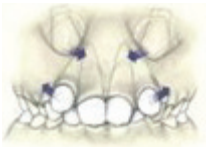


*Figure: 26*

Lingual displacement of one permanent mandibular lateral incisor resulting in a dental midline discrepancy. Ectopic eruption of a permanent maxillary first molar (see figure 25).

Splayed maxillary lateral incisors resulting from crowding in the root area. Insufficient space for the unerupted permanent canines creates pressure on the roots of the incisors. Bulging of the mucosa area is frequently indicative of the situation (see figure 26).

***Environmental Factors***

Environmental factors may be corrected by the regaining of space and treated without the extraction of permanent teeth. The following are examples of malposition of teeth that may be the result of environmental influences:

Premature loss of the primary maxillary second molars with unfavorable drifting of the permanent molars, resulting in a lack of space for the erupting second premolars (see figure 27).

*Figure: 27*

*Figure: 28*

*Figure: 29*

Prolonged retention of the primary maxillary second molar, causing a deflection of the erupting first premolar and a lack of space for the permanent canine (see figure 28).

Prolonged retention of the primary second molar associated with uneven resorption of its roots causing the permanent premolar to be displaced to one side out of alignment (see figure 29).

**Spacing of Teeth**

***Hereditary Factors***

The following are examples of tooth-size, jaw-size discrepancies that result in spacing. These conditions may require the use of restorative dentistry in conjunction with orthodontic treatment for complete correction.

Congenital absence of a permanent maxillary right lateral incisor* and a relatively small left lateral incisor (peg lateral)** (see figure 30).

*Figure: 30*

*Figure: 31*

*Figure: 32*

Tooth size, jaw size discrepancy resulting from relatively small teeth (see figure 31).

Supernumerary tooth positioned between the permanent maxillary central incisors (see figure 32).

***Environmental Factors***

The following are examples of malposition of teeth that may be the result of environmental influences which may be corrected by the removal of the causative factor prior to or during orthodontic treatment.

Muscle imbalance of a strong tongue force on the inside of the teeth and a weak lip force on the outside resulting in a dental protrusion with spaces (see figure 33).

*Figure: 33*

*Figure: 34*

*Figure: 35*

An excessive amount of gingival tissue between the permanent maxillary central incisors (labial frenum) (see figure 34).

Unfavorable placement of the thumb and the lower lip behind the permanent maxillary incisors causing a dental protrusion with spaces (see figure 35).

**Classification of the Face**

Facial classification is done in the vertical and horizontal dimensions.

***Vertical***

When we analyze a person's face in the vertical orientation we observe two extreme types: High Angle (Hyperdivergent) and Low Angle (Hypodivergent).

High Angle (hyperdivergent) means that a line coincident with the base of the cranium crosses a line coincident with the lower border of the mandible at a relatively large angle (see figure 36). Low Angle means that the angle is relatively small (see figure 37). Most faces are situated between these two extremes.

High Angle Characteristics

- Narrow head (dolicochalic)
- Long, narrow face
- Anterior face height long relative to posterior
- Ectomorphic body type
- Stooped posture

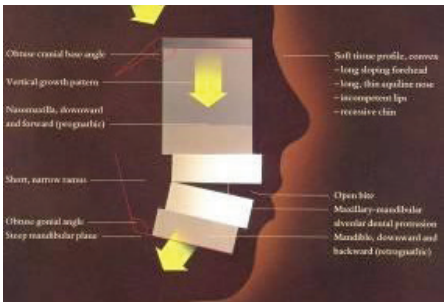



*Figure: 36*

Low Angle Characteristics

- Wide head (brachycephalic)
- Short, broad face (brachycephalic)
- Anterior face height approximately equals posterior
- Mesomorphic to endomorphic body type
- Erect posture

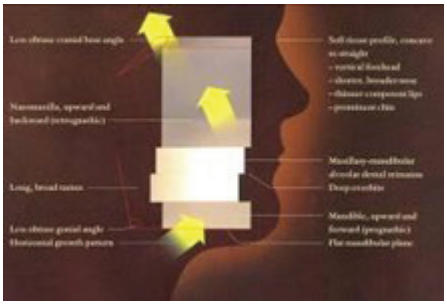


*Figure: 37*

***Horizontal***

When we analyze a person's face from the profile view, we observe the following types:

**CLASS I**

It is not sufficient to categorize orthodontic malocclusion on the basis of a classification of the teeth alone. The relationship with other craniofacial structures must also be taken into consideration. For instance, a Class I dentition may be associated with a variety of craniofacial features which might necessitate totally different treatment plans. Class I malocclusions occur more frequently than either Class II or Class III. They constitute 55 percent of all malocclusions. This varies ethnically.

Possible combinations of Class I faces

1. Maxillary–mandibular alveolar dental protrusion – teeth (see figure 38).

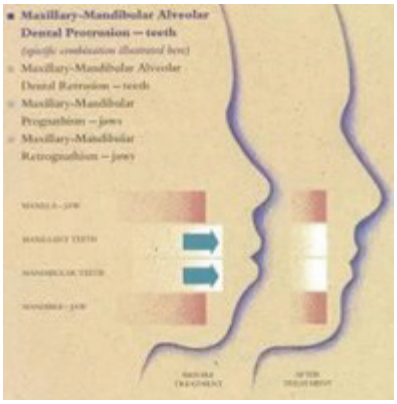



*Figure 38: Also called bimaxillary protrusion, this is an example of a Class I dental malocclusion that may require the extraction of teeth for corrections.*

2. Maxillary-mandibular alveolar dental retrusion – teeth (see figure 39).

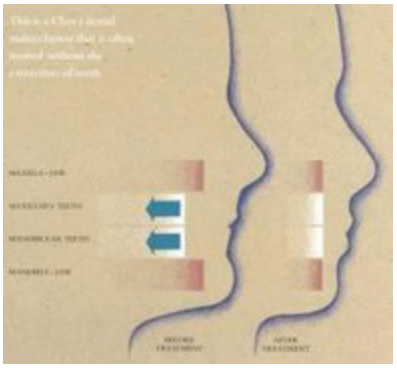


*Figure 39: Also called bimaxillary retrusion, this is an example of a Class I dental malocclusion that is often treated without the extraction of teeth.*

3. Maxillary-mandibular prognathism – jaws
4. Maxillary-mandibular retrognathism – jaws

**CLASS II**

Class II malocclusions constitute 32 percent of all malocclusions. Again, this will vary ethnically.

Possible combinations of Class II faces

1. Maxillary alveolar dental protrusion – teeth (see figures 40, 41).

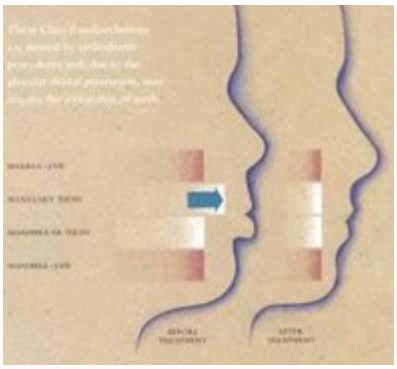


*Figure 40: This figure illustrates this specific combination, where only the protrusion of the upper teeth are contributing to the Class II malocclusion, the remaining possible contributing factors are within the range of normal. These Class II malocclusions are treated by orthodontic procedures and, due to the alveolar dental protrusion, may require the extraction of teeth).*

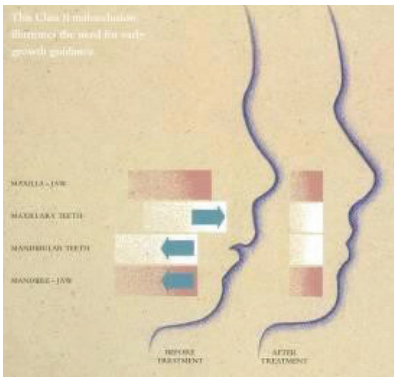


*Figure 41: This figure illustrates this specific combination, where protrusion of the upper teeth and a retrognathic mandible are both contributing to the Class II malocclusion and facial profile. This Class II malocclusion illustrates the need for early growth guidance.*

2. Mandibular alveolar dental retrusion – teeth
3. Maxillary prognathism – jaws
4. Mandibular retrognathism – jaws see figure 42).

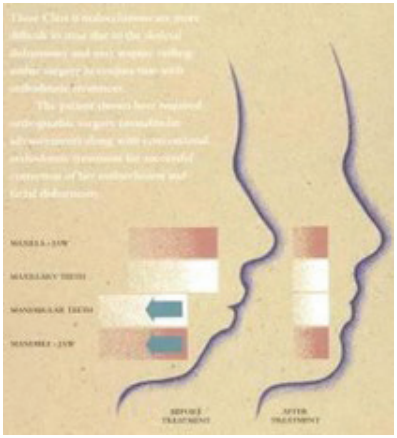


*Figure 42: These Class II malocclusions are more difficult to treat due to the skeletal disharmony and may require orthognathic surgery in conjunction with orthodontic treatment, as illustrated.*

**CLASS III**

Class III malocclusions constitute 3 percent of all malocclusions. Like Class I and II, this percentage will vary ethnically.

Possible combinations of Class III faces

1. Maxillary alveolar dental retrusion – teeth
2. Mandibular alveolar dental protrusion – teeth (see figure 43).

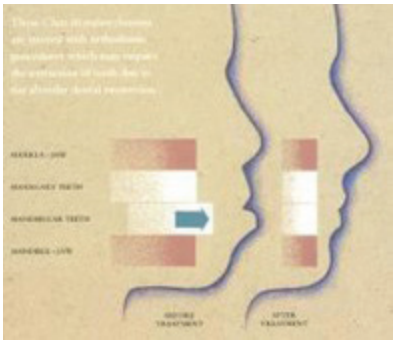


*Figure 43: These Class III malocclusions are treated with orthodontic procedures which may require the extraction of teeth due to the alveolar protrusion.*

3. Maxillary retrognathism – jaws
4. Mandibular prognathism – jaws see figure 44).

*Figure 44: These Class III malocclusions are more difficult to treat due to the skeletal disharmony and may require orthognathic surgery (when the jaw has finished growing) in conjunction with orthodontic treatment, as this illustration demonstrates).*

**Treatment**

Treatment protocol cannot be generalized. Early treatment (carried out prior to the emergence of all the permanent teeth) may be appropriate for some patients but not for others. The timing of treatment depends on the circumstances.

A. Interceptive Guidance (I.G.) Active Treatment (A.T.) vs. One Phase (see figure 45).

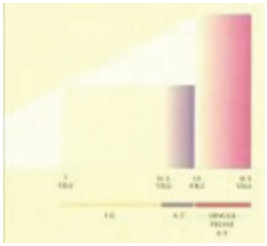


*Figure 45*

B. First Phase, Interceptive Treatment/Observation; Second Phase, Active Treatment vs. One Phase (see figure 46).

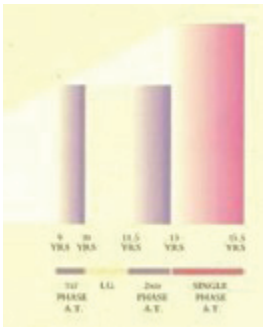


*Figure 46*

C. One Phase, Active Treatment (see figure 47).

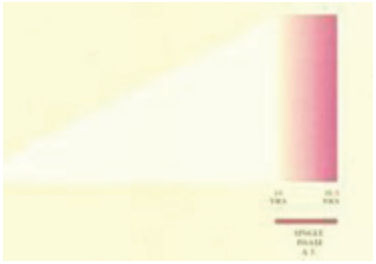


*Figure 47*

D. Adult Treatment

Adult treatment must be diagnosed and managed somewhat differently from treatment that is carried out prior to maturity. In the adult, growth and development of the face has virtually ceased. Quite often, adult treatment is a compromise due to this lack of growth. Additional complications such as periodontal breakdown, loss of teeth, or temporomandibular disorders frequently make adult care a cooperative effort involving several members of the dental team. (see figure 48).

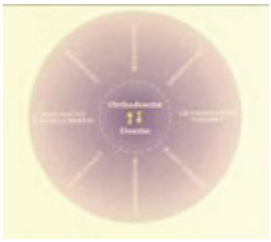


*Figure 48*

**INTERCEPTIVE GUIDANCE/ACTIVE TREATMENT**

Interceptive orthodontics allows the orthodontist to intercede or correct problems as they develop. Interceptive orthodontics includes the following:

- Correction of a crossbite through the use of a removable or fixed appliance
- Correction of a jaw size discrepancy through the use of a removable or fixed appliance
- Reducing the risk of trauma to protruding front teeth
- Use of appliances cemented in place to correct oral habits such as thumb sucking that may be damaging to the permanent dentition and have an adverse effect on the development of the jaws (see figure 49)

*Figure 49*

- Early detection of genetic and congenital anomalies that may influence dental development
- Supervision of the natural exfoliation (shedding) of the primary teeth. If retained for too long, primary teeth may cause permanent teeth to erupt out of alignment or to be impacted
- Extraction of primary teeth that may be contributing to malalignment of the permanent dentition

Space management is important in orthodontic treatment. There are malocclusions that require the preservation of space during the developmental years. Others require the extraction of teeth to provide space.

***Space Maintenance***

Using a space maintainer can save space for the eruption of permanent teeth. (see figures 50, 51).

*Figure 50: Space maintainers most often are cemented into place to ensure wear and avoid loss and are retained until the permanent tooth erupts.*

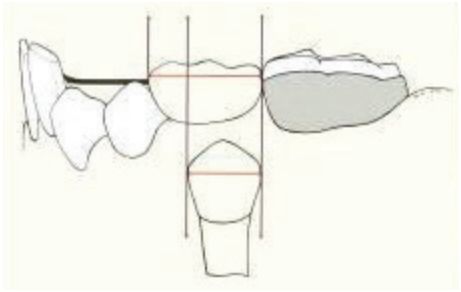


*Figure 51: Leeway space is the difference between the combined widths of the three buccal primary teeth (canine and two molars) and their permanent successors (canine and two premolars). The maintenance of the leeway space can help orthodontists gain up to 3mm of space.*

A thorough diagnosis should be carried out prior to the placement of a space maintainer, or the initiation of serial extraction, to determine if the patient's malocclusion is to be treated with or without the extraction of permanent teeth.

***Serial Extractions***

Extractions are typically reserved for a very specific type of malocclusion, i.e. when a decision has been made during the early mixed dentition that expansion is fruitless and that some permanent teeth will need to be removed. It can, however, also be used in less crowded malocclusions where it stops short of the removal of permanent teeth.

It is a planned sequence of tooth removal that can reduce crowding and irregularity during the transition from the primary to the permanent dentition. It will also allow the teeth to erupt over the alveolus and through keratinized tissue, rather than being displaced buccally or lingually. This sequence involves the timed extraction of primary and ultimately, when the crowding is severe, permanent teeth as well (as illustrated below).

Step 1: Crowded mixed dentition prior to serial extractions – the extraction of the primary canines (see figure 52).

*Figure 52*

Step 2: The extraction of the primary first molars (see figure 53). Relieving the crowding in the apical area of the permanent lateral incisor by extracting the primary first molar accelerates the eruption of the first premolar, which may prevent the impaction of the canine. Timing is important, and it may be done in patients that are being treated either with or without extraction of permanent teeth.

*Figure 53*

Step 3: The extraction of the permanent first premolars (see figure 54).

*Figure 54*

Step 4: The extractions have been completed, the patient is almost ready for appliances (braces) (see figure 55).

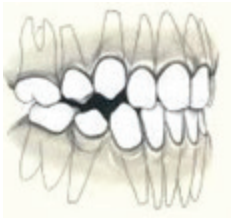


*Figure 55*

Step 5: Appliance required to complete treatment (see figure 56).

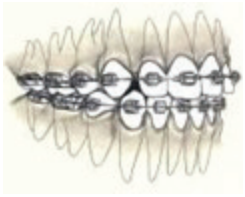


*Figure 56*

Step 6: Treatment completed (see figure 57).

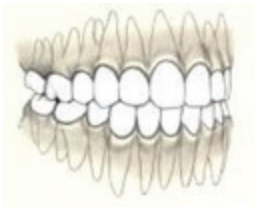


*Figure 57*

**FIRST PHASE, INTERCEPTIVE TREATMENT/OBSERVATION; SECOND PHASE, ACTIVE TREATMENT**

Patients with protruding maxillary incisors may benefit from early treatment. The retraction of the incisors creates a more normal relationship between the lips, teeth, tongue and jaws. It also reduces the risk of injury to the incisor teeth (see figure 58 for an illustration of how a functional appliance can be used to address a specific problem).

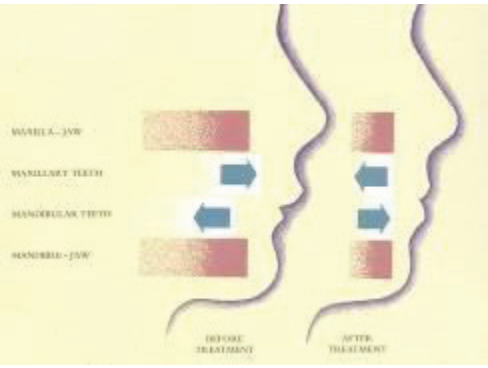


*FIgure 58:*

*Problem –*
*Low Angle (hypodivergent face)*
*Excessive Freeway Space*
*Maxillary Alveolar Dental Protrusion (protruding teeth)*
*Mandibular Alveolar Dental Retrusion (retruding teeth)*
*Short Anterior Face Height*

The removable functional appliance is held in place by the teeth, but the patient must posture their jaws to "fit" into the appliance. There is still some debate on the exact mode of action, but it appears, as in this illustration, that the teeth are moved (retraction of the upper incisors, uprighting of the retruded lower incisors) while the posterior teeth are allowed to erupt, reducing the freeway space and increasing the anterior face height.

***Habits***

Those that contribute to malalignment must be corrected if orthodontic treatment is to be successful. Thumb sucking, tongue thrusting, lip biting and mouth breathing are usually treated as early as possible. Functional problems such as mandibular displacement–often associated with anterior or posterior crossbites–are also best treated early.

Habit appliances are designed many different ways. Some designs are more successful than others. Much depends on the habit, the effects of the habit, the timing of the treatment and, most importantly, the cooperation of the patient.

***Crossbites***

There are many effective methods for correcting crossbites. There are also unfavorable responses to some methods. It is important to make a careful diagnosis in the beginning, and it is important to monitor the progress for unfavorable responses during treatment. For example, unfavorable extrusion of posterior teeth will create an open bite in the anterior area.

**ONE PHASE (CORRECTIVE ORTHODONTICS)**

The first step in the preparation of treatment of a major orthodontic malocclusion is the placement of an appropriate appliance (braces). During each subsequent appointment, a system of directional forces is established like archwires, elastic modules, elastic chains and steel ligature ties. You will learn more about braces and directional forces in subsequent modules. It is absolutely essential that the patient cooperates and becomes a part of that system if success is to be realized. Your role as an assistant to help with patient motivation and compliance cannot be overstated.

The scope of corrective orthodontics includes conditions that require the movement of teeth and the correction of malrelationships and malformations. These adjustments between and among teeth and facial bones are made by the application of fixed appliances with force and sometimes through stimulation and redirection of functional forces within the dentofacial structure. Corrective orthodontics includes the following:

- Fixed appliances (e.g. cemented or bonded in place; cannot be removed by the patient)
- Removable appliances for the correction or maintenance of orthodontic treatment
- Orthognathic surgery when the orthodontic problem is too severe to be corrected by movement of the teeth alone

**ADULT TREATMENT**

Adults frequently require a multi-disciplinary approach. It is especially important that the supporting structures of the teeth are healthy prior to orthodontic treatment (no inflammation). Consultation with the referring dentist or a periodontist regarding periodontal health may be necessary.

In response to the stimulus of pressure, cells within the bone and periodontal ligament differentiate to form specialized cells called osteoclasts, which are associated with bone resorption in advance of the moving tooth. In response to the stimulus of tension, other cells differentiate to form specialized cells called osteoblasts, which produce bone behind the moving tooth (see figure 59).

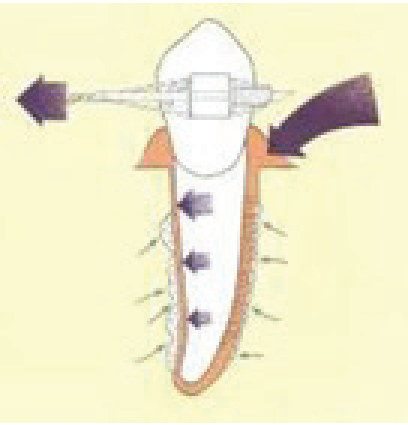


*Figure 59*

Many adult patients require some periodontal therapy prior to orthodontic treatment (see figure 60).

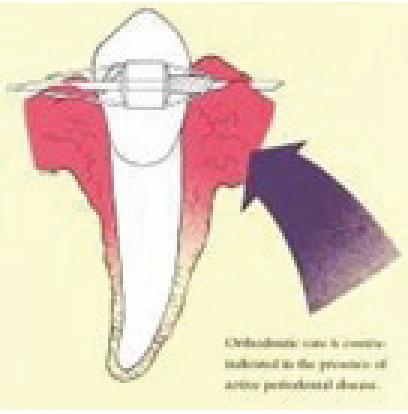


*Figure 60*

*Periodontal disease*
*Gingival inflammation*
*Periodontal ligament infection*
*Bone loss*
*Tooth must not be moved until periodontal infection is under control*
*The periodontium should be in a healthy condition prior to orthodontic treatment*

**RETENTION**

Retaining appliances are usually required at the completion of the active phase of orthodontic treatment to stabilize the teeth in their new position while the supporting tissues are adapting. The wearing time varies from patient to patient and is determined by the orthodontist. In some instances, indefinite retention wear may be necessary.

***Removable Retaining Appliance***

Figure 61 depicts how excessive overjet of the maxillary incisors was corrected during the active phase of orthodontic treatment, and then is retained with a removable retainer.

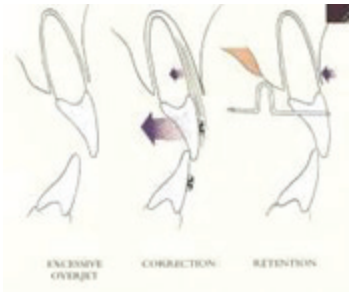


*Figure 61*

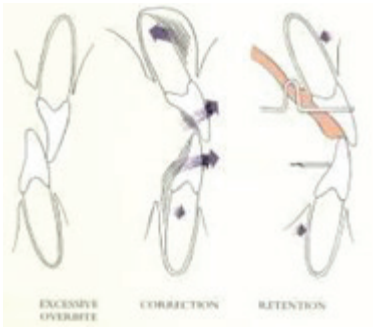


*Figure 62*

Extensive collapse of the mandibular teeth may be associated with excessive muscular force. Since this muscle force does not disappear after orthodontic treatment, retention may be required for many years or indefinitely.

***Fixed Retaining Appliance***

Figure 62 depicts how an upper removable appliance with a bite plane (added acrylic lingual to the maxillary incisors) is being used to prevent a return of the deep overbite. There is also a bonded lingual wire in place to prevent the lingual collapse of the lower incisors. Bonded lingual wire retainers can be bonded on either all six lower anterior teeth, at two points in the canines, or a modification of the two. The materials of bonded lingual wire retainers can vary including: braided wires, single piece stainless steel, TMA wires, Titanium, chain link/serpentine (OrthoFlex Tech), NiTi (Memotain robotically bent wires).

The decision on the third molar removal is frequently a decision made in consultation with the referring dentist and/or with the input from an oral surgeon.

**Patient Cooperation**

The most difficult challenge in orthodontic treatment is patient motivation. If the patient does not cooperate by following instructions, keeping the teeth clean, being on time for and not missing appointments, and caring for the appliance properly, the most sophisticated treatment plan or appliance therapy will fail to produce a satisfactory result.

**Dental Health Considerations**

The ideal alignment of the teeth, optimal overbite and overjet of the anterior teeth, positive contact with proper positioning of the contact areas and favorable axial inclinations of all the teeth, enhance dental health.

***Dental Disease***

Malocclusion can contribute to dental decay and periodontal disease. When the teeth and tissues do not receive the benefits of normal occlusion and natural cleansing, proper plaque removal becomes difficult.

Embrasures provide spillways for food and prevent food impaction (see figures 63 & 64). Each contact area has four embrasures:

- Gingival
- Occlusal, Incisal
- Lingual
- Buccal, Labial

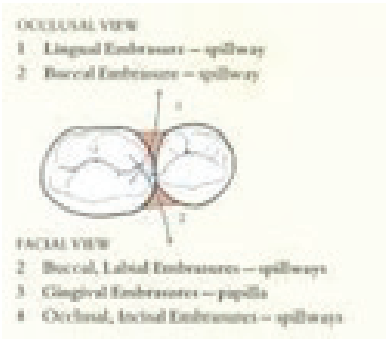



*Figure 63*

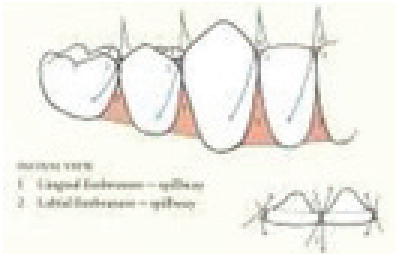


*Figure 64*

***Excessive Overbite***

In severe cases the mandibular incisors contact the palatal mucosa lingual to the maxillary incisors, also known as an impinging deep bite (see figure 65). A removable appliance to help prevent this from recurring was shown in figure 62.

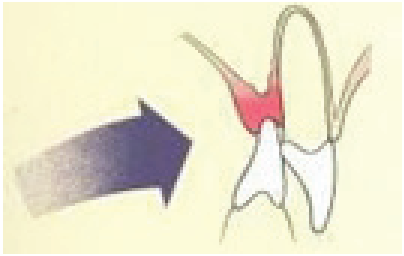


*Figure 65*

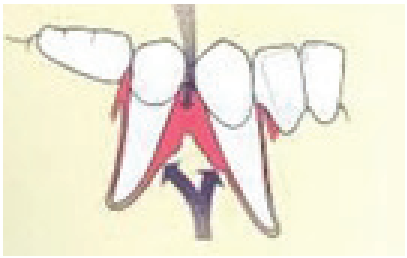


*Figure 65: The premolar teeth do not have adequate contact, this is referred to as an open contact area. Additionally, the roots are tipped divergently. Food can become impacted in these areas, leading to trauma and inflammation of the gums which in the presence of disease and a poor host response, could lead to bone loss.*

**Benefits of Orthodontic Treatment**

Ideally, a healthy functional occlusion resulting from orthodontic treatment is characterized by canine protected occlusion, incisal guidance and absence of balancing side interferences.

***Canine Protected Occlusion – desired***

Only the right canines are contacting on the right excursion of the mandible (see figure 67).

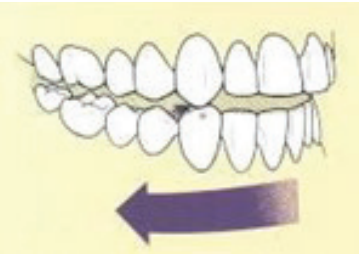


*Figure 67*

***Incisal Guidance – desired***

When the mandible is moved forward with the teeth in contact, the incisal edges of the mandibular incisors touch, and are guided by, the lingual surface of the maxillary incisors (see figure 68).

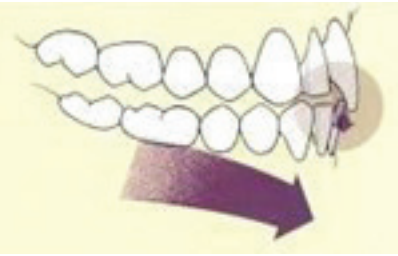


*Figure 68*

***Balancing Side Interference – not desired***

Only the right second molars are contacting on the left excursion of the mandible. Canines are not contacting on either side (see figure 69).

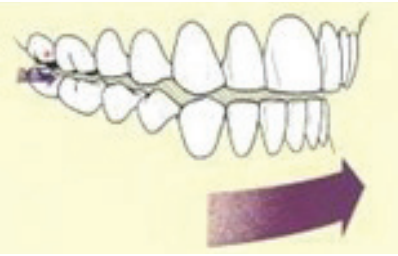


*Figure 69*

**Psychological Considerations**

Severe malocclusion and dental facial deformities can be a social handicap. The impact of these types of problems may have a strong influence on a patient's self-esteem and their positive feelings about themselves.

Whether the patient is a teenage boy competing in high school, a college graduate about to begin a professional career, a young executive striving to establish their position in the business world, a young mother attempting to create an ideal image for their young children, a child standing on the threshold of a lifetime or a grandmother who is enjoying a senior position of respect and dignity within the family circle… .a beautiful, healthy smile translates into happiness, invites communication and opens the doors to success and fulfillment.

**Patient Education**

Following are descriptions and instructions that can be discussed with patients regarding various phases of their treatment (toothbrushing, wearing of elastics, wearing of headgear, adjunctive periodontal procedures etc.).

## COMMON APPLIANCES AND TECHNIQUES USED IN TREATMENT AND PATIENT INFORMATION

**Removable Appliances**

The key to orthodontic treatment with a removable appliance is wearing it, not removing it!

Removable appliances often are not braces at all. Unlike conventional braces, which create pressure by being attached directly to the teeth, removable appliances are used in different ways. Some (i.e. functional appliances) are intended to influence growth of the jaws in order to effect changes in facial structure. Some are used to retain teeth in their corrected positions (i.e. retainers). In addition, they are often used before and in conjunction with fixed appliances (braces).

Still, removable appliances are not right for all orthodontic problems. It takes skill and experience to recognize conditions that will respond favorably to removable appliances.

Timing of such therapy also is very important. An orthodontic specialist is trained to make such treatment decisions.

***They won't work if they are not worn.***

Since removable appliances can easily be taken out by the patient, there may be a tendency not to wear them as prescribed. This means running the risk of having teeth, jaws and muscles move toward their original positions (relapse) or fail to move in the desired directions. Some removable appliances require special cooperation and care. At first patients may notice an effect on eating and speaking. As with anything placed in the mouth, removable appliances may increase the flow of saliva. After the patient is used to wearing and caring for the appliance they will see how easy it is to follow simple instructions that will help them achieve and maintain a great smile.

**Wear and Care Tips**

- Patients should wear their appliance as directed by the orthodontist. It only works when it is being worn.
- The appliances should be kept clean and in its protective case when not being worn. Patients are not to place them directly in their pocket or purse as they are fragile and may break or bend. Also, they are not to be put in a napkin or on the table while eating as this often leads to them being thrown away.
- The appliance is not to be placed in hot water or near high heat if it is made of plastic or acrylic. It can warp, and it is flammable.
- Patients are instructed to place their name and telephone number on their appliance carrying case in case they are lost or misplaced. As removable appliances take time to replace the additional time may prolong their active treatment, and a replacement charge is common practice.

**Typical Removable Appliances**

The most common removable appliance is the retainer. It is worn after the braces are removed to hold the teeth in their corrected positions until the bones and gums adapt to the change.

Patients are asked to wear their retainers exactly as instructed by the orthodontist; otherwise, the teeth may move toward their original positions and the benefits of wearing braces will be lost.

The retention process does take time. The orthodontist will determine how long each individual patient needs to wear their retainers. The time varies with individual patients. Some children and adults may need retainers for an extended period of time to make sure no shifting of the teeth occurs. Depending upon the patient's situation, wearing time may range from a year or more of full-time wear to only part-time wear. On occasion, indefinite or permanent retention may be necessary. Under certain circumstances, retainers also may be used for other minor corrections.

**Instructions for Wearing of Retainers**

Wear them. That means in the mouth, not in a pocket or purse. Retainers are effective only if the patient faithfully follows the orthodontist's instructions.

Keep them clean. After meals all parts of the retainer should be cleaned with a brush as instructed. If the patient is unable to brush, they should be sure to rinse the retainers and their mouth. If the lower retainer is attached to their teeth, it is important to clean under the wire with dental floss as instructed and demonstrated by the orthodontist. Mineral buildup can often be ameliorated by soaking the appliance in white vinegar to loosen the deposits that can then be removed by routine cleaning with a toothbrush and toothpaste.

Handle them with care. Retainers are easy to lose. They fall out of pockets and purses. They should be kept in a retainer case for safety. Later, if instructed to leave them out part of the time, they are to be kept in a safe place where they won't get damaged. Some orthodontists may recommend the retainer be kept in a moist environment when not being worn. When they are just lying around, they have a way of falling on the floor and being stepped on, or even being picked up/chewed on by pets.

**Functional Appliances**

Several examples of functional appliances include the Activator, Bionator, Herbst and Frankel. These types of appliances usually are used with young patients who are still growing. The purpose of these types of appliances is to reposition the jaws and control the tongue, lips and cheeks to keep them from interfering with tooth position.

Bite Planes and Thumb Guards are types of removable appliances that control habits such as tooth grinding or clenching, tongue thrusting and thumb or finger sucking. These appliances are used until the harmful habit has stopped.

Clicking popping or pain around the ear in the temporomandibular joint sometimes may be alleviated by certain removable appliances called Splints which may allow the jaw muscles and teeth to assume a more comfortable relationship. These conditions may require the dentist and orthodontist to work together to diagnose and treat the problem.

**Palatal Expansion**

Palatal expansion is a combination of tooth movement and jaw expansion. It works by widening the two halves of the upper jaw, called the palate. The two halves are joined together by a suture in the middle of the roof of the mouth. The orthodontist custom makes an expander for each patient. An expander can be fixed or removable. The expander is attached to the upper back teeth and eases the suture apart, which makes the upper jaw wider. As the jaw expands, new bone fills in between the two halves of the palate. This process is called distraction

osteogenesis. Expansion can take a few weeks to a few months, depending on the amount of expansion required for an individual patient.

A rapid palatal expander (RPE), also known as a rapid maxillary expander (RME), is generally worn from four to six months. During the first few weeks of wear it is necessary to expand (activate) the appliance. Depending on the appliance, the RPE may require activation with a special key or wrench. The orthodontist will provide detailed instructions on how to activate the appliance and operate it properly to achieve the desired results.

Palatal expansion improves the way the upper and lower jaws and the upper and lower teeth work. It widens the jaw so there is sufficient room for permanent upper and lower teeth to come in. Expansion can make the final smile broader and more attractive.

Without expansion, and depending on the problem, permanent teeth may not have enough space to come in; or the lower jaw could grow out of proportion, which could require corrective surgery as an adult. Left untreated, a narrow palate can lead to excessive wearing of the teeth or the need for extensive dental work as an adult.

The orthodontist will advise the patient or parent on the need for expansion and which type of expansion is best suited to correct the problem. Expansion is easiest and results are most stable when performed on the growing child or teen.

Age alone, however, is not the best predictor of when a palatal expansion should be used. Ideally a patient should still be growing. The orthodontist may analyze the growth plates on a hand-wrist x-ray to help determine skeletal maturation and whether a patient is still growing. Patients who have completed growth may require surgically- assisted rapid palatal expansion.

The orthodontist will recommend the type of expansion appliance necessary. Different appliances require different activation techniques. The orthodontist will provide specific instructions on how to expand the appliance and how often to expand it.

It may take a few days to get used to the palatal expander. Chewing, swallowing and talking may be awkward at first. The mouth and nose may be sore or may tingle. Some patients report a slight headache. The orthodontist may recommend over-the-counter analgesics to relieve discomfort.

After a few days of expanding, the patient may notice space between the front teeth. This is a sign that the appliance is working and the palate is being expanded.

Most patients require full orthodontic treatment (braces) following palatal expansion.

**Care of the Expansion Appliance**

The expander should be brushed whenever teeth are brushed. Patients should rinse

their mouth with water after eating or after drinking a beverage with sugar. Removable expanders should be brushed and rinsed each time the appliance is taken out of the mouth.

**Elastics**

Successful orthodontic treatment primarily depends on two things: constant pressure and time. Sometimes it takes added force to move teeth and jaws into their correct positions. Elastics, also called rubber bands, have the pull to make that happen. But they won't work without the patient wearing them. Therefore, to achieve the desired results, the patient must carefully follow the instructions they receive regarding their placement and use. Any time missed in wearing will only make the treatment take longer.

Patients are responsible for placing the elastics on their braces between appointments. They are to make sure they wear them as they were instructed. They are to remove them only when brushing their teeth, gums and braces after meals. They are then to place them back on immediately, unless different instructions have been given.

Patients are to always carry elastics with them, so if one breaks they can replace it right away. If their supply runs low, they are to contact the office to pick up more or possibly have some mailed to them.

If a patient happens to forget to insert their elastics one day, they are not to double up the next day; rather just follow the regular instructions.

Elastics get tired. When they lose their stretch, elastics don't provide the proper pressure on the teeth and jaws. It is therefore very important to change them as directed, even when they are not broken.

Elastics may cause the teeth to hurt a little at first. That is because the teeth are moving, which is the goal. Usually the tenderness lasts a day or two. Not wearing the elastics as instructed will only make the tenderness last longer and make the tooth movement take more time.

If the patient has any problems—like elastics breaking frequently, a wire or a band loosening, or a hook breaking off—they are to call the office immediately. Patients should not wait until their next scheduled appointment. These problems need to be corrected as soon as possible.

**Orthodontic Headgear**

Headgear can be a very important part of the treatment for certain patients. Its purpose is to achieve the best possible correction of their orthodontic problem. Headgears create special forces that guide the growth of the face and jaws. They are also used to move teeth into better positions or to prevent teeth from moving when they are not supposed to.

Regular use of the headgear achieves the best results. That is why it is important for the patient to follow the instructions on the number of hours each day it should be worn. Forgetting will just make the treatment take longer, and it may even affect the final results.

Patients are to take proper care of the headgear and bring it with them to every appointment.

The teeth may be tender or even slightly loose the first few days the headgear is worn. This tenderness will disappear as the patient adjusts to the new pressure, so they should not be discouraged. If the patient continues to be uncomfortable for more than a few days they should contact the orthodontist right away.

The wear of a headgear may not be much fun, but it is necessary for their treatment. If they follow the instructions exactly, they will be finished sooner than they think. The short-term sacrifice they make now will well be worth the healthy, beautiful smile that they will have for a lifetime.

**Types of Headgear**

There are many kinds of headgears. Each model, in its own specific way, constitutes a valuable auxiliary to treatment mechanics if it is worn by the patient properly and with consistent regularity. The type and design of the headgear depends on the patient's specific problem, the treatment philosophy and the mechanotherapy involved.

Posterior Pull – headgear that is inserted into the tubes on the upper first molar bands, can be used to retard forward growth of the upper jaw and move maxillary molars distally (see figure 70).

*Figure 70*

Anterior Pull (J hook type) – J Hook Type - consists of a metal wire with a loop on the end that attaches to hooks or eyelets on the archwire that can be used to retract cuspids and intrude incisors. Sometimes the loops are opened to slide over the archwire and pull directly against one or more teeth on either side. The J hook is attached to a head cap that fits over the patient's head or to a neck strap to prove force or pressure on the teeth (see figure 71).

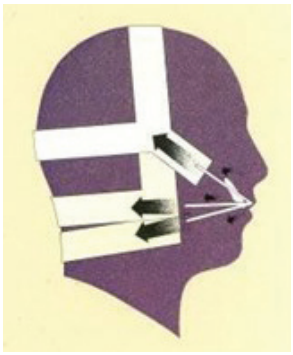


*Figure 71*

Facebow Type – Consists of a metal bow that fits into the tubes on the back teeth and a band that fits behind the neck or over the head to provide pressure to the facebow.

Cervical Pull – An (primarily) extraoral orthodontic or orthopedic appliance designed to deliver force to the dentition that is principally posteriorly and inferiorly directed.

High Pull – An (primarily) extraoral orthodontic or orthopedic appliance designed to deliver force to the dentition that is principally directed to the back and top of the head.

Reverse Pull – An (primarily) extraoral orthodontic or orthopedic appliance designed to deliver force to the dentition that is principally or totally anteriorly directed.

**Safety Instructions**

Always be careful to remove the headgear as shown by the orthodontist. If the headgear is removed carelessly, the part that fits into their mouth and attaches to their teeth could injure their cheeks, lips, face, or even their eyes.

Never try to remove the headgear until the straps have been disconnected.

Never try to lift the headgear over the face.

Never wear the headgear when running or playing sports. This includes rough-and- tumble games. Accidents can occur even when the patient is just having fun.

Never allow anyone to grab or pull on the headgear. Brothers, sisters, or friends who do not wear headgear may not understand the dangers involved, even in play.

The advent of orthodontic temporary anchorage devices (TADs) and bollard plates that are anchored directly in the bone, have given rise to many appliances that can be used intraorally to direct tooth and bone movements, instead of using extraoral force with headgear.

**Adjunctive Periodontal Procedures for Successful Orthodontic Treatment**

The goal of orthodontic treatment is to provide patients with a functional bite and a healthy, beautiful smile that's good for life. The orthodontist works with the general dentist and other dental specialists, as necessary, to achieve this goal.

Sometimes orthodontic treatment alone is not enough to address all of the problems that exist in a patient's mouth, so the orthodontist may enlist the aid of the general dentist or dental specialists to provide additional treatment before, during or after orthodontic treatment. If an adjunctive (additional) treatment is recommended by the orthodontist the patient may be referred to their general dentist or pediatric dentist, a periodontist, an oral and maxillofacial surgeon or a prosthodontist for the procedure.

**Frenectomy**

The term frenum refers to the fibrous gum tissue that connects the lips, cheeks or tongue to the gums. A frenectomy is a minor surgical procedure that removes or repositions a portion of the frenum where there is excessive or particularly thick tissue.

A frenectomy is most often performed for patients who have a gap (diastema) between their upper two front teeth that may be caused by the frenum. The procedure repositions or removes some of the tissue to allow the diastema to close and stabilizes the teeth so the space can remain closed. Patients with a thick frenum may need the procedure to relieve tension that otherwise could eventually cause gums to recede. A frenectomy may be recommended to achieve optimal results from orthodontic treatment. The orthodontist is in the best position to advise if the procedure is indicated and, if so, when it should be performed.

**Fiberotomy**

A fiberotomy is a minor surgical procedure that releases tiny elastic fibers around teeth. For some patients, these fibers cause teeth to turn, or rotate, significantly. The procedure may be recommended as an additional measure to maintain the functional bite and healthy, beautiful smile achieved through orthodontic treatment.

Patients whose teeth had a high degree of rotation before orthodontic treatment may need a fiberotomy. Such teeth have a strong tendency to relapse, or return to their original positions, due to the "memory" of the elastic fibers. This "memory" may work to return the teeth to their pre-treatment positions. A fiberotomy releases the elastic fibers to minimize rotational relapse after braces or other orthodontic appliances are removed. The orthodontist will base the recommendation for a fiberotomy on his/her education and clinical experience. The orthodontist is in the best position to advise on the timing of this treatment. Retainers may still be needed to maintain alignment of the teeth following treatment.

**Gingivoplasty**

A gingivoplasty is an adjunctive, or additional procedure that may be performed separate from, or often, at the same time, as a frenectomy or fiberotomy. A gingivoplasty can be a removal or sculpting of gingival (gum) tissue, to correct a "gummy" smile, or to balance uneven gum heights.

The orthodontist may also recommend a gingivoplasty if there is hyperplastic tissue. This condition can be caused by poor oral hygiene (especially during orthodontic treatment), some medications or some illnesses.

Some patients may opt for a gingivoplasty if they have a gummy smile. This kind of gingivoplasty is often referred to as crown lengthening. It uncovers normal tooth surfaces that are concealed by excess gum tissue and contributes to a more beautiful smile.

Patients whose gums are uneven may be candidates for a gingivoplasty to sculpt and even out the height of the gums. The result is a balanced, symmetrical appearance of the teeth.

The orthodontist will advise when a gingivoplasty should be performed, whether during or immediately following orthodontic treatment.

**Interproximal Reduction**

To help patients achieve a healthy new smile the orthodontist may feel that interproximal reduction, making some of the teeth slightly narrower, will contribute to the successful outcome of their orthodontic treatment. It may also contribute to long-term stability of the results after the braces are removed. It involves removal of some of the outer tooth surface (enamel) usually between teeth that touch. It has been used in orthodontics since the 1940s. It is also known as slenderizing, stripping, enamel reduction, reproximation and selective reduction.

Whatever the name, the intentions are the same—to acquire more space for the teeth, to bring the teeth into alignment, to improve the bite or to make the teeth more attractive. Sometimes interproximal reduction is done alone, but it is usually done in combination with orthodontic appliance treatment (fixed or removable). Sometimes it is even done in conjunction with tooth extractions. Sometimes it is done following orthodontic treatment to establish stability. Many times, front teeth are contoured during or after orthodontic treatment to create a balanced and harmonious appearance of the teeth.

The health of the patient's teeth and gums is of utmost concern to the orthodontist. Studies among patients who have had interproximal reduction show that the procedure does not make teeth more susceptible to tooth decay. Nor does the procedure predispose gums to gum disease. Occasionally, some patients may experience some sensitivity to hot or cold. Overall, the results are generally positive.

How the Procedure Works

- The orthodontist will identify which teeth are to be slenderized.
- Enamel is removed from the sides of each tooth, where the tooth comes in contact with neighboring teeth. The enamel may be removed manually or with the aid of a specially designed dental handpiece.
- The orthodontist carefully removes the desired amount of enamel, leaving each tooth with sufficient enamel to remain healthy and sound.
- In performing enamel reduction, the doctor carefully creates needed space that will allow teeth to be placed so that the bite is improved and the teeth take on a pleasing appearance.
- Desired positioning can be achieved after teeth are slenderized.

When deciding if reshaping of teeth is to a patient's advantage, the orthodontist will consider such factors as the size and shape of the teeth, their positions and alignment, and the patient's facial features. Front teeth form the framework upon which the lips rest, and their positions play an important role in facial appearance. Sometimes the orthodontist may suggest the removal of teeth to enhance the facial appearance.

Education and experience in evaluating facial characteristics allow the orthodontist to develop a treatment goal that produces a healthy bite, which can contribute to nice-looking teeth and facial attractiveness.

The removal of the enamel generally causes no discomfort for most patients because there are no nerve endings in the outer layer of the tooth.

After the teeth have been slenderized, they are smoothed and polished. Your doctor may recommend a topical fluoride treatment, as well as daily use of a fluoride rinse to help the teeth maintain their resistance to decay.

Where indicated, interproximal reduction will help the orthodontist position the teeth for good function and good looks. In some cases, enough space can be created so that teeth do not need to be removed. After the braces are removed, the more slender teeth are more likely to stay where the orthodontist has moved them.

**Tooth Brushing and Braces**

With orthodontic appliances (braces) in place, proper oral hygiene (brushing and flossing) will take some extra time and effort.

When the braces are removed everyone wants the teeth to look their best, so the patient must be their smile's best friend. They can do this by brushing, rinsing and looking, making sure the teeth and braces are spotlessly clean. Plaque is the problem. It is a sticky, white substance that collects on the teeth while eating. It is made up of bacteria, food and saliva. If plaque and trapped food are left on the teeth and around the braces, they can cause swollen gums, bad breath, marks on the teeth (decalcification, or white lesions), and cavities. Plaque can also discolor the teeth and make them look yellow.

The patient should use the kind of toothbrush and toothpaste the orthodontist recommends and use them often. If possible, the patient is to brush after every meal, especially if they have eaten anything sticky or sweet. If they cannot brush, they should be sure to at least rinse their mouth well with water.

What is most important is that at least once every day the patient should vigorously brush their teeth and braces until they are spotlessly clean. This takes extra time so most patients do it at night before they go to bed. Whatever time is chosen they must make absolutely sure their teeth and braces are as clean as they can get them.

Patients are to remove every trace of plaque and trapped food from all the surfaces of their teeth, and under the wires using techniques and aids demonstrated by the orthodontist. They must pay very close attention to brushing the gum line because plaque left there will make the gums sore and swollen, which will make brushing even more difficult. This is also the time when the patient should use the extra things recommended such as dental floss, special brushes, mouthwashes and oral irrigators. After brushing the patient should rinse really well then inspect the teeth and braces to make sure they are spotless. This should be done by looking at them closely in a well- lighted mirror. This is very important because patients can't feel plaque but they can usually see it. Patients may have to brush and rinse two or three times before all the plaque is gone. This may sound hard, but nobody wants straight teeth with cavities or permanent marks.

## TIMING OF TREATMENT

***Age 1 - Good Dental Health Begins***

The ADA recommends that a child first visit the family dentist by their first birthday. Even though all of a child's primary (baby) teeth usually have yet to erupt it's an excellent time to lay the foundation for a lifetime of good dental habits.

At this early age, the child's teeth can be examined and cleaned without discomfort.

This allows the child's first experience with the dentist to be a positive one. That in turn begins to establish a good attitude toward dental care and future visits. At the first checkup, the parent and child will likely receive instructions on proper tooth brushing and advice on the importance of a proper diet. Thereafter, regular visits are necessary for detecting problems early and maintaining good dental health.

***Age 7 - Another Important Visit***

The American Association of Orthodontists (AAO) recommends that every child first visit an orthodontist at age seven. This may surprise parents because orthodontic treatment is generally associated with adolescence. An early examination, however, is very important to ensure the maximum dental health for a child.

The following warning signs may indicate that the child should have an orthodontic examination as soon as possible:

- Difficulty in chewing
- Open-mouth breathing
- Thumb or finger sucking
- Overlapping or crowding of erupting permanent teeth
- Jaws that tend to click or pop
- A developing underbite, overbite, protruding front teeth, or other abnormal bite development.

Although age seven is the best time for the majority of children to have their first orthodontic examination, a visit at even a younger age is advisable if a particular problem has been noted by the parent, family dentist or child's physician.

### The Benefits of Early Diagnosis

Orthodontists can improve smiles at any age, but there is usually a best age for treatment to begin. An early examination allows the orthodontic specialist to determine how and when a child's particular problem should be treated for maximum improvement with the least time and expense. In some cases, early treatment achieves results that are unattainable once the face and jaws have finished growing.

### The First Visit

An orthodontic examination at age seven does not always result in immediate treatment. After evaluating the child, the orthodontist may simply want to check the child periodically while the permanent teeth erupt and the jaws and face continue to grow. If, however, the child has a problem, the orthodontist may recommend interceptive treatment. These limited measures are used to guide facial growth and tooth eruption, thereby preventing more serious problems from developing. Early intervention frequently makes the completion of treatment at a later age easier and less time consuming.

### Types of Orthodontic Problems

The technical term for teeth and jaws that do not fit and work together properly is "malocclusion," which means "bad bite." Most malocclusions are inherited, but some are acquired.

Inherited problems include crowding of teeth, too much space between teeth, extra or missing teeth, and a wide variety of other irregularities of the jaws and face. Acquired malocclusions can be caused by thumb or finger sucking, tongue thrusting, the airway being restricted by tonsils or adenoid tissue, dental disease, or premature loss of primary or permanent teeth. Whether inherited or acquired, many of these problems affect not only alignment of the teeth but also facial appearance. It is also important to note that orthodontic problems can be present behind perfectly acceptable smiles. An orthodontic specialist is especially qualified to diagnose existing or potential conditions that require treatment.

### The Importance of Treatment

Every parent wants their child to have a beautiful smile—and every child ought to have a healthy one. The orthodontist's goal is to achieve both for the patient. Untreated malocclusions may contribute to conditions which cause tooth decay, diseased gums, bone destruction, loss of teeth, and jaw joint problems. The increased cost of dental care to treat these problems after they develop may actually exceed the cost of orthodontic treatment.

In addition, uncorrected problems can affect a child's speech, general health, and self- esteem.

A child's self-confidence almost always increases when his or her smile is improved. This can lead to greater success in all areas of the child's life. Therefore, the value of a beautiful smile should never be underestimated.

### Adult Orthodontics: A Healthy, Beautiful Smile at Any Age

Orthodontic treatment is about a change for the better, no matter what the patient's age. It can give the patient the confidence and pride that comes with straight teeth and a great smile. But the orthodontist has another equally important treatment goal: to improve the health of your teeth and gums.

The fact is, when left untreated, many orthodontic problems may become worse. When you have a malocclusion, your teeth may be crowded, spaced or not fit together correctly. Crowded teeth are hard to clean and maintain. Given time, crowding may contribute to tooth decay, gum disease and even tooth loss. Bad bites can also result in abnormal wearing of tooth surfaces, difficulty in chewing and damage to supporting bone and gum tissue. Poor tooth alignment can contribute to pain in the jaw joints.

Today's technology makes people wearing braces feel better about how they look. Metal brackets are much smaller than they used to be. Even less noticeable are braces made of ceramic or plastic. And lingual braces (braces that go behind your teeth) may be appropriate in some cases. Clear plastic tray aligners have given the orthodontist another option that may be appropriate for certain patients.

No matter what type of braces, or which technique is used, the patient will need to make a few adjustments to treatment. Chewing ice and certain treats, such as caramels and peanut brittle, will be off-limits. Also, their mouth and teeth may be a little tender after adjustments. And, of course, it is especially important that the patient visits their family dentist for regular check-ups.

A consultation with an orthodontist is the best way to determine if a patient can benefit from orthodontic treatment. Remember, the biological process involved in tooth movement is the same in both adults and children. The condition of the patient's teeth, gums and supporting bone is the most important factor in determining the potential for improving a patient's smile and dental health. After an initial examination the orthodontist will be able to tell the patient what their treatment will likely involve and its approximate cost. If they decide to proceed, the next step involves making diagnostic records. These often include impressions for study casts, special x-rays and photographs. Every person's malocclusion is different. After carefully analyzing the nature of the needed correction, the orthodontist will recommend the best course of treatment for improving their smile and oral health.

The cost of orthodontic treatment will depend on many factors, including the severity of the problem, its complexity and length of treatment. The orthodontist will be glad to discuss the cost with patients before the treatment begins. Patients are finding that braces are more affordable today than ever. Most orthodontists have a variety of convenient payment plans. Often there are combined plans available for parents and children who have treatment at the same time. In addition, many dental insurance plans now include orthodontic benefits.

**Orthodontics and Surgery:**
**When Treatment Calls for a Specialized Partnership**

The upper and lower jaws are the foundations by which the teeth are supported. Sometimes, when the jaws are too short, or long, too wide or narrow, braces alone can't completely correct a bad bite. And, in addition to affecting a person's appearance, an improper bite can lead to serious problems, such as abnormal tooth wear, periodontal disease, and possible joint pain.

Orthodontists correct crooked teeth and bad bites. For problems related to jaw formation and misalignment (skeletal problems), an oral surgeon may be needed. When both conditions come into play, it is common for an orthodontist and oral surgeon to work together. Some severe cases can only be corrected with a combination of orthodontics and surgery. The orthodontist, working with the oral surgeon, designs a combined treatment plan. Depending on the problem, treatment by other dental specialists may also be required. This teamwork between the orthodontist, the family dentist and other dental specialists provides better dental health for thousands of patients who are rewarded with straight teeth, bright smiles and facial symmetry—a beautiful combination of shape, form, position and function.

There are many types of jaw development and alignment problems. Some are inherited, some are growth problems, and some are caused by an accident or other trauma. The most commonly corrected problems included:

- a protruding upper or lower jaw (one that sticks out too far)
- a retruded chin (one that is too far back)
- an unsightly display of gum tissue above the upper front teeth (a "gummy" smile)
- an inability to achieve lip contact when the lips are relaxed
- an elongated face asymmetry (facial imbalance)
- cleft palate (in young children)

Most orthodontic patients undergo an initial period of orthodontic treatment to align the teeth so they will fit together properly after surgery is performed. The orthodontist and oral surgeon will schedule surgery after the teeth have been properly aligned. Usually, braces or other orthodontic devices used to align the teeth before surgery are left in place during the surgical procedure to help stabilize the teeth and jaws. After surgery there is usually an additional period of orthodontic treatment to bring teeth into their final, desired positions, complementing the new facial symmetry.

While the prospect of undergoing surgery as part of the overall treatment plan may seem daunting, it really is not uncommon. The rewards for such treatment can be very dramatic. Following completion of orthodontic treatment and surgery the patient will enjoy better dental health and have a better facial

appearance. Best of all, the patient will have a more beautiful smile that reflects a happier, healthier patient for the rest of their life.

**Personal Benefits of Orthodontics**

While others sometimes judge us by the way we look, there are other more compelling reasons for considering orthodontic treatment. Your dental health has an effect on your overall health and comfort. And how you feel about how you look also plays a role in your quality of life. When you feel unattractive because of crooked teeth or jaws that don't meet properly, you may become self-conscious and preoccupied with your appearance. You may cover your mouth when speaking or laughing, hesitate to smile, or attempt to hide your facial appearance. Orthodontic treatment can improve your dental health and change your facial appearance for the better, and it can boost your self-esteem. It can provide you with the chance to participate in improving the way you look. Patients often feel more self- confident even before treatment is completed. As you see yourself looking better, you may find yourself feeling better and enjoying a better quality of life. With an attractive smile, you can face your career and your personal relationships with confidence.

Orthodontic treatment can improve dental health as it improves your looks. Straight, well-aligned teeth are easier to clean and maintain. Correcting orthodontic problems can help prevent tooth decay, gum disease and even tooth loss. With a smile that is truly healthy, you feel better about yourself and your interactions with others.

**How to Find an Orthodontist Near You**

When you're looking for an orthodontist, remember: all active members of the American Association of Orthodontists (AAO) are uniquely qualified specialists. Each has met the exacting standards of education and experience required to be an orthodontist by the American Dental Association and by the American Association of Orthodontists for membership.

**Partnership: You, Your Orthodontist and Your Dentist**

Achieving healthy, beautiful smiles is a team effort that involves the orthodontist, the family dentist, the patient (and the parents, if the patient is young) and, as needed, other dental specialists. The orthodontist provides the expertise, the treatment plan and the techniques to straighten teeth and align the jaws. The family dentist helps make sure that the teeth and gums stay clean and healthy. The patient must cooperate by following the dentist's and the orthodontist's instructions carefully so that the teeth and jaws move in the way desired and on the prescribed schedule.

Because dental hygiene is so important, regular visits to the family dentist must continue every six months during orthodontic treatment (or more often, if recommended). It is essential that the patient avoid food which may damage orthodontic appliances. The patient must also maintain a healthy, nutritional diet to achieve the best possible results from treatment. A good diet provides essential nutrients to bones and tissues undergoing change during orthodontic treatment.

**INTRODUCTION TO THE DENTAL PRACTICE ACT**

Effective July 1, 2009, the Dental Board of California (DBC) is the regulatory board for licensed Dentists (DDSs), Registered Dental Assistants (RDAs) and Registered Dental Assistants in Extended Functions (RDAEFs) health care professionals. The mission of the DBC is to protect the health and safety of consumers. The Dental Board:

- Licenses qualified dental health care professionals
- Takes action to enforce compliance of the Dental Practice Act and California laws
- Strives to enhance the education of consumers and licensees

Up to date information regarding any changes in the laws or regulations that govern the profession of dentistry can be found on the DBC website (http://www.dbc.ca.gov).

The Dental Practice Act itself is a set of laws and regulations that oversees and guides the practice of dentistry in the state of California. A published copy of the complete current Dental Practice Act is available for purchase from the DBC website.

The pertinent information, with regards to dental assisting, are the designations that exist (Dental Assistant, Registered Dental Assistant, Orthodontic Assistant Permit), levels of training that must be accomplished to attain these designations (including state required courses and examinations) and the scope of practice (or allowable duties) that each designation allows the assistant to perform. This information can be found at the DBC website, with the most relevant passages excerpted and copied below:

1741. As used in this article:

(a) "Board" means the Dental Board of California.

(b) "Direct supervision" means supervision of dental procedures based on instructions given by a licensed dentist, who must be physically present in the treatment facility during the performance of those procedures.

(c) "General supervision" means supervision of dental procedures based on instructions given by a licensed dentist but not requiring the physical presence of the supervising dentist during the performance of those procedures.

1749.1. In addition to any other examination required by this article, the board may require applicants for licensure under this article to successfully complete the Registered Dental Assistant Combined Written and Law and Ethics Examination.

**Dental Assistant**

1750. (a) A dental assistant is an individual who, without a license, may perform basic supportive dental procedures, as authorized by Section 1750.1 and by regulations adopted by the board, under the supervision of a licensed dentist. "Basic supportive dental procedures" are those procedures that have technically elementary characteristics, are completely reversible, and are unlikely to precipitate potentially hazardous conditions for the patient being treated.

(b) The supervising licensed dentist shall be responsible for determining the competency of the dental assistant to perform the basic supportive dental procedures, as authorized by Section 1750.1.

(c) The employer of a dental assistant shall be responsible for ensuring that the dental assistant who has been in continuous employment for 120 days or more, has already successfully completed, or successfully completes, all of the following within a year of the date of employment:

(1) A board-approved two-hour course in the Dental Practice Act.

(2) A board-approved eight-hour course in infection control.

(3) A course in basic life support offered by an instructor approved by the American Red Cross or the American Heart Association, or any other course approved by the board as equivalent and that provides the student the opportunity to engage in hands-on simulated clinical scenarios.

(d) The employer of a dental assistant shall be responsible for ensuring that the dental assistant maintains certification in basic life support.

1750.1. (a) A dental assistant may perform the following duties under the general supervision of a supervising licensed dentist:

(1) Extra-oral duties or procedures specified by the supervising licensed dentist, provided that these duties or procedures meet the definition of a basic supportive procedure specified in Section 1750.

(2) Operate dental radiography equipment for the purpose of oral radiography if the dental assistant has complied with the requirements of Section 1656.

(3) Perform intraoral and extraoral photography.

(b) A dental assistant may perform the following duties under the direct supervision of a supervising licensed dentist:

(1) Apply nonaerosol and noncaustic topical agents.

(2) Apply topical fluoride.

(3) Take intraoral impressions for all nonprosthodontic appliances.

(4) Take facebow transfers and bite registrations.

(5) Place and remove rubber dams or other isolation devices.

(6) Place, wedge, and remove matrices for restorative procedures.

(7) Remove postextraction dressings after inspection of the surgical site by the supervising licensed dentist.

(8) Perform measurements for the purposes of orthodontic treatment.

(9) Cure restorative or orthodontic materials in operative site with a light-curing device.

(10) Examine orthodontic appliances.

(11) Place and remove orthodontic separators.

(12) Remove ligature ties and archwires.

(13) After adjustment by the dentist, examine and seat removable orthodontic appliances and deliver care instructions to the patient.

(14) Remove periodontal dressings.

(15) Remove sutures after inspection of the site by the dentist.

(16) Place patient monitoring sensors.

(17) Monitor patient sedation, limited to reading and transmitting information from the monitor display during the intraoperative phase of surgery for electrocardiogram waveform, carbon dioxide and end tidal carbon dioxide concentrations, respiratory cycle data, continuous noninvasive blood pressure data, or pulse arterial oxygen saturation measurements, for the purpose of interpretation and evaluation by a supervising licensed dentist who shall be at the patient's chairside during this procedure.

(18) Assist in the administration of nitrous oxide when used for analgesia or sedation. A dental assistant shall not start the administration of the gases and shall not adjust the flow of the gases unless instructed to do so by the supervising licensed dentist who shall be present at the patient's chairside during the implementation of these instructions. This paragraph shall not be construed to prevent any person from taking appropriate action in the event of a medical emergency.

(c) Notwithstanding subdivision (b), when operating in a school-based setting or a public health program created or administered by a federal, state, county, or local governmental

entity pursuant to Sections 104762 and 104830 of the Health and Safety Code, a dental assistant may apply topical fluoride under the general direction of a licensed dentist or physician.

(d) Under the supervision of a registered dental hygienist in alternative practice, a dental assistant may perform intraoral retraction and suctioning.

(e) The board may specify additional allowable duties by regulation.

(f) **The duties of a dental assistant or a dental assistant holding a permit in orthodontic assisting or in dental sedation do not include any of the following procedures unless specifically allowed by law:**

(1) Diagnosis and comprehensive treatment planning.

(2) Placing, finishing, or removing permanent restorations.

(3) Surgery or cutting on hard and soft tissue including, but not limited to, the removal of teeth and the cutting and suturing of soft tissue.

(4) Prescribing medication.

(5) Starting or adjusting local or general anesthesia or oral or parenteral conscious sedation, except for the administration of nitrous oxide and oxygen, whether administered alone or in combination with each other and except as otherwise provided by law.

(g) The duties of a dental assistant are defined in subdivision (a) of Section 1750 and do not include any duty or procedure that only an orthodontic assistant permitholder, dental sedation assistant permitholder, registered dental assistant, registered dental assistant in extended functions, registered dental hygienist, or registered dental hygienist in alternative practice is allowed to perform.

**Orthodontic Assistant Permit**

1750.2. (a) The board may issue an orthodontic assistant permit to a person who files a completed application including a fee and provides evidence, satisfactory to the board, of all of the following eligibility requirements:

(1) Current, active, and valid licensure as a registered dental assistant or completion of at least 12 months of verifiable work experience as a dental assistant.

(2) Successful completion of a two-hour board-approved course in the Dental Practice Act and an eight-hour board-approved course in infection control.

(3) Successful completion of a course in basic life support offered by an instructor approved by the American Red Cross or the American Heart Association, or any other course approved by the board as equivalent.

(4) Successful completion of a board-approved orthodontic assistant course, which may commence after the completion of six months of work experience as a dental assistant.

(5) Passage of a written examination administered by the board after completion of all of the other requirements of this subdivision. The written examination shall encompass the knowledge, skills, and abilities necessary to competently perform the duties specified in Section 1750.3.

(b) A person who holds an orthodontic assistant permit pursuant to this section shall be subject to the same continuing education requirements for registered dental assistants as established by the board pursuant to Section 1645 and the renewal requirements of Article 6 (commencing with Section 1715).

(Amended by Stats. 2018, Ch. 703, Sec. 17. (SB 1491) Effective January 1, 2019.)

1750.3. **A person holding an orthodontic assistant permit pursuant to Section 1750.2 may perform the following duties under the direct supervision of a licensed dentist:**

(a) All duties that a dental assistant is allowed to perform.

(b) Prepare teeth for bonding, and select, preposition, and cure orthodontic brackets after their position has been approved by the supervising licensed dentist.

(c) Remove only orthodontic brackets and attachments with removal of the bonding material by the supervising licensed dentist.

(d) Size, fit, and cement orthodontic bands.

(e) Remove orthodontic bands and remove excess cement from supragingival surfaces of teeth with a hand instrument.

(f) Place and ligate archwires.

(g) Remove excess cement with an ultrasonic scaler from supragingival surfaces of teeth undergoing orthodontic treatment.

(h) Any additional duties that the board may prescribe by regulation.

1751. At least once every seven years, the board shall review the allowable duties for dental assistants, registered dental assistants, registered dental assistants in extended functions, dental sedation assistant permitholders, and orthodontic assistant permitholders, the supervision level for these categories, and the settings under which these duties may be performed, and shall update the regulations as necessary to keep them current with the state of the dental practice.

**Registered Dental Assistant**

1752.1. (a) The board may license as a registered dental assistant a person who files an application and submits written evidence, satisfactory to the board, of one of the following eligibility requirements:

(1) Graduation from an educational program in registered dental assisting approved by the board, and satisfactory performance on the Registered Dental Assistant Combined Written and Law and Ethics Examination administered by the board.

(2) For individuals applying prior to January 1, 2010, evidence of completion of satisfactory work experience of at least 12 months as a dental assistant in California or another state and satisfactory performance on the Registered Dental Assistant Combined Written and Law and Ethics Examination administered by the board.

(3) For individuals applying on or after January 1, 2010, evidence of completion of satisfactory work experience of at least 15 months as a dental assistant in California or another state and satisfactory performance on the Registered Dental Assistant Combined Written and Law and Ethics Examination administered by the board.

(b) For purposes of this section, "satisfactory work experience" means performance of the duties specified in Section 1750.1 in a competent manner as determined by the employing dentist, who shall certify to such satisfactory work experience in the application.

(c) The board shall give credit toward the work experience referred to in this section to persons who have graduated from a dental assisting program in a postsecondary institution approved by the Department of Education or in a secondary institution, regional occupational center, or regional occupational program, that are not, however, approved by the board pursuant to subdivision (a). The credit shall equal the total weeks spent in classroom training and internship on a week-for-week basis. The board, in cooperation with the Superintendent of Public Instruction, shall establish the minimum criteria for the curriculum of nonboard-approved programs. Additionally, the board shall notify those programs only if the program's curriculum does not meet established minimum criteria, as established for board-approved registered dental assistant programs, except any requirement that the program be given in a postsecondary institution. Graduates of programs not meeting established minimum criteria shall not qualify for satisfactory work experience as defined by this section.

(d) In addition to the requirements specified in subdivision (a), each applicant for registered dental assistant licensure shall provide evidence of having successfully completed board-approved courses in radiation safety and coronal polishing as a condition of licensure. The length and content of the courses shall be governed by applicable board regulations.

(e) In addition to the requirements specified in subdivisions (a) and (d), individuals applying for registered dental assistant licensure on or after January 1, 2010, shall demonstrate satisfactory performance on the Registered Dental Assistant Combined Written and Law and Ethics Examination administered by the board and shall provide written evidence of successful completion within five years prior to application of all of the following:

(1) A board-approved course in the Dental Practice Act.

(2) A board-approved course in infection control.

(3) A course in basic life support offered by an instructor approved by the American Red Cross or the American Heart Association, or any other course approved by the board as equivalent.

(f) **A registered dental assistant may apply for an orthodontic assistant permit or a dental sedation assistant permit, or both, by submitting written evidence of the following:**

(1) Successful completion of a board-approved orthodontic assistant or dental sedation assistant course, as applicable.

(2) Passage of the Registered Dental Assistant Combined Written and Law and Ethics Examination administered by the board that shall encompass the knowledge, skills, and abilities necessary to competently perform the duties of the particular permit.

(g) A registered dental assistant with permits in either orthodontic assisting or dental sedation assisting shall be referred to as an "RDA with orthodontic assistant permit," or "RDA with dental sedation assistant permit," as applicable. These terms shall be used for reference purposes only and do not create additional categories of licensure.

(h) Completion of the continuing education requirements established by the board pursuant to Section 1645 by a registered dental assistant who also holds a permit as an orthodontic assistant or dental sedation assistant shall fulfill the continuing education requirements for the permit or permits.

(i) The board shall, in consultation with the Office of Professional Examination Services, conduct a review to determine whether a practical examination is necessary to demonstrate competency of registered dental assistants, and if so, how this examination should be developed and administered. The board shall submit its review and determination to the appropriate policy committees of the Legislature on or before July 1, 2017.

(j) Notwithstanding any other law, if the review conducted by the Office of Professional Examination Services pursuant to subdivision (i) concludes that the practical examination is unnecessary or does not accurately measure the competency of registered dental assistants, the board may vote to suspend the practical examination. The suspension of the practical examination shall commence on the date the board votes to suspend the practical examination.

(k) The Registered Dental Assistant Combined Written and Law and Ethics Examination required by this section shall comply with Section 139.

(Amended by Stats. 2019, Ch. 865, Sec. 52. (AB 1519) Effective January 1, 2020.)

1752.4. (a) **A registered dental assistant may perform all of the following duties:**

(1) All duties that a dental assistant is allowed to perform.

(2) Mouth-mirror inspections of the oral cavity, to include charting of obvious lesions, existing restorations, and missing teeth.

(3) Apply and activate bleaching agents using a nonlaser light-curing device.

(4) Use of automated caries detection devices and materials to gather information for diagnosis by the dentist.

(5) Obtain intraoral images for computer-aided design (CAD), milled restorations.

(6) Pulp vitality testing and recording of findings.

(7) Place bases, liners, and bonding agents.

(8) Chemically prepare teeth for bonding.

(9) Place, adjust, and finish direct provisional restorations.

(10) Fabricate, adjust, cement, and remove indirect provisional restorations, including stainless steel crowns when used as a provisional restoration.

(11) Place post-extraction dressings after inspection of the surgical site by the supervising licensed dentist.

(12) Place periodontal dressings.

(13) Dry endodontically treated canals using absorbent paper points.

(14) Adjust dentures extra-orally.

(15) Remove excess cement from surfaces of teeth with a hand instrument.

(16) Polish coronal surfaces of the teeth.

(17) Place ligature ties and archwires.

(18) Remove orthodontic bands.

(19) All duties that the board may prescribe by regulation.

(b) A registered dental assistant may only perform the following additional duties if he or she has completed a board-approved registered dental assistant educational program in those duties, or if he or she has provided evidence, satisfactory to the board, of having completed a board-approved course in those duties.

(1) Remove excess cement with an ultrasonic scaler from supragingival surfaces of teeth undergoing orthodontic treatment.

(2) The allowable duties of an orthodontic assistant permitholder as specified in Section 1750.3. A registered dental assistant shall not be required to complete further instruction in the duties of placing ligature ties and archwires, removing orthodontic bands, and removing excess cement from tooth surfaces with a hand instrument.

(3) The allowable duties of a dental sedation assistant permitholder as specified in Section 1750.5.

(4) The application of pit and fissure sealants.

(c) Except as provided in Section 1777, the supervising licensed dentist shall be responsible for determining whether each authorized procedure performed by a registered dental assistant should be performed under general or direct supervision.

**DENTAL ASSISTING TABLE OF PERMITTED DUTIES**

In the following pages is a table of duties which Dental Assistants (DA), Orthodontic Assistants (OA), Dental Sedation Assistants (DSA), Registered Dental Assistants (RDA) and Registered Dental Assistants in Extended Functions (RDAEF) are allowed to perform in California.

This table is intended to provide summary information to interested parties. It is not intended to cover all aspects of applicable laws or provide a substitute for reviewing the laws that are cross-referenced below. It is highly recommended that applicants and licensees review the actual text of the laws cited at the link provided below. **If a duty is not listed in the sections of law cited below, assistants are NOT allowed to perform the duty.** Under each category of assistant is one of the following notations: "D", "C", "G" or "DD".

**"D"** = the assistant may perform the duty under the **Direct** supervision ofa dentist, which means supervision of dental procedures based on instructions given by a licensed dentist who must be physically present in the treatment facility duringthe performance of those procedures. The duty must be performed pursuant to the order, control and full professional responsibility of the supervising dentist. Such procedures must be checked and approved by the supervising dentist prior to dismissal of the patient from the office of said dentist.

Note: Dental Sedation Assistant permit holders may also perform the listed duty under a licensed health care professional authorized to administer conscious sedation or general anesthesia in the dentaloffice.

**"C"** = the assistant may perform the duty in the specified setting under the supervision of a dentist, Registered Dental Hygienist, or Registered Dental Hygienist in Alternative Practice.

**"G"** = the assistant can perform the duty under the **General** supervision of a dentist, which means based on instructions given by a licensed dentist, but not requiring the physical presence of the supervising dentist during the performance ofthose procedures.

**"DD"** = The supervising licensed dentist shall be responsible for determining whether each authorized procedure performed by a registered dental assistant shouldbe performed under general or direct supervision, except as provided in Section 1777.

The sections of law noted below are contained in the Dental Practice Act locatedin Chapter 4 of Division 2 of the California Business and Professions Code (BPC). For the actual text of the laws, the following link will take you to the page on the Dental Board's web site https://www.dbc.ca.gov/about_us/lawsregs/laws.shtml.

| ALLOWABLE DUTIES | SECTION OF LAW (Statute or Regulation) | D | C | G | DD |
|---|---|---|---|---|---|
| **DENTAL ASSISTANT (DA) BPC, SECTION 1750.1** | | | | | |
| Extra-oral duties or procedures specified by the supervising licensed dentist, provided that these duties or procedures meet the definition of a basic supportive procedure specified in Section 1750 | 1750.1 | | | X | |
| Operate dental radiography equipment for the purpose of oral radiography if the dental assistant has complied with the requirements of Section 1656 | 1750.1 | | | X | |
| Perform intraoral and extraoral photography | 1750.1 | | | X | |
| Apply nonaerosol and noncaustic topical agents | 1750.1 | X | | | |
| Apply topical fluoride | 1750.1 | X | | | |
| Take intraoral impressions for all nonprosthodontic appliances | 1750.1 | X | | | |
| Take facebow transfers and bite registrations | 1750.1 | X | | | |
| Place and remove rubber dams or other isolation devices | 1750.1 | X | | | |
| Place, wedge, and remove matrices for restorative procedures | 1750.1 | X | | | |
| Remove postextraction dressings after inspection of the surgical site by the supervising licensed dentist | 1750.1 | X | | | |
| Perform measurements for the purposes of orthodontic treatment | 1750.1 | X | | | |
| Cure restorative or orthodontic materials in operative site with a light-curing device | 1750.1 | X | | | |
| Examine orthodontic appliances | 1750.1 | X | | | |
| Place and remove orthodontic separators | 1750.1 | X | | | |
| Remove ligature ties and archwires | 1750.1 | X | | | |
| After adjustment by the dentist, examine and seat removable orthodontic appliances and deliver care instructions to the patient | 1750.1 | X | | | |
| Remove periodontal dressings | 1750.1 | X | | | |
| Remove sutures after inspection of the site by the dentist | 1750.1 | X | | | |
| Place patient monitoring sensors | 1750.1 | X | | | |
| Monitor patient sedation, limited to reading and transmitting information from the monitor display during the intraoperative phase of surgery for electrocardiogram waveform, carbon dioxide and end tidal carbon dioxide concentrations, respiratory cycle data, continuous noninvasive blood pressure data, or pulse arterial oxygen saturation measurements, for the purpose of interpretation and evaluation by a supervising licensed dentist who shall be at the patient's chairside during this procedure | 1750.1 | X | | | |
| Assist in the administration of nitrous oxide when used for analgesia or sedation. A dental assistant shall not start the administration of the gases and shall not adjust the flow of the gases unless instructed to do so by the supervising licensed dentist who shall be present at the patient's chairside during the implementation of these instructions. This paragraph shall not be construed to prevent any person from taking appropriate action in the event of a medical emergency | 1750.1 | X | | | |
| Apply topical fluoride under the general direction of a licensed dentist or physician, when operating in a school-based setting or a public health program created or administered by a federal, state, county, or local governmental entity pursuant to Sections 104762 and 104830 of the Health and Safety Code | 1750.1 | | | X | |
| Intraoral retraction and suctioning under the supervision of a registered dental hygienist in alternative practice | 1750.1 | | X | | |

| ALLOWABLE DUTIES | SECTION OF LAW (Statute or Regulation) | D | C | G | DD |
|---|---|---|---|---|---|
| **ORTHODONTIC ASSISTANT PERMIT (OA) BPC, SECTION 1750.3** | | | | | |
| All duties that a dental assistant is allowed to perform | 1750.3 | X | | | |
| Prepare teeth for bonding, and select, preposition, and cure orthodontic brackets after their position has been approved by the supervising licensed dentist | 1750.3 | X | | | |
| Remove only orthodontic brackets and attachments with removal of the bonding material by the supervising licensed dentist. | 1750.3 | X | | | |
| Size, fit, and cement orthodontic bands | 1750.3 | X | | | |
| Remove orthodontic bands and remove excess cement from supragingival surfaces of teeth with a hand instrument | 1750.3 | X | | | |
| Place and ligate archwires | 1750.3 | X | | | |
| Remove excess cement with an ultrasonic scaler from supragingival surfaces of teeth undergoing orthodontic treatment | 1750.3 | X | | | |
| **DENTAL SEDATION ASSISTANT PERMIT (DSA) BPC, SECTION 1750.5** | | | | | |
| All duties that a dental assistant is allowed to perform | 1750.5 | X | | | |
| Monitor patients undergoing conscious sedation or general anesthesia utilizing data from noninvasive instrumentation such as pulse oximeters, electrocardiograms, capnography, blood pressure, pulse, and respiration rate monitoring devices. Evaluation of the condition of a sedated patient shall remain the responsibility of the dentist or other licensed health care professional authorized to administer conscious sedation or general anesthesia, who shall be at the patient's chairside while conscious sedation or general anesthesia is being administered | 1750.5 | X | | | |
| Drug identification and draw, limited to identification of appropriate medications, ampule and vial preparation, and withdrawing drugs of correct amount as verified by the supervising licensed dentist | 1750.5 | X | | | |
| Add drugs, medications, and fluids to intravenous lines using a syringe, provided that a supervising licensed dentist is present at the patient's chairside, limited to determining patency of intravenous line, selection of injection port, syringe insertion into injection port, occlusion of intravenous line and blood aspiration, line release and injection of drugs for appropriate time interval. The exception to this duty is that the initial dose of a drug or medication shall be administered by the supervising licensed dentist | 1750.5 | X | | | |
| Removal of intravenous lines | 1750.5 | X | | | |
| **REGISTERED DENTAL ASSISTANT (RDA) BPC, SECTION 1752.4** | | | | | |
| All duties that a dental assistant is allowed to perform | 1752.4 | | | | X |
| Mouth-mirror inspections of the oral cavity, to include charting of obvious lesions, existing restorations, and missing teeth | 1752.4 | | | | X |
| Apply and activate bleaching agents using a nonlaser light-curing device | 1752.4 | | | | X |
| Use of automated caries detection devices and materials to gather information for diagnosis by the dentist | 1752.4 | | | | X |
| Obtain intraoral images for computer-aided design (CAD), milled restorations | 1752.4 | | | | X |

| ALLOWABLE DUTIES | SECTION OF LAW (Statute or Regulation) | D | C | G | DD |
|---|---|---|---|---|---|
| **REGISTERED DENTAL ASSISTANT (RDA) BPC, SECTION 1752.4 – Continued** | | | | | |
| Pulp vitality testing and recording of findings | 1752.4 | | | | X |
| Place bases, liners, and bonding agents | 1752.4 | | | | X |
| Chemically prepare teeth for bonding | 1752.4 | | | | X |
| Place, adjust, and finish direct provisional restorations | 1752.4 | | | | X |
| Fabricate, adjust, cement, and remove indirect provisional restorations, including stainless steel crowns when used as a provisional restoration | 1752.4 | | | | X |
| Place post-extraction dressings after inspection of the surgical site by the supervising licensed dentist | 1752.4 | | | | X |
| Place periodontal dressings | 1752.4 | | | | X |
| Dry endodontically treated canals using absorbent paper points | 1752.4 | | | | X |
| Adjust dentures extra-orally | 1752.4 | | | | X |
| Remove excess cement from surfaces of teeth with a hand instrument | 1752.4 | | | | X |
| Polish coronal surfaces of the teeth | 1752.4 | | | | X |
| Place ligature ties and archwires | 1752.4 | | | | X |
| Remove orthodontic bands | 1752.4 | | | | X |
| *A registered dental assistant may only perform the following additional duties if he or she has completed a board-approved registered dental assistant educational program in those duties, or if he or she has provided evidence, satisfactory to the board, of having completed a board-approved course in those duties | | | | | |
| *Remove excess cement with an ultrasonic scaler from supragingival surfaces of teeth undergoing orthodontic treatment | 1752.4 | X | | | |
| *The allowable duties of an orthodontic assistant permitholder as specified in Section 1750.3. A registered dental assistant shall not be required to complete further instruction in the duties of placing ligature ties and archwires, removing orthodontic bands, and removing excess cement from tooth surfaces with a hand instrument | 1752.4 | X | | | |
| *The allowable duties of a dental sedation assistant permitholder as specified in Section 1750.5 | 1752.4 | X | | | |
| *The application of pit and fissure sealants | 1752.4 | X | | | |
| **REGISTERED DENTAL ASSISTANT in EXTENDED FUNCTIONS (RDAEF) BPC, SECTION 1753.5 Licensed on or after January 1, 2010** | | | | | |
| All duties that a dental assistant is allowed to perform | 1753.5 | | | | X |
| All duties that a registered dental assistant is allowed to perform as specified in and limited by Section 1752.4 | 1753.5 | | | | X |
| Conduct preliminary evaluation of the patient's oral health, including, but not limited to, charting, intraoral and extra-oral evaluation of soft tissue, classifying occlusion, and myofunctional evaluation | 1753.5 | X | | | |
| Perform oral health assessments in school-based, community health project settings under the direction of a dentist, registered dental hygienist, or registered dental hygienist in alternative practice | 1753.5 | | X | | |
| Cord retraction of gingiva for impression procedures | 1753.5 | X | | | |
| Size and fit endodontic master points and accessory points | 1753.5 | X | | | |
| Cement endodontic master points and accessory points | 1753.5 | X | | | |
| Take final impressions for permanent indirect restorations | 1753.5 | X | | | |
| Take final impressions for tooth-borne removable prosthesis | 1753.5 | X | | | |
| Polish and contour existing amalgam restorations | 1753.5 | X | | | |
| Place, contour, finish, and adjust all direct restorations | 1753.5 | X | | | |
| Adjust and cement permanent indirect restorations | 1753.5 | X | | | |

| ALLOWABLE DUTIES | SECTION OF LAW (Statute or Regulation) | D | C | G | DD |
|---|---|---|---|---|---|
| **Additional authorized duties of a registered dental assistant in extended functions (RDAEF), BPC, Section 1753.55. A registered dental assistant in extended functions is authorized to perform the additional duties as set forth in subdivision (b) pursuant to the order, control, and full professional responsibility of a supervising dentist, if the licensee meets one of the following requirements:**<br>**(1) Is licensed on or after January 1, 2010.**<br>**(2) Is licensed prior to January 1, 2010, has successfully completed a board-approved course in the additional procedures specified in paragraphs (1), (2), (5), and (7) to (11), inclusive, of subdivision (b) of Section 1753.5, and passed the examination as specified in Section 1753.4. The pocket license of the authorized licensee will state the RDAEF perform the duties per B&P 1753.5 and 1753.55**. | | | | | |
| Determine which radiographs to perform on a patient who has not received an initial examination by the supervising dentist for the specific purpose of the dentist making a diagnosis and treatment plan for the patient. In these circumstances, the dental assistant in extended functions shall follow protocols established by the supervising dentist. This paragraph only applies in the following settings:<br>(A) In a dental office setting.<br>(B) In public health settings, using telehealth, as defined by Section 2290.5, for the purpose of communication with the supervising dentist, including, but not limited to, schools, head start and preschool programs, and community clinics, under the general supervision of a dentist. | 1753.55 | | | X | |
| Place protective restorations in a dental office setting, under the direct or general supervision of a dentist as determined by the dentist. | 1753.55 | | | | X |
| Place protective restorations after the diagnosis, treatment plan, and instruction to perform the procedure provided by a dentist in public health settings, using telehealth, as defined by Section 2290.5, for the purpose of communication with the supervising dentist, including, but not limited to, schools, head start and preschool programs, and community clinics, under the general supervision of a dentist. | 1753.55 | | | X | |
| **REGISTERED DENTAL ASSISTANT in EXTENDED FUNCTIONS (RDAEF) BPC, SECTION 1753.6**<br>**Licensed prior to January 1, 2010 and has not completed a Board-approved course in the additional procedures specified in paragraphs (1), (2), (5) and (7) to (11) inclusive, of Section 1753.5 (b) and an examination as specified in Section 1753.4** | | | | | |
| All duties that a registered dental assistant is allowed to perform as specified in and limited by Section 1752.4 | 1753.6 | | | | X |
| Cord retraction of gingiva for impression procedures | 1753.6 | | | | X |
| Take final impressions for permanent indirect restorations | 1753.6 | X | | | |
| Formulate indirect patterns for endodontic post and core castings | 1753.6 | X | | | |
| Fit trial endodontic filling points | 1753.6 | X | | | |
| Apply pit and fissure sealants | 1753.6 | X | | | |
| Remove excess cement from subgingival tooth surfaces with a hand instrument | 1753.6 | X | | | |

**INTRODUCTION TO DENTAL INFECTION CONTROL**

An extensive working knowledge of infection control practices and procedures is required. This material serves as an introduction, with the CDA (California Dental Association) course available for required training.

**Introduction**

Good hand hygiene is one of the most critical control strategies in outbreak management. Hand hygiene is defined as any method that removes or destroys microorganisms on hands. It is well-documented that the most important measure for preventing the spread of pathogens is effective handwashing. Hand hygiene programs should include clear guidance on procedures for the removal of common pathogens from the hands of passengers and crew members. Included in this program should be detailed instructions on when, where, why and the "how tos" of proper hand hygiene, including the use of soap and water, followed by effective hand drying. When supplied to either passengers or crew members, instructions should also be given on the effective use of antiseptic hand washes and hand rubs/sanitizers.

During outbreaks of acute gastroenteritis, enhanced hand hygiene messages should be inserted into printed materials and announcements should be made throughout the day encouraging proper hand hygiene.

**Handwashing and Drying**

Hand washing is defined as the vigorous, brief rubbing together of all surfaces of lathered hands, followed by rinsing under a stream of water. Handwashing suspends microorganisms and mechanically removes them by rinsing with water. The fundamental principle of hand washing is removal, not killing.

The amount of time spent washing hands is important to reduce the transmission of pathogens to other food, water, other people and inanimate objects (fomites), such as door knobs, hand railings and other frequently touched surfaces. Proper hand hygiene involves the use of soap and warm, running water, rubbing hands vigorously for at least 20 seconds. The use of a nail brush is not necessary or desired, but close attention should be paid to the nail areas, as well as the area between the fingers.

Wet hands have been known to transfer pathogens much more readily than dry hands or hands not washed at all. The residual moisture determines the level of bacterial and viral transfer following hand washing. Careful hand drying is a critical factor for bacterial transfer to skin, food and environmental surfaces. The drying times required to reduce the transfer of these pathogens varies with drying methods. Repeated drying of hands with reusable cloth towels is not recommended and should be avoided.

Recommended hand drying methods and drying times are outlined below:

Drying method: Single-use paper towels

- Protocol: Rub hands on two paper towels drying hands for 10 seconds on each
- Total drying time: 20 seconds
- Comments: The first towel removes the bulk of the water; the seconds achieves complete drying

Drying method: Air dryer

- Protocol: Rub hands together for while rotating them under warm air
- Total drying time: 30-45 seconds
- Comments: A prolonged drying period is required to achieve complete drying

Drying method: Single-use cloth towel

- Protocol: Rub hands on two sections of the towel, drying hands for 10 seconds on each section
- Total drying time: 20 seconds
- Comments: The first section of the towel removes the bulk of the water; the seconds achieves complete drying

***The following material comes from an article, Infection Control Patrol printed in the April/May 2007 publication,* Orthodontic Products*, and is authored by Leslie Canham, CDA, RDA. Leslie currently offers courses in Infection Control to satisfy the requirements mandated by the Dental Board of California and the Dental Practice Act***

# Infection Control Patrol

*By: Leslie Canham, CDA, RDA*

**SIX COMMON AREAS OF CROSS-CONTAMINATION IN AN ORTHODONTIC PRACTICE**

As new patients join your practice, the welcoming process should include a statement about your concern for patient safety through proper sterilization and infection-control techniques as well as strict adherence to OSHA regulations. But today's orthodontic practices are often busy, and staff members need to work at top speed to perform efficiently and stay on schedule. Sometimes, in the rush to stay on time, they can forget to perform some basic infection-control protocols. Other times, the protocols are followed but sabotaged by recontamination. Let's look at some of the common areas of cross-contamination and how to eliminate them.

**Infection Control in the Orthodontic Office Hand Hygiene**

Hand hygiene is defined as any method that removes or destroys microorganisms on hands. It is well-documented that the most important measure for preventing the spread of pathogens is effective handwashing.1 Effective handwashing includes vigorously rubbing together all surfaces of lathered hands for at least 20 seconds, followed by rinsing under a stream of water. Handwashing suspends microorganisms and mechanically removes them by rinsing the hands with water. The fundamental principle of handwashing is removal, not killing. The amount of time spent washing hands is important to reduce the transmission of pathogens to your patients, inanimate objects, and other frequently touched surfaces.

Drying hands is important, too, because wet hands can transfer pathogens much more readily than dry hands or unwashed hands. The residual moisture determines the level of bacterial and viral transfer following handwashing. Careful hand drying is critical to preventing bacterial transfer to skin, food, and environmental surfaces. Also, be certain that hands are dry before donning gloves to reduce the chances of developing skin irritation.

If the hands are not visibly soiled, an alcohol-based hand rub is adequate. Alcohol hand rubs are rapidly germicidal when applied to the skin and should include such antiseptics as chlorhexidine, quaternary ammonium compounds, octenidine, or triclosan to achieve persistent activity. Some products marketed to the public as antimicrobial hand sanitizers are not effective in reducing bacterial counts on hands. For alcohol-based hand sanitizers used in the health care professions, the FDA recommends a concentration of 60% to 95% ethanol or isopropanol—the concentration range of greatest germicidal efficacy.

**Gloves**

Gloves are considered single-use, disposable items, which means they should be used on one patient and then discarded. Hand hygiene should be performed after removing and discarding gloves. Occasionally, in the middle of treatment, the orthodontist or assistant needs to leave the patient to get an instrument or device. If the gloves are not removed, cross contamination could occur when you touch a surface with your gloved hand.

Removing only one glove to open a drawer or cabinet creates another concern because handwashing would not take place. After retrieving the desired instrument, if the same previously worn glove is reworn, cross contamination occurs again.

Touching a keyboard or mouse with a gloved hand is a common cause of cross- contamination. Here, a black light shows the spreading of simulated spray contamination. One possible solution is to wear overgloves.

The three cross-contamination issues here are the following:

- The gloved hand may contaminate the surface touched.
- If only one glove is removed, the ungloved hand cannot be effectively washed, thus further spreading contamination.
- The provider may have contaminated his or her hand by rewearing the dirty glove.

One solution is to have food handlers' gloves or overgloves available. Another method would be to use a cotton pliers or a drawer tweezer to open the drawer and grasp the needed item. Salad tongs or forceps can be used as well. As always, be sure to disinfect between patients.

These solutions help to avoid the time-consuming process of removing both gloves, performing hand hygiene, and regloving. If you do need to unglove and leave the patient, remember that you must discard the gloves and perform hand hygiene.

**Street Clothes Versus Clinical Jackets**

Clothing worn by the orthodontic team is an important area of cross contamination. A clinical jacket protects the orthodontist's or assistant's street clothing and skin from the patient's oral materials generated during patient treatment. A visible spray is created during the use of dental instruments such as handpieces, ultrasonic scalers, and air- water syringes. This spray travels only a short distance and settles quickly, landing on either the floor, the nearby operatory surfaces, the dental health care personnel providing care, or the patient. OSHA mandates that protective clothing such as gowns, clinic jackets, or similar outer garments shall be worn in occupational exposure situations. General work clothes such as uniforms, scrubs, pants, and shirts are not intended to protect against a hazard, nor are they considered personal protective equipment.

**Masks, Face Shields, and Protective Eyewear**

OSHA requires dental health care providers (DHCPs) to wear masks and face shields or protective eyewear to protect the skin and the mucous membranes of the eyes, nose, and mouth from exposure to spray generated during a dental procedure. This spray may land on and contaminate masks and protective eyewear but not be visible. To prevent cross-contamination, you must disinfect the contaminated eyewear after each patient and be careful to avoid touching the contaminated eyewear with your bare hand. A surgical mask protects the patient against microorganisms generated by the wearer with greater than 95% bacterial filtration efficiency, and also protects the DHCP from large-particle droplet spatter that might contain blood-borne pathogens or other infectious microorganisms. The mask's outer surface can become contaminated with infectious droplets from spray of oral fluids or from touching the mask with contaminated fingers. Also, when a mask becomes wet from exhaled moist air, the resistance to airflow through the mask increases, causing more airflow to pass around the edges of the mask. If the mask becomes wet, it should be changed between patients or even during patient treatment, when possible.2

As shown by a black light, a surgical mask’s outer surface can become contaminated with infectious droplets from spray of oral fluids or from touching the mask with contaminated fingers. Wet masks should be changed.

**Environmental Surfaces**

Environmental surfaces include surfaces or equipment that do not contact patients directly but can become contaminated during patient treatment. This occurs as a result of spray generated during treatment, contact with contaminated instruments or devices, or when a member of the orthodontic team touches the surfaces with contaminated gloves. These surfaces can serve as reservoirs of microbial contamination. Transfer of microorganisms from contaminated environmental surfaces to patients occurs primarily through DHCP hand contact. When you touch these surfaces, microbial agents can be transferred to instruments; other environmental surfaces; or to the nose, mouth, or eyes of workers or patients.

Environmental surfaces are divided into clinical contact surfaces and housekeeping surfaces. Clinical contact surfaces are surfaces that come in contact with sprays, spatters, contaminated instruments, and your gloved hand. These include:

- dental light handles
- chair switches

- dental radiography equipment
- chairside computer keyboard;
- reusable containers of dental materials
- drawer handles
- faucet handles
- countertops
- pens
- telephones
- doorknobs
- contaminated instruments or devices

An effective way to protect some surfaces is to use barriers. Barriers can be clear plastic wrap, bags, sheets, tubing, and plastic-backed paper or other materials impervious to moisture. Because barriers can become contaminated, they should be removed and discarded after each patient while you are still gloved. After you remove the barrier, if the surface becomes soiled, then it must be cleaned and disinfected. Otherwise, after removing gloves and performing hand hygiene, you should place clean barriers on these surfaces before the next patient.

Clinical contact surfaces that are not barrier-protected must be disinfected between patients. There are a number of surface disinfectants to choose from. The CDC Guidelines state that an EPA-registered disinfectant with a minimum kill claim of HBV and HIV should be used on clinical contact surfaces. When the surface is visibly contaminated with blood or other potentially infectious material, an intermediate-level disinfectant (with a tuberculocidal kill claim) should be used.

There are two steps to proper surface disinfection: First, you must clean the surface; and second, you must disinfect the surface. Always follow the manufacturer's directions for correct use of the product. When using spray disinfectants, the system of "spray- wipe-spray" means spray the surface to moisten, then wipe up to remove any debris.

Once the surface is clean, spray the surface again and allow the product to remain on the surface for the recommended contact time. When using pre moistened wipes, the manufacturer's directions indicate a system of "wipe-discard-wipe," which means wipe the surface to remove any debris, discard the contaminated wipe, and then use a fresh wipe to disinfect the surface for the recommended contact time. While it may seem that you use twice as many wipes when you follow the manufacturer's directions, you may not achieve disinfection by using only one wipe. Another issue to address is placing disinfectant solutions in a container with 4x4 gauze for use on dental equipment. This is not listed on the manufacturer's label as proper use of the product, primarily because the cotton fibers contained in the gauze may shorten the effectiveness of some disinfecting agents when they are stored together in containers. If gauze is used to apply disinfectant to surfaces, it should be saturated with the disinfecting agent at the time of use.

Examples of housekeeping surfaces include floors, walls, and sinks. Housekeeping surfaces pose little risk for disease transmission in dental health care settings. The majority of housekeeping surfaces need to be cleaned only with a detergent and water or an EPA-registered hospital disinfectant/detergent, depending on the nature of the surface and the type and degree of contamination.

**Instruments and Other Patient Care Items**

To determine if you are processing instruments properly, ask yourself three questions:

1) Would I feel comfortable putting this instrument in my mouth?
2) Have I sterilized this item according to the CDC guidelines?
3) Is there any event that might have caused this item to become contaminated after it was sterilized?

Here are four common pitfalls to be aware of in instrument reprocessing:

***Cleaning***

Ultrasonic cleaners are an efficient way to remove debris from instruments. Use ultrasonic solutions that are specifically designed for ultrasonic cleaner use. Other products such as disinfectants can "fix" blood and debris onto the instrument. Be sure to use the appropriate baskets or cassettes to suspend the instruments in the ultrasonic solution. While bundling instruments together with a hair tie will keep sets of instruments organized, it defeats the cleaning process by preventing the instruments from being exposed on all sides to the action of the bubbles and solution. Be sure to close the lid of the ultrasonic tank when in use to prevent contaminated solution from being aerosolized.

***Packaging***

Make sure instruments are rinsed and dried thoroughly prior to packaging. The packaging or wrap should be designed for the type of sterilization process being used. In orthodontic practices, most of the instruments fall into the category of "semicritical instruments," those that touch mucous membranes but will not touch bone or penetrate soft tissue. Semicritical instruments that are sterilized unwrapped on a tray or in a container system should be used immediately or within a short time. When sterile items are open to the air, they will eventually become contaminated. Even temporary storage of unwrapped semicritical instruments should be discouraged because it permits exposure to dust, airborne organisms, and other unnecessary contamination before use on a patient.

***Sterilizing***

Load the sterilizer according to the manufacturer's instructions. Do not overload it, since too many instruments in the chamber can cause the cycle to fail. Use the full recommended cycle times for wrapped instruments. Allow packages to cool down and dry before removing them from the sterilizer. Cross-contamination can occur to instruments when autoclave bags are handled when they are still wet. Wet bags may wick (draw in) bacteria from hands, dust, and contaminates from surfaces. Wet bags can also puncture more easily, which compromises the sterility of the instruments.

Use chemical indicators to distinguish processed and unprocessed instruments. Test each sterilizer weekly, and maintain results as required by state and federal regulations. Biological indicators commonly known as spore tests are the most accepted method for monitoring the sterilization process.

***Storing***

Store instruments in a clean, dry environment to maintain the integrity of the package. Clean supplies and instruments should be stored in closed cabinets. Dental supplies and instruments should not be stored under sinks or in other locations where they might become wet or torn. If the packaging is compromised, instruments must be recleaned, repackaged, and sterilized again.

In today's busy orthodontic practices, patients expect your infection-control practices to protect them from diseases. You must meet their concern for safety with proper sterilization and infection-control techniques as well as strict adherence to OSHA regulations. With a little extra attention to the daily routine of infection control, everyone can eliminate cross-contamination.

A couple of additional articles that are highly recommended but couldn't be reproduced here due to copyright costs are:

- Risky short-cuts in sterilization—from the August 2009 edition of Dental Products Report.
- Getting the Most from Infection Control—from the December 2008 edition of Dental Products Report.

Both are authored by Chris Miller, PhD who is Professor Emeritus of Oral Microbiology and Executive Associate Dean Emeritus at the Indiana University School of Dentistry. The articles should still be accessible online by entering the title of the articles into a search engine (i.e. Google search). Dr. Miller is also the Editor-in-Chief of Infection Control in Practice. A bi-monthly publication of the Organization for Safety and Asepsis Procedures.

# Glossary

***anterior tongue thrust*** **–** the tongue rests on the lingual surfaces of the maxillary teeth

***archwire*** **–** a metal or coated (esthetic) wire that provides force when attached to the teeth (with elastic or steel ties) to the brackets or bands (which are bonded or cemented to the teeth)

***auxiliary*** **–** attachment located on brackets and bands that hold archwires and elastics

***band*** **–** stainless steel ring attached to teeth (primarily molars and bicuspids) to hold the archwire and auxiliaries for orthodontics. Typically has a facial bracket and may have a lingual attachment as well (i.e. a cleat or a sheath)

***braces*** **–** another term for fixed orthodontic appliances

***bracket*** **–** a small device bonded to teeth to hold the archwire to the teeth

***bruxism*** **–** involuntary grinding or clenching of the teeth in movements other than chewing. This occurs most frequently during sleep. The grinding of teeth causes unnatural wear of the enamel and pressure on the periodontium.

***centric occlusion*** **–** occurs when the jaws are closed in a position that produces maximal stable contact between the occluding surfaces of the maxillary and mandibular teeth. In this position, the condyles are seated in an unstrained position in the glenoid fossa.

***centric relation*** **–** the most anterior superior position of the condyle disc assembly within the glenoid fossa.

***cephalometric radiograph*** **–** an extraoral radiograph of the bones and tissues of the head.

***cone beam computed tomograph*** **–** a special radiograph this is a 3-dimensional volume scan.

***crossbite*** **–** condition that occurs when a tooth is not properly aligned facio-lingually with its opposing tooth or teeth.

***crowding*** **–** condition that occurs when teeth are not properly aligned in the arch.

***dentofacial*** **–** structures that include the teeth, jaws, and surrounding facial bones.

***distoclusion*** **–** a class II malocclusion in which the mesiobuccal cusp of the maxillary first molar occludes mesial to the mesiobuccal groove of the mandibular first molar.

***fetal molding*** **–** pressure applied to the jaw, causing a distortion.

***fiberotomy*** **–** a minor surgical procedure that releases tiny elastic fibers around teeth.

***frenectomy*** **–** a minor surgical procedure that removes or repositions a portion of the frenum.

***functional appliance*** **–**fixed or removable appliance that repositions the jaws

***functional occlusion*** **–** the term used to describe contact of the teeth during biting and chewing movements (also known as physiologic occlusion).

***headgear*** **–** an external orthodontic appliance that is used to control growth and tooth movement.

***ligature tie*** **–** a soft, light wire that can be used to hold the archwire in its bracket.

***linguoversion*** **–** refers to the position of the maxillary incisors behind the mandibular incisors (anterior crossbite). Normally, the maxillary incisors slightly overlap the front of the mandibular incisors.

***malocclusion*** **–** abnormal or malpositioned relationships of the maxillary teeth to the mandibular teeth when they are in centric occlusion (i.e. occlusion that is deviated from a class I normal occlusion).

***mesioclusion*** **–** a class III malocclusion in which the mesiobuccal cusp of the maxillary first molar occludes distal to the mesiobuccal groove of the mandibular first molar.

***mouth breathing*** **–** may be the result of narrowing of the maxilla or blockage of the nasal airway. If present for a number of years, it can cause a change in the dentofacial structure of the child.

***occlusion*** **–** the natural contact of the maxillary and mandibular teeth in all positions.

***open bite*** **–** a lack of vertical overlap of the maxillary incisors with the mandibular incisors, creating an opening of the anterior teeth.

***orthodontics*** **–** specialty of dentistry designed to prevent, intercept, and correct skeletal and dental problems.

***osteoblasts*** **–** cells responsible for the building up of bone

***osteoclasts*** **–** cells responsible for the breakdown of bone

***overbite*** **–** increased vertical overlap of the maxillary incisors with the mandibular incisors. In an extreme overbite, the mandibular incisors may not be visible. overjet is excessive protrusion of the maxillary incisors, causing space or distance between the facial surface of the mandibular incisors and the lingual surface of the maxillary incisors.

***overjet*** **–** horizontal projection of maxillary teeth beyond the mandibular anterior teeth, usually measured parallel to the occlusal plane. When not otherwise specified, the term is generally assumed to refer to central incisors and is measured from the labial surface of the mandibular tooth to the lingual surface of the maxillary at the level of the edge of the upper incisor. Unique conditions may sometimes require other measuring techniques.

***parafunction*** **–** function demanded of the teeth and jaws outside the norm (i.e. bruxism)

***retainer*** **–** an appliance used for maintaining the positions of the teeth and jaws after orthodontic treatment.

***separator*** **–** a device made from wire or elastic and used to separate teeth before fitting and placement of orthodontic bands.

***space maintainer*** **–** fixed or removable appliance designed to prevent loss of space

***tongue thrust swallowing*** **–** the tongue presses forward against the anterior teeth with each swallow, placing a forward pressure against the teeth; tongue thrusts can be anterior in position or lateral (fan type)

# Written Examination

1. Orthodontics is the specialty of dentistry that involves
   a. Diagnosis
   b. Prevention
   c. Treatment of dental and facial irregularities
   d. a and b
   e. a, b and c
2. The orthodontist's primary role is the correction of malocclusion.
   a. True
   b. False
3. Horizontal overlap of the incisor teeth is referred to as:
   a. Deep overbite
   b. Over jet
   c. Overbite
4. Dr. Edward Angle in 1899 introduced a classification of malocclusion. It includes Class I, Class II Division III and Class III.
   a. Both statements are true
   b. The first statement is false and the second is true
   c. Both statements are false
   d. The first statement is true and the second is false
5. Dental irregularities found within a dental arch may include:
   a. Crowding
   b. Spacing
   c. Deep overbite
   d. a and c only
   e. a and b
6. Class III malocclusion is defined as retrognathic. The mandible has a mesial relationship with the maxilla.
   a. Both statements are true
   b. The first statement is false and the second is true
   c. Both statements are false
   d. The first statement is true and the second is false
7. The American Association of Orthodontists has recommended that a child's first visit to the orthodontist take place at ___ years of age.
   a. Five
   b. Six
   c. Seven
   d. Eight
   e. None of the above
8. Two major causes of malocclusion are genetic and environmental. The most common cause of malocclusion is heredity.
   a. Both statements are true
   b. Both statements are false
   c. The first statement is true the second is false
   d. The first statement is false and the second is true
9. Crossbite may occur on just one side or both sides of the mouth. It may involve one tooth or several teeth.
   a. The first statement is true and the second is false
   b. The first statement is false and the second is true
   c. Both statements are false
   d. Both statements are true

Match the following:

10. Interceptive treatment _____
11. Corrective treatment _____
12. Functional appliances _____
13. Fixed appliance _____
    a. Occurs at various stages of dentition development
    b. Heads off certain problems before negative effects
    c. The most common treatment modality in adolescent group
    d. Removable device used during corrective treatment
14. Orthodontic Records include the following:
    a. Medical history and dental history
    b. Clinical examination and study models
    c. Panoramic and Cephalometric radiographs
    d. a and c
    e. a, b and c

15. High sugar foods do not need to be avoided during orthodontic treatment.
    a. True
    b. False
16. A space maintainer
    a. Is an example of corrective therapy
    b. Used when a primary tooth is lost prematurely
    c. Prevents drifting of adjacent teeth into an edentulous area
    d. b and c
17. Which of the following is not true regarding oral hygiene practices for the orthodontic patient?
    a. Plaque must be removed more frequently
    b. Brushing around bands and brackets requires additional time and specialized oral health aids
    c. A critical area to brush is between the bracket and gingival margin
    d. Flossing is not an important part of daily home care
18. Discrepancies of occlusion often affect the short-term health of the dentition and surrounding oral tissues. TMJ can result from untreated malocclusions due to stress on the jaw muscles and joints.
    a. Both statements are true
    b. Both statements are false
    c. The first statement is false the second is true
    d. The first statement is true and the second is false
19. Open bites never occur in the posterior region of the mouth
    a. True
    b. False
20. In general, most orthodontic problems are due to:
    a. Environmental influences
    b. Developmental influences
    c. Genetic influences
    d. All of the above
21. Developmental disturbances include:
    a. Congenitally missing teeth
    b. Supernumerary teeth
    c. Malformed teeth
    d. All of the above

Match the following:

22. Malocclusion _____
23. Distoclusion _____
24. Mesiocclusion _____
    a. Deviated from a ideal normal occlusion
    b. Term used for Class III malocclusion
    c. Term used for Class II malocclusion
25. The most common radiograph taken for the orthodontic patient is the:
    a. FMX
    b. Bitewing
    c. Cephalometric
26. The orthodontist works very closely with the:
    a. Periodontist
    b. General dentist
    c. The Pedodontist
    d. The Prosthodontist
    e. b and c
    f. All the Above

Match the following:

27. Anterior tongue thrust _____
28. Lateral tongue thrust _____
29. Fan tongue thrust _____
    a. The tongue thrusts out at the occlusal surfaces
    b. Pressure of tongue causes bite to open—prevents permanent teeth from erupting
    c. Tongue rests on lingual surfaces of maxillary teeth—pressure causes teeth to move forward.

Match the following terms:

30. Band _____
31. Braces _____
32. Bracket _____
33. Headgear _____
34. Ligature tie _____
35. Retainer _____

    a. A small device bonded to teeth to hold the archwire to the teeth

    b. Stainless steel ring attached to teeth, holds archwire to teeth (molars and bicuspids)

    c. Light wire used to hold the archwire to bracket

    d. An appliance used to retain teeth in desired position

    e. Another term for fixed orthodontic appliances

    f. An external orthodontic appliance that is used to alter growth and tooth movement

36. Fetal Molding occurs after a baby is born. Fetal molding can alter the shape of the jaws.

    a. First statement is true, the second is true and the third is false.

    b. Both statements are true

    c. Both statements are false

    d. The first statement is false, the second statement is true

37. Habits can contribute to malalignment. Contributing factors may include sucking the thumb, tongue, or lip. These habits have long-term effects beyond the mixed dentition.

    a. First statement is true, the second is true and the third is false.

    b. All three statements are true

    c. All three statements are false

    d. The first statement is false, the second is false and the third is true.

38. The permanent mandibular second molars are the key to Dr. Angle's classification system for occlusion and malocclusion

    a. True

    b. False

39. The tooth numbering system used most often in dentistry in the United States is:

    a. Palmer notation system

    b. Universal numbering system

    c. Federation Dentaire Internationale system

40. In the universal numbering system the teeth are numbered 1 to 32 starting at the lower right quadrant.

    a. True

    b. False

41. Diseases can be transmitted in the dental office in a variety of ways

    a. Patient to patient

    b. Patient to dental team member

    c. Dental team to patient

    d. All of the above

42. CDC and OSHA are federal agencies that play a very important role in infection control for dental offices. CDC issues specific recommendations and OSHA is a regulatory agency that issues specific standards to protect the health of employees in the United States. The dental assistant should follow all of the guidelines and recommendations.

    a. The statements above are all true

    b. The statements above are all false

    c. The first and second statements are true the third is false

    d. The first two statements are false and the third is true.

43. The agency responsible for issuing guidelines for infection control in dental health care settings is:

    a. OSHA

    b. CDC

    c. Health and Human Services

44. The agency responsible for Bloodborne Pathogens Standard is

    a. CDC

    b. Health and Human Services

    c. OSHA

45. The concept that all human blood and body fluids, saliva included are to be treated as if they are known to be infectious is termed:
    a. Normal precautions
    b. Universal precautions
    c. Standard precautions
    d. Usual precautions
46. Dental personnel should wash their hands
    a. Before and after each patient
    b. Before placing latex gloves
    c. After removal of latex gloves
    d. If the integrity of the gloves is in question during a procedure, gloves are removed, hands are washed and new gloves are placed
    e. All of the above
47. Infection control measures that can prevent disease transmission include
    a. nstrument sterilization
    b. Surface barriers
    c. Hand washing
    d. Use of gloves, masks, glasses and immunization
    d. Pre-procedural mouth rinses for patients
    f. All of the above
48. Dental impressions should be disinfected as soon as possible upon removal from the patent's mouth.
    a. True
    b. False
49. Contaminated waste that has had contact with blood or other body fluids is disposed of in the general waste.
    a. True
    b. False
50. Infectious waste is contaminated waste that is capable of transmitting disease that includes sharps, blood, and blood-soaked materials.
    a. True
    b. False

# Written Examination Answer Key

1. e
2. a
3. b
4. d
5. e
6. b
7. c
8. a
9. d
10. b
11. a
12. d
13. c
14. e
15. b
16. d
17. d
18. c
19. b
20. d
21. d
22. a
23. c
24. b
25. c
26. f
27. c
28. b
29. a
30. b
31. e
32. a
33. f
34. c
35. d
36. d
37. b
38. b
39. b
40. b
41. d
42. a
43. b
44. c
45. b
46. e
47. f
48. a
49. b
50. a

# Module 2

# Orthodontic Banding

## SIZING, FITTING, CEMENTING AND REMOVING ORTHODONTIC BANDS

*By: Michael Payne*

**PERFORMANCE OBJECTIVES**

**After completing the following areas of didactic, laboratory, and clinical instruction in sizing, fitting and cementing orthodontic bands the student will be able to:**

1. List and explain the function of each component of the armamentaria required for sizing, fitting and cementing orthodontic bands
2. Define the proper sequential steps in the procedure of sizing, fitting, and cementing orthodontic bands
3. Explain basic concepts of cements, including characteristics, composition, storage and handling protocol of cementing materials
4. Identify the problem-solving techniques associated with the cements
5. List the major factors that are associated with cement failure and how to avoid them
6. Explain the principles of proper moisture control protocol used for cementing orthodontic bands while practicing patient management and maintaining a dry field
7. Identify the steps for appropriate infection control protocol for the operator and the dental operatory. List the protocol for barrier placement, surface disinfection and sterilization as it relates to cementing orthodontic bands according to OSHA and DBC
8. Identify factors that may cause a health hazard to the operator by viewing a MSDS sheet and know preventive measures that should be employed

**On typodont teeth and patients the student will be able to:**

1. Assemble appropriate armamentaria for sizing, fitting and cementing orthodontic bands
2. Select and fit orthodontic bands for a maxillary and mandibular molar
3. Properly contour the orthodontic band to the tooth
4. Remove the band in preparation of cementation
5. Rinse, dry and load band with cement
6. Isolate and dry quadrant in preparation for band cementation
7. Position and seat orthodontic band
8. Remove excess cement from tooth
9. Perform final curing if using light cure cement
10. Evaluate product using ideal criteria with 75% accuracy
11. Provide appropriate patient education
12. Maintain appropriate infection control throughout all procedures
13. Protect her/him and the patient from any hazardous situations as defined in the MSDS forms for any cement materials used

# Outline

**DIDACTIC SESSION**

***2 Hours***

1. Theory of Band Positioning and Tooth Movement
2. Orthodontic Band Composition
3. Techniques for Orthodontic Band Sizing, Fitting, Cementing & Removal including:
    a. Armamentaria
    b. General principles
    c. Normal placement of brackets, tubes, lingual sheaths, lingual cleats and buttons onto bands
4. Orthodontic Cements and Adhesive Materials
    a. Classifications
    b. Armamentaria
    c. Mixing technique
5. Cementing Bands
    a. Armamentaria
    b. Mixing techniques
    c. Cementation procedures
6. Removal of Bands after Cementation

**LABORATORY SESSION 1**

***2 Hours***

During this session, students will practice sizing, fitting and cementing orthodontic bands on typodont teeth using plain bands and bands with attachments.

**LABORATORY SESSION 2**

***2 Hours***

Laboratory practice on typodont teeth continues but now for different quadrants of the mouth and different tooth types including molars, bicuspids and anteriors. Students will become familiar with use of bite sticks in simulation, band pushers, mechanical band seaters and pluggers used for contouring. Additional time should be spent using the mechanical band seaters, as typodonts will not provide adequate pressure to seat bands on typodonts. During laboratory session 2 students will fit a minimum of two first molar bands on typodont teeth with the cementing and removal of one first molar band serving as a practical examination.

**PRECLINICAL SESSION**

***4 Hours***

Prior to preclinical session, student partners will place orthodontic separators mesial and distal of maxillary and one mandibular molar 3-4 days prior to the start of the session. During this session, student partners work on each other in simulation as described and demonstrated by instructor on day one. Working with a partner, each student functioning as the operator sizes, fits and cements orthodontic bands. Student will then function as an assistant to observe and evaluate placement with partner. Students will size, fit, and cement orthodontic bands to four first molar teeth with the cementing and removal of two first molar bands serving as a practical examination.

**WRITTEN FINAL EXAMINATION**

***1 Hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

**CLINICAL INSTRUCTION**

***8 Hours***

During this session, the instructor will demonstrate the sequence for sizing, fitting and cementing an orthodontic band on active patients. Student experience on active patients will include sizing, fitting, and cementing of orthodontic bands after inspection by the orthodontist on two-four posterior teeth depending on patient needs on a minimum of two patients, with two of the cemented first molar bands used for a clinical exam.

# Didactic Material

**THEORY OF BAND POSITIONING AND TOOTH MOVEMENT**

An orthodontic band is a thin seamless metal cylindrical ring, usually made of stainless steel, which serves to bind orthodontic attachments to a tooth. Modern bands are mostly placed on the maxillary or mandibular molars. Bands are also placed on other teeth with a surface or shape that will not accept a bonded bracket. Some orthodontists prefer placing bands on mandibular premolars as these teeth have a higher incidence of bracket bond failures during treatment. Often, a pre-welded bracket can be seated more gingivally with a band than possible with bonding.

Before brackets could be bonded directly to enamel, orthodontic bands were the standard means to attach appliances to all the teeth. Bands encircle the tooth and rely on both a close customized fit and a luting cement to keep them firmly in place. The luting cement fills and seals the irregular spaces between the actual band and the tooth surface. Luting cements don't typically adhere to either the tooth or band material well but some of the newer banding cements do have good adhesive characteristics.

With the advent of bondable brackets, the universal use of orthodontic bands on all teeth has decreased. Currently, despite the broad use of bonded brackets, there are a number of circumstances where bands still remain the preferred option. Bands provide increased strength and resistance to dislodging compared to bonded brackets. Bands provide a convenient platform for soldered appliances such as palatal expansion appliances, Nance holding arches and fixed lingual arches. Bands also permit easy spot welding of a myriad of attachments on both the facial and lingual aspects of the teeth.

**ORTHODONTIC BAND COMPOSITION**

Orthodontic bands were originally fabricated from precious metal alloys including gold. Stainless steel was later introduced as an alternative to gold alloys. In selecting a band alloy, engineers considered the properties necessary for a band to function well in the oral environment and for it to adapt easily to the varied sizes and shapes of teeth. Teeth have variable anatomy specific to each patient, including tapered crown forms and compound curves requiring a very formable adaptable material. Bands were originally custom fit for each patient's tooth from a ribbon of band material supplied in rolls. A short strip of the ribbon was stretched and formed around the tooth (pinched) with the overlapping ends soldered together to form a complete ring (thus the term "bands"). This method was quite slow and labor intensive. Only experienced hands could produce a well-fitting band.

An orthodontic band must fit the tooth very well while in order to provide resistance against the forces produced by bite sticks, chewing and attachments welded or soldered to the band. Bands are engineered to provide adequate strength, flexibility, the ability to accept welds and solder while maintaining resistance against oral corrosion. Bands, also, must not be a source of allergens for sensitive patients. If this list of properties is not long enough, the basic band alloy must also be inexpensive and easy to fabricate into bands.

Stainless steel is the alloy of choice which meets all of these criteria to varying degrees. There are over 50 different compositions of stainless steel utilized in industry, food service, as well as in the medical field. The composition of a stainless steel alloy can be altered to improve its characteristics by varying the levels of iron, carbon, nickel, chromium and some trace elements. Orthodontic manufacturers have designed stainless steel alloys to provide a strong and malleable/ductile material that can adapt quickly to the majority of teeth

**Characteristics of Band Material**

Band materials possess the following characteristics:

***Malleability***

Malleability is a material's ability to be compressed into a thin sheet by hammering or rolling without forming cracks or fractures in the material. Gold provides an excellent example of malleability as gold and many of its alloys can be hammered to a continuous sheet virtually a few atoms in thickness. When comparing metal malleability, gold is the most malleable followed by silver, lead, copper, aluminum, tin, platinum, zinc, iron, and nickel.

***Ductility***

Ductility is similar to malleability though a distinction is made where ductile materials are able to be drawn or stretched extensively, without breaking, to form thin wires and sheets. As with malleability, gold remains the "gold standard" as it is one of the most ductile materials followed by silver, platinum, iron, nickel, copper, aluminum, zinc, tin, and lead. The stainless steel used to produce orthodontic wires must be very ductile.

***Stiffness***

Stiffness refers to the resistance against temporary deformation and permanent bending. High stiffness permits using the high forces required to seat the bands during placement as well as the forces placed upon the cemented bands by orthodontic forces and mastication. Low stiffness enables close adaptation of the band's margin to the shape of the teeth. In this application we are seeking a material that is both malleable and ductile while also stiff enough to avoid deformation (crushing) when using a bite stick to seat the band.

***Work Hardening***

Work hardening is the process of progressively increasing the stiffness and resistance toward further deformation (reduced ductility/malleability) as the metal is shaped. Bending and shaping a band makes it more resistant toward further bending and shaping. When a band becomes overly work hardened, one cannot shape it anymore and it may need to be discarded.

This characteristic is in direct contrast to a very ductile or malleable material which can be continually reshaped without significant work hardening and resistance to further re-shaping. The potential for work hardening is to be minimized when designing an alloy for an orthodontic band. As a band is fitted to the tooth, continually stretching and bending the band material will result in some work hardening and increased resistance to further adaptation. This is more problematic with stainless steel than with the previously used gold alloys.

A work hardened material can become very brittle and subject to fracture. This is more apparent with orthodontic wires that are bent back and forth many times. Most broken wires are a result of repeated flexing which produces work hardening resulting in increased stiffness, and ultimately, wire fracture.

***Orthodontic Band Dimensions***

Bands are usually made of stainless steel in that is .005-.007 inches thick. This thickness allows the band to pass through separated tooth contacts while thick enough to maintain strength. The height of a band is, on average, .25" (¼ inch) tall. The height of the band varies to avoid impingement on the gingival tissues while offering adequate height for retention, to provide room for welded attachments and to provide strength to resist splitting from the forces of chewing and forces delivered by head gear and other devices.

***Orthodontic Band Sizes***

Bands are designed to fit specific teeth. There are separate designs to fit all the various teeth in the mouth. Often, there are different shapes (mirror images) for the right and left side versions of the same tooth. Bands are designed with anatomical contours to fit the average tooth. Manufacturers offer kits of preformed bands in closely graduated band sizes (circumferences). Thus, one band size will accommodate only a narrow range of tooth circumferences or perimeters. By design, band sizing takes advantage of the ductile properties (stretching) of the stainless steel to bridge the size gap between preformed band sizes. The reduced expense of using stainless steel for bands provides the option of having multiple band inventories containing different pre-welded attachment arrangements.

***Modern Band Features***

Features of modern bands include:

1. Fine medical grade stainless steel
2. Seamless without a lapped or welded joint
3. Anatomical form corresponds to the morphology of tooth providing increased mechanical retention
4. Ease of rapid fitting/adaptation
5. Smooth surface with comfortable feel
6. Close gradation between sizes
7. Permanent laser marking for size and tooth location
8. Rough inner surface to enhances bond strength

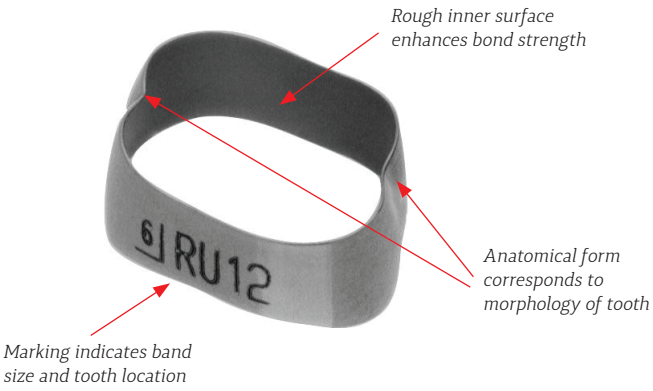



*Figure 1*

**ARMAMENTARIUM FOR BAND PLACEMENT**

The following equipment may be used during band placement.

*Separating Pliers:* specialized pliers designed to stretch and place orthodontic separators.

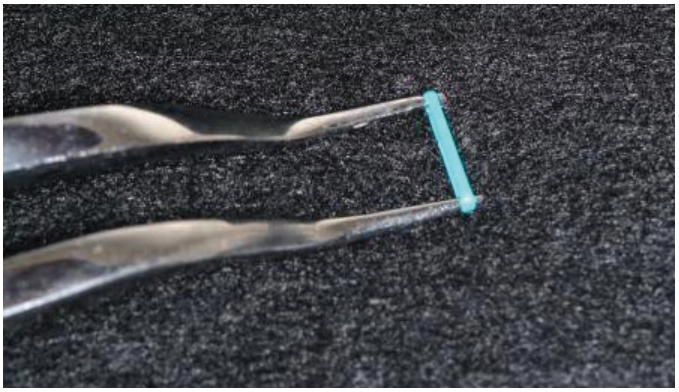


*Figure 2*

*Figure 3*

*Band Removing Pliers*: Pliers designed with specialized tips designed to dislodge and elevate a cemented band. One tip has a protective plastic pad. This pad is normally placed on the occlusal cusp of the tooth for leverage. The plastic pad is designed to prevent damage to the tooth as the plier is squeezed. The opposite tip has a horizontal blade or ledge usually made of hardened carbide steel. It is placed under the gingival aspect of the band or bracket creating a second purchase point. Squeezing the pliers creates a controlled lifting force which dislodges the band when removing a band during trial fitting or when removing a fully seated and cemented band.

*Figure 4*

*Figure 5*

*Band Pusher:* Instrument with a solid serrated carbide tip, used with hand pressure, to guide and push bands into place and for gross contouring of the band margins.

*Figure 6*

*Figure 7*

*Bite Block/Stick:* Bite stick handles are composed of a high strength plastic that are usually autoclavable. They have an inserted serrated tungsten carbide tip. The tip design varies with triangular, round and square configurations. The edge of the insert is used to put force on either the edge of the band material or on a pre-welded attachment. As the patient bites on the plastic portion of the stick, the serrated insert forces the band further on the tooth. Using the bite stick is the preferred method for final band seating as its force is precisely controlled using the patient's own biting force to seat the band.

*Figure 8*

*Figure 9*

*Mechanical Band Seater (Thumper):* Mechanical device with features similar to a band pusher with the addition of a spring activated hammer designed to progressively seat bands. The band seater replicates the seating action formerly provided with a band driver and mallet. It is most often used when the patient's biting force is either inadequate or the orientation of force created with a bite stick is ineffective.

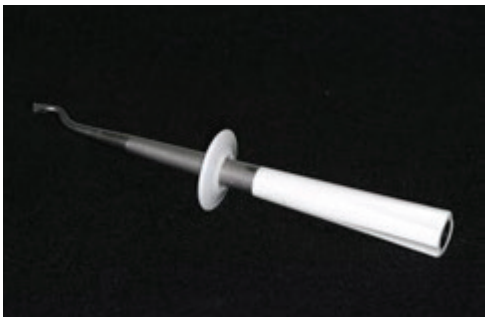


*Figure 10*

*Scaler and Serrated Plugger:* The (amalgam) plugger is a small handled version of the band pusher. By using only finger pressure, it has a reduced chance of tip slippage and enables more finite instrument control. The plugger has a serrated round or oval tip for initial seating of the band. Both the s caler edge and plugger tip can be used for final contouring of the band margins.

*Figure 11*

*Crown and Bridge Scissors:* When bands are seated in some cases there may be areas where the band margin seats too gingival impinging on the interproximal gingiva. Scissors can be used to trim these impinging areas creating a custom trauma free fit.

*Figure 12*

*Howe Pliers:* Often very effective in band seating used by holding a band firmly by the pre-welded bracket. This permits directing a heavy gingival force that can be used to shape and seat a band without crumpling the unsupported band edge.

*Figure 13*

**SIZING AND FITTING BANDS**

A well fitted band encompasses the height of contour of the tooth with the occlusal margin of the band located near the height of the marginal ridges, both mesial and distal, and is parallel to the occlusal surface. The proper vertical orientation of the band may occasionally require additional trimming of the band's occlusal margin.

Fitting the band also includes closely adapting the occlusal margin of the band to the tooth's contours. Rarely, the gingival margins may need to be crimped for better conformation to the gingival tooth surface. Loose (poorly adapted) bands will lead to reduced retention, thick cement lines and cement margin washout with subsequent enamel decalcification. Bands that are too small are also unacceptable as a small band will not fully seat which places the pre-welded bracket too occlusally on the tooth.

You should not be able to remove a well fit band easily with your fingers prior to cementing. A well fitted band usually requires partial removal with a debanding plier.

Understanding the anatomy of the tooth and the varying height of the gingiva are critical to fitting a well sized band. Tooth surfaces are not parallel nor perfectly round. Teeth have heights of contour or points on the tooth that equate with the largest diameter or circumference of the tooth. This height of contour will provide a good guide while selecting the smallest band that can be stretched and adapted to the tooth.

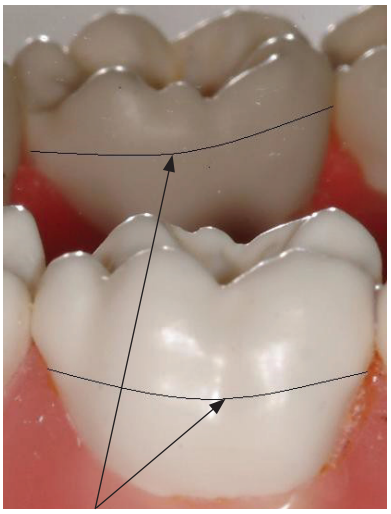


*Figure 14: Height of Contour*

Once separators are removed, test the contact area with floss to determine whether the contact is sufficiently open to accommodate the thickness of the band material. Tight contacts may falsely indicate that a too large band is the correct size or prevent the fitting of the correct smaller size. If separation is inadequate, consider re-separating and rescheduling the band fitting.

Thoroughly pumice the teeth planned for bands and then rinse away all debris.

Identify any irregularities in tooth shape such as extra cusps or variations in tooth shape including the taper from the occlusal to the gingival aspect. These variations will affect the fit of the band. Initial size selection of the bands can be done with the study model. Initially, select a band which appears to be slightly **larger** than necessary. This will minimize unnecessary distortion of bands while trial fitting and reduces permanent distortion of unselected bands which are subsequently re-sterilized and replaced back into inventory for future use.

If a band can be seated over the tooth easily with finger pressure and seats below the level of the marginal ridge, the band is too large. If this occurs, select a smaller band and try again. A well sized band may only be seated by finger pressure up to one third of the way to its final position. Resistance to initial finger seating is the best gauge of proper band size. Final fitting of the band requires stretching while driving the band more gingivally first with a band pusher and then with a bite stick.

Occasionally, where the anatomy of the tooth creates challenges in fitting, one may consider using a plain band that does not have any welded attachments. The more flexible plain band can be fitted to the varied anatomy of the tooth as this band does not have the additional areas of rigidity imparted by the addition of welded attachments. The attachment will have to be welded after the band has been fully adapted and seated. Re-check the band's fit after the attachments have been welded as they may have distorted the formerly perfectly fit band.


*Figure 1: Plain Band without Attachments*

***Pre-Welded Attachments***

The orthodontic bands come from the manufacturer either plain or with pre-welded attachments. The factory will add a multitude of attachments as per the prescription of the ordering doctor. Some orthodontists will maintain a second inventory of plain bands for use fabricating custom appliances.

***Brackets***

Brackets are oriented on the buccal surface according to the orthodontist's prescription and are welded either by the manufacturer or at chair side. Molar brackets include single, double and triple tube configurations as well as those designed with various head gear tube and rectangular slot combinations.

***Lingual Sheaths***

Lingual sheaths can be welded on the lingual surface of maxillary and mandibular molars. The sheaths rectangular opening (tube) will accept doubled over .030 or.036 wires formed to fit securely into the sheath (tube). .030 Lingual sheaths are normally used just on lower molar bands where the larger .036 lingual sheaths can be used on either arch. The larger wires (.036) provide the extra rigidity necessary for maxillary lingual arches, trans-palatal arches as well as other auxiliaries.

***Seating Lugs & Cleats***

Orthodontists may prescribe seating lugs or cleats which provide a positive seat for bite sticks avoiding placement of excess force on the bendable edge of the bands when fitting. These same cleats or lugs are quite handy for loosening bands at removal time.

***Buttons & Hooks***

The number and location of hooks and buttons that can be placed is vast and specific to different force application needs. These attachments have pads that can be welded on an "as needed basis" to individual bands in the office using an orthodontic spot welder.

## ORTHODONTIC CEMENTS

Band cement increases the band's resistance to dislodging by filling and sealing the void between the band and tooth surface. It also blocks the possible seepage of food, bacteria and oral fluids into a safe haven under the band preventing decalcification. Dental cements are hard, resilient materials formed by mixing powders and liquids together which harden with a chemical reaction. Other cements are delivered as a viscous material that is activated (hardened) with a light curing unit. Some cements act as a passive filler while others (adhesive cements) also actively bond to the tooth and band surfaces.

### Classification of Orthodontic Cements

#### *Water-based Cements*

**Zinc oxyphosphate** cement was widely used for crown and bridge and band cementation for much of the last c entury. Although it has a high compressive strength, useful in cementing crowns, it also has the characteristic of low tensile strength. Zinc phosphate acts only as a luting agent as it does not bond directly to either tooth or band surfaces. Luting agents only act as a passive filler. Zinc phosphate cement also is slowly soluble over time. This slow loss of the cement can promote decalcification of the tooth near the margin of the band.

**Zinc polycarboxylate** cements were introduced to orthodontics in the early 1970s as an alternative to zinc phosphate cement with the advantage of chemical adherence to enamel. Unfortunately, the polycarboxylate cements also had poor tensile bond strength, increased solubility (dissolve easily), and a short working time. They are no longer used for orthodontic applications.

**Glass ionomer** cement was developed in 1972 and offered considerable advantages in physical properties over previous band cements. GICs adhere to enamel and metal and have good compressive strength. GICs also better protect the teeth from micro-leakage since any bond failure usually occurs at the cement/band interface leaving the cement/ tooth enamel interface sealed and protected by the intact cement. Furthermore, GICs slowly leach fluoride over a prolonged period which is thought to reduce the potential for demineralization. Despite their obvious improvements, GICs have technique sensitive steps with mixing that can affect the final physical properties of the hardened cement. Manufacturers have developed capsules for mixing which have improved the consistency of the mixing process.

**Resin-modified glass ionomer** cements were modified by incorporating resin (for more strength), water-soluble initiators and activators to produce a dual cure hybrid cement that was easier to mix with a longer working time and a more controlled setting time. It is thought that the addition of the resin reduces fluoride leaching thus reducing the anti-caries effect of traditional GICs.

#### *Resin-based Cements*

**Acid-modified composite resin cements** are compomer or composite cements composed of ion-leachable glass in a polymeric matrix. They are cured through a light activated reaction not by chemical reactions commonly used by previous cements. These cements come in both dual paste systems and single paste systems. The handling characteristics are generally good including minimal mixing and increasing working times. The mixed material can be difficult to place inside the bands. As with other cements, compomers have some negative properties as these cements, unlike the GICs, usually fail at the enamel/cement interface instead of the cement/band interface thus leading to higher risks of decalcification and white spot lesions under a band that does not appear or act "loose."

### Cementation Armamentaria

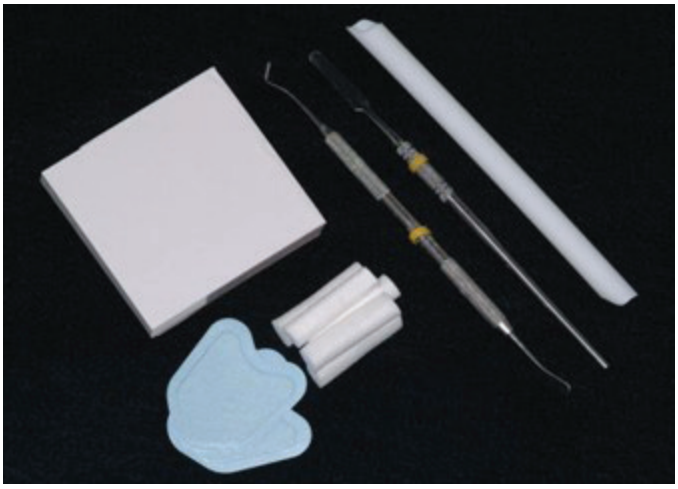


*Figure 15: Mixing slab or pad, Mixing spatula, Plastic instrument, Cotton rolls, Dry angles, Suction tip*

### Mixing Techniques

The cement mixing technique varies considerably with the type of cement being used. For those with a water base and powder and liquid components the materials are mixed typically on a glass or Teflon coated slab with a mixing spatula. Since water-based materials rely on an acid-base reaction, these materials have a limited working time. To increase working time, the slab may be ***chilled*** in a refrigerator before use.

The resin cements rely on light activated polymerization started with a light curing unit. Once mixed, the material is loaded into the bands with either a spatula or a plastic instrument. The cement must fully coat the inner band surface occluso-gingivally.

Typically, resin materials require additional effort to load onto the band surface. Since their cure is light activated, assistants have the luxury of unlimited working time to load and seat the band prior to starting the cure with a curing light.

**BAND PREPARATION FOR CEMENTING**

Once the bands have been fit to each tooth, they are removed with de-band pliers with care being taken to avoid damage to the gingival and subsequent bleeding. The removed bands must be stored in a logical order so that each band will be identified and cemented on the same tooth it was removed from.

Inspect the bands and sand blast the internal surface of bands as needed. Some bands have been pre-etched by the manufacturer. An etched band will have better mechanical retention at the band/cement interface especially with the resin cements which do not readily bond to the metal surfaces

Some orthodontists may request placement of masking tape over the occlusal surface of the band to encourage gingival cement flow while seating and to keep cement off the fingers, gloves and instruments.

**Tooth Preparation for Banding**

Have the orthodontist treat any areas of continued bleeding with a coagulating agent. Prophy and rinse the teeth thoroughly. Isolate teeth with dry angles, retractors and cotton rolls as needed. Then, blow dry the teeth with compressed air. When using GIC cements, the teeth can be left "damp" as they do not have to be "bone dry."

**Band Cementation**

The bands are seated initially with finger pressure followed by full seating with band pushers and bite sticks. Once fully seated, depending on the type of cement, excess cement is removed. The tooth and band should be inspected by the orthodontist for ideal placement with any final contouring and burnishing of the band margins as needed.

# Laboratory, Preclinical and Clinical Instruction

**LABORATORY SESSION 1**

***2 Hours***

During this session, students will practice sizing, fitting and cementing orthodontic bands on typodont teeth using bands with pre-welded attachments (using plain bands is an optional extra). Students will work in pairs during these procedures. One student will be the operator while the other will assist the operator. The assisting student will observe each stage of the process for subsequent evaluation. Once the first operator is finished, the students will switch duties.

**LABORATORY SESSION 2**

***2 Hours***

Laboratory practice on typodont teeth continues but in different quadrants of the mouth and on different tooth types including molars & bicuspids. Students will become familiar with use of bite sticks in simulation, band pushers, pluggers, and spring activated band seaters. Additional time should be spent using the mechanical spring activated band seaters, as typodonts will not provide adequate pressure to shape & seat bands on the typodont.

**Laboratory Instructions**

The following is an approximate step-by-step description of the procedures that should be followed during all the laboratory practice sessions:

1. Students will be provided with a typodont, a bench mount for the typodont and at least four posterior typodont teeth. In addition, the student will be provided with individualized packets that will include:
    a. Assortment of band sizes which range above and below those required to fit the typodont teeth
    b. Armamentarium for band sizing, fitting and cementation
    c. Banding cement
2. Each student will set up his/her armamentaria for sizing, fitting and band cementation.
3. Instructor will describe evaluation criteria for ideal band fitting and cementation.
4. Instructor will provide ideal examples that will be passed around for viewing.
5. Student will select the appropriate band sizes, fit bands, contour the bands, prepare them for cementation and then seat and cement the orthodontic bands on the provided typodont teeth.
6. The assisting partner observes, evaluates and records on evaluation worksheet.
7. The student operator will also evaluate him/herself on every step of the procedure.
8. The instructor will evaluate every banding process.
9. The entire process will be repeated using fresh new bands and will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
10. Each student will fit and cement a minimum of three bands.
11. Partners then switch places—the operator becomes the evaluating assistant, and the former evaluating assistant becomes the operator. The new operator will fit and cement a minimum of three bands as described above.
12. At this point, both students will have fit and cemented at least three bands each. Instructor will now present product evaluation form and how it is used to evaluate final sizing, fitting, and cementing orthodontic bands.
13. Using the product evaluation form, the student operator, the student assistant and instructor will grade all the cemented orthodontic bands for each other.
14. Discussion of evaluation results is conducted in small groups with emphasis on techniques to speed the process and how to improve the quality of the finished product.

**PRECLINICAL SESSION**

***4 Hours***

***Prior to Preclinical Practice:***

Student partners will place orthodontic separators mesial and distal of maxillary and one mandibular molar 3-4 days prior to the start of preclinical session 3.

During this session, student partners work on each other in simulation as previously described and demonstrated by instructor. The following general procedures will occur:

1. Each student, functioning as the operator, sizes, fits, and cements orthodontic bands on their partner/patient.
2. Student will then switch with the operator becoming the patient and the patient becoming the operator.
3. During the entire process, both students will evaluate every step of the process.

The following general procedures will occur for each patient:

1. Operatory will be set up following infection control guidelines
2. Equipment and supplies will be checked by student
3. Student/patient will be seated and prepared for treatment
4. Student operator will perform a patient assessment
5. Instructor will follow-up and check the procedures #1, #2, #3 & #4
6. Patient is given explanation of procedures to be performed
7. Student operator will perform the following according to the stated criteria:
    a. Remove the orthodontic separators
    b. Select, fit and seat orthodontic bands to maxillary and mandibular molars
    c. Properly contour the orthodontic band margin to the tooth
    d. Remove the band in preparation for cementation
    e. Rinse, dry and store the band
    f. Isolate and dry quadrant in preparation for band cementation
    g. Mix the cement (if needed)
    h. Load band with cement
    i. Position and seat orthodontic band completely
    j. Remove excess cement from band and tooth
    k. Request inspection by orthodontist for final positioning
    l. Perform final curing (if using a light curing cement)
    m. Remove all excess cement
    n. Evaluate product using ideal criteria
    o. Give patient post-op instructions
    p. Dismiss patient
    q. Perform operatory clean-up according to infection control guidelines

During the procedure the following will take place:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/patient will observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' performance following stated criteria entering findings on the worksheet and product evaluation form.
4. Discussion of the results will be conducted on the spot by the instructor.
5. The instructor will explain the upcoming clinical examination protocol. When the student operator performs the last procedure on their student partner, the procedure will be termed and evaluated as a "mock exam" in preparation for the final clinical exam on a bona fide clinical patient.

*After the student has finished with the reading materials, laboratory, and preclinical instruction the course provider will provide a written exam to test your knowledge. Use the exam results to determine areas where you need further instruction.*

**WRITTEN EXAMINATION**

***1 Hour***

**CLINICAL INSTRUCTION**

***8 Hours***

During this session, the instructor will demonstrate the sequence for sizing, fitting, and cementing an orthodontic band on active patients.

The following procedures will be demonstrated:

1. Remove the orthodontic separators
2. Select, fit and seat orthodontic bands to a maxillary and mandibular molar
3. Properly contour the orthodontic band margin to the tooth
4. Remove the band in preparation for cementation
5. Rinse, dry and store the band
6. Isolate and dry quadrant in preparation for band cementation
7. Mix the cement (if needed)
8. Load band with cement
9. Position and seat orthodontic band completely
10. Remove excess cement from band and tooth
11. Request inspection by orthodontist for final positioning
12. Perform final curing (if using a light curing cement)
13. Remove all excess cement.
14. Evaluate product using ideal criteria
15. Give patient post-op instructions
16. Dismiss patient
17. Perform operatory clean up according to infection control guidelines

**Note:** Student experience on active patients will include sizing, fitting and cementing of orthodontic bands (after inspection by the orthodontist) on two-four posterior teeth, depending on patient needs, on a minimum of two patients with two of the cemented first molar bands used for clinical exam.

The following general procedures will occur for each patient:

1. Operatory will be set up following the infection control guidelines
2. Equipment and supplies will be checked by student
3. Student/patient will be seated and prepared for treatment
4. Student operator will perform a patient assessment and check the patient's treatment plan
5. Instructor will follow-up and check the procedures #1, #2, #3 & #4
6. Patient is given explanation of procedures to be performed
7. Student operator will perform the following according to the stated criteria:
    a. Remove the orthodontic separators
    b. Select, fit and seat orthodontic bands to a maxillary and mandibular molar
    c. Properly contour the orthodontic band margin to the tooth
    d. Remove the band in preparation for cementation
    e. Rinse, dry and store the band
    f. Isolate and dry quadrant in preparation for band cementation
    g. Mix the cement (if needed)
    h. Load band with cement
    i. Position and seat orthodontic band completely
    j. Remove excess cement from band and tooth
    k. Request inspection by orthodontist for final positioning
    l. Perform final curing (if using a light curing cement)
    m. Remove all excess cement
    n. Evaluate product using ideal criteria
    o. Give patient post-op instructions
    p. Dismiss patient
    q. Perform operatory clean up according to infection control guidelines

**After the student operator completes the sequence of procedures, the student operator, the assistant and the instructor will evaluate the performance of the student operator using the worksheet and product evaluation.**

During this process the following procedures will occur:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/assistant will assist, observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work/ performance using stated criteria using the worksheet and product evaluation forms.
4. Discussion on results will be conducted.

# Worksheets

**LABORATORY & CLINICAL PATIENT WORKSHEETS**

**General Information on Worksheets**

The student operator, student assistant, and instructor use these forms. Each of these individuals will watch the performance of the specified steps of the given procedure and then identify if any of these steps are not followed and/or inadequately performed by the student operator. During the learning process, errors can and will occur. Students and clinical instructors identify common errors encountered during each step of the entire procedure utilizing the worksheets. Worksheets are not grade sheets, but they assist the student to identify his or her own errors during performance of these steps. They are used for measuring student's progress toward attainment of clinical proficiency.

**General Procedures**

An important part of the learning experience in the process of sizing, fitting and cementing bands is the ability to identify technique errors, understand their causes and find solutions. Equally important is to determine the degree of error and when it constitutes a need to redo an inadequately cemented band. The first step in this process is to identify the error(s). Using the Sizing, Fitting and Cementing Bands Laboratory and Clinical Patient Worksheets does this. The worksheets are not grade sheets but are documents that are used to assist students in learning to identify common technique errors related to the procedures associated with the sizing, fitting and cementing orthodontic bands. The student uses this form in the following manner:

The worksheet consists of a column titled Procedure-Laboratory and Procedure-Clinical, which is the step-by-step description of the procedures associated with preparing teeth for bonding brackets. The procedures are subdivided into the following categories:

- Infection Control/Patient Safety
- Assemble Armamentaria
- Sizing & Fitting
- Cementing
- Patient Education
- Infection Control/Patient Safety/Clean-up

**How Worksheets Are Used by Student Operator and Student Assistant**

1. When performing multiple procedures either in the laboratory or on clinical patients, all of the errors from these series are placed on one worksheet.
2. Each laboratory/clinical experience is graded in a different column.
3. When an error occurs in any of the individual steps described in the Procedure column, a check is placed in the box corresponding to the laboratory/clinical experience.

For example, on the clinical patient worksheet there would be a box for each step of the clinical practice patients. For the laboratory worksheet, there would be a box for the typodont teeth. With worksheet check-offs, the student can identify a clustering pattern of errors in any particular step. When an instructor evaluates the student's performance, he/she cannot only see how a student performs, but whether or not the student can identify errors that he/she makes.

**How the Student Identifies Cause and the Correction of Errors**

After the student identifies the error(s) performed, he/she will write the cause of the error and how it shall be rectified. The student then identifies whether the error is significant enough to require re-sizing, re-fitting, re-cementing. During this process, the student will review the criteria for successful sizing, fitting and cementing orthodontic bands.

**How the Instructor Uses the Worksheets**

The instructor watches the student operator during the entire process of sizing, fitting and cementing orthodontic bands. The instructor will check the appropriate box on the same worksheet used by the student operator and the student assistant. The instructor observes both students, and then evaluates the grading completed by both students for accuracy. The instructor reviews the worksheets for information related to: cause, solution and whether any part of the procedure requires additional steps. The instructor can provide additional assistance where needed. This process of identification of errors, causes and solutions will ensure the student will progress towards clinical competence and expected course objectives will be met. This process will continue throughout all laboratory and clinical requirements. When the clinical final exam is administered the student should be clinically competent in sizing, fitting and cementing orthodontic bands.

**Satisfactory Performances of Psychomotor Skills**

Students will practice psychomotor skills during the laboratory and preclinical sessions until they reach a competence level of 75% utilizing the sizing, fitting and cementing documented criteria evaluated using the behaviorally anchored rating scale. Students must achieve a passing score on a minimum of two typodont teeth or natural teeth before progressing on to successive laboratory, preclinical and clinical sessions.

# Worksheet – Laboratory/Preclinical

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Band sizing, fitting and cementing on minimum of (8) first molars. Record tooth number(s):

Optional: Add anterior teeth for band sizing, fitting and cementing. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector, band removing pliers, band pusher, bite stick, mechanical band seater, scaler and serrated plugger, crown and bridge scissors, howe pliers, band, crimping pliers, curing light if applicable and cement product | | | |
| 5. Isolation products-long and short cotton rolls, cheek retractors, tongue guard/ etc. | | | |
| 6. Typodont with appropriate teeth and bench mount/pole | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Sizing & Fitting Orthodontic Bands | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 7. Remove the orthodontic separators | | | |
| 8. Select and fit orthodontic bands to a maxillary and mandibular first molar | | | |
| 9. Properly contour the orthodontic band to the tooth | | | |
| 10. Remove the band in preparation for cementation | | | |
| 11. Rinse, dry and load band with cement | | | |
| 12. Isolate and dry quadrant in preparation for band cementation | | | |
| **Cementing Orthodontic Band** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 13. Position and seat the orthodontic band | | | |
| 14. Remove excess cement from band and tooth | | | |
| 15. Request inspection by orthodontist for final positioning | | | |
| 16. Perform final curing if light curing cement | | | |
| 17. Rinse and suction debris. | | | |
| 18. Remove any remaining isolation materials and rinse well | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 19. Give post-operative instructions to the patient or parent | | | |
| 20. Document procedure in patient chart to include: date, HH review or update, teeth where bands were cemented and products used, problems encountered, operator signature, and instructor or DDS signature | | | |

| Infection Control/Patient Safety/Clean-Up | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 21. Surface disinfect | | | |
| 22. Prepare institute sterilization procedures | | | |
| 23. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 24. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Worksheet – Clinical Patient

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Circle one: Patient #1 Patient #2

Patient Name

Band sizing, fitting and cementing on minimum of (8) first molars. Record tooth number(s):

Optional: Add anterior teeth for band sizing, fitting and cementing. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector, band removing pliers, band pusher, bite stick, mechanical band seater, scaler and serrated plugger, crown and bridge scissors, howe pliers, band, crimping pliers, curing light if applicable and cement product | | | |
| 5. Isolation products-long and short cotton rolls, cheek retractors, tongue guard/ etc. | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Sizing & Fitting Orthodontic Bands | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 6. Remove the orthodontic separators | | | |
| 7. Select and fit orthodontic bands to a maxillary and mandibular first molar | | | |
| 8. Properly contour the orthodontic band to the tooth | | | |
| 9. Remove the band in preparation for cementation | | | |
| 10. Rinse, dry and load band with cement | | | |
| 11. Isolate and dry quadrant in preparation for band cementation | | | |
| **Cementing Orthodontic Band** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 12. Position and seat the orthodontic band | | | |
| 13. Remove excess cement from band and tooth | | | |
| 14. Request inspection by orthodontist for final positioning | | | |
| 15. Perform final curing if light curing cement | | | |
| 16. Rinse and suction debris. | | | |
| 17. Remove any remaining isolation materials and rinse well | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 18. Give post-operative instructions to the patient or parent. | | | |
| 19. Document procedure in patient chart to include: date, HH review or update, teeth where bands were cemented and products used, problems encountered, operator signature, and instructor or DDS signature. | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 20. Surface disinfect | | | |
| 21. Prepare institute sterilization procedures | | | |
| 22. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 23. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Product Evaluation Forms

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

**General Procedures**

Product evaluation evaluates the end result of any performance, not the steps. This facility utilizes the behaviorally anchored rating scale (BARS) system. This 10-point system clusters the critical incidents into categories. The instructor can score objectively the end result of sizing, fitting and cementing orthodontic bands by choosing the criteria specified in each point level. Performance is assessed according to established criteria for each of these procedures. The points are then converted to a pass or fail grade.

**How Instructor Uses Product Evaluation Form**

A product evaluation form will be used for each patient. In the "scores" area on the form you will note that an open box rather than specific grids occurs. This open box allows you to enter a score for each of the posterior first molars.

**The student must maintain a minimum point value of 7.5 on all clustered critical incidences per tooth. He/she must receive this minimum score for all four posterior first molars during preparation in order to pass this module. A grade of 7.5 represents a 75% passing score.**

**Product Evaluation Point Conversion**

The student will receive points for a given level of achievement from the point scale utilized for product evaluation.

**POINT SYSTEM TO A PASS/ FAIL SCORE**

***Conversion***

| Points | Grades |
|---|---|
| **10** | ➨ Pass-Excellent |
| **7.5** | ➨ Pass |
| **5** | ➨ Fail-Critical Error(s) |
| **3** | ➨ Fail-Critical Errors-no concept |

# Product Evaluation/Practical Examination – Lab Session 1

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

1 first molar sized, fitted and cemented. Record tooth number(s):

**PREPAIRING FOR ORTHODINTIC BANDING**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth<br>**Sizing Bands**<br>A. Estimate size from study model | | |

## FITTING ORTHODINTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Fitting**<br>A. Initial fitting<br>B. Final contouring<br>C. Remove band in preparation for cementation<br>D. Sand blast inside of band | | |

## CEMENTING ORTHODONTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Cementing**<br>A. Mixing, preparation, and loading of orthodontic cement<br>B. Rinse dry and load band with cement<br>C. Isolate and dry quadrant<br>D. Position and seat orthodontic band<br>E. Remove excess cement<br>F. Final contouring and burnishing<br>G. Perform final curing if using curing light | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Lab Session 2

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

1 first molar sized, fitted and cemented. Record tooth number(s):

**PREPAIRING FOR ORTHODINTIC BANDING**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth<br>**Sizing Bands**<br>A. Estimate size from study model | | |

## FITTING ORTHODINTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Fitting**<br>A. Initial fitting<br>B. Final contouring<br>C. Remove band in preparation for cementation<br>D. Sand blast inside of band | | |

## CEMENTING ORTHODONTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Cementing**<br>A. Mixing, preparation, and loading of orthodontic cement<br>B. Rinse dry and load band with cement<br>C. Isolate and dry quadrant<br>D. Position and seat orthodontic band<br>E. Remove excess cement<br>F. Final contouring and burnishing<br>G. Perform final curing if using curing light | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Preclinical Session

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

2 first molar sized, fitted and cemented. Record tooth number(s):

**PREPAIRING FOR ORTHODINTIC BANDING**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth<br>**Sizing Bands**<br>A. Estimate size from study model | | |

## FITTING ORTHODINTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Fitting**<br>A. Initial fitting<br>B. Final contouring<br>C. Remove band in preparation for cementation<br>D. Sand blast inside of band | | |

## CEMENTING ORTHODONTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Cementing**<br>A. Mixing, preparation, and loading of orthodontic cement<br>B. Rinse dry and load band with cement<br>C. Isolate and dry quadrant<br>D. Position and seat orthodontic band<br>E. Remove excess cement<br>F. Final contouring and burnishing<br>G. Perform final curing if using curing light | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Clinical Session

**SIZING, FITTING & CEMENTING ORTHODONTIC BANDS**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

2 first molar sized, fitted and cemented. Record tooth number(s):

**PREPAIRING FOR ORTHODINTIC BANDING**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth<br>**Sizing Bands**<br>A. Estimate size from study model | | |

## FITTING ORTHODINTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Fitting**<br>A. Initial fitting<br>B. Final contouring<br>C. Remove band in preparation for cementation<br>D. Sand blast inside of band | | |

## CEMENTING ORTHODONTIC BANDS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| **Cementing**<br>A. Mixing, preparation, and loading of orthodontic cement<br>B. Rinse dry and load band with cement<br>C. Isolate and dry quadrant<br>D. Position and seat orthodontic band<br>E. Remove excess cement<br>F. Final contouring and burnishing<br>G. Perform final curing if using curing light | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation Documented Criteria

| SIZING & FITTING ORTHODONTIC BAND | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Separators are removed without trauma to tissue<br>➨ Teeth are clean and pumiced<br>➨ Band fits well to anatomy and height of contour<br>➨ Band seats by finger pressure to one third of the way to the final position<br>➨ Field is totally isolated and maintained during procedure |
| **7.5 Points** | ➨ Separators are removed with small amount of tissue trauma.<br>➨ Teeth are relatively clean and pumiced<br>➨ Band fits relatively well to anatomy and height of contour.<br>➨ Band seats by finger pressure to one third of the way to the final position<br>➨ Field is adequately isolated and maintained during procedure |
| **5 Points** | ➨ Separators are removed with tissue trauma<br>➨ Teeth are not cleaned<br>➨ Band does not fit well to anatomy and height of contour.<br>➨ Band does not seat by finger pressure to one third of the way to the final position<br>➨ Isolation is faulty and saliva penetrates area |
| **3 Points** | ➨ Separators are removed with gross tissue trauma.<br>➨ Teeth are not cleaned<br>➨ Band does not fit to anatomy and height of contour<br>➨ Band does not seat on tooth<br>➨ Isolation is not attempted |

# Product Evaluation Documented Criteria

| CEMENTING ORTHODONTIC BAND | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Material is carefully prepared according to manufacturer's directions<br>➨ Material is evenly applied to inside of band without voids.<br>➨ Band does not interfere with occlusion<br>➨ Cement is properly monitored and or cured appropriately.<br>➨ Excess cement is completely removed<br>➨ Oral cavity is rinsed all debris is removed |
| **7.5 Points** | ➨ Material is prepared reasonably accurate to manufacturer's directions<br>➨ Minor air bubbles in material inside of band<br>➨ Band does not interfere with occlusion<br>➨ Cement is adequately monitored and or cured appropriately<br>➨ Excess cement is removed<br>➨ Oral cavity is adequately rinsed with most debris removed |
| **5 Points** | ➨ Material is carelessly prepared<br>➨ Material is either uneven, irregular or in excess.<br>➨ Band interferes with occlusion<br>➨ Cement is not properly monitored and or cured appropriately<br>➨ Excess cement inadequately removed<br>➨ Oral cavity is inadequately rinsed with visible debris |
| **3 Points** | ➨ Material is crudely manipulated<br>➨ Material is applied with voids<br>➨ Bands and excess cement interfere with occlusion<br>➨ Cement is properly monitored and or cured appropriately<br>➨ Excess cement is not removed<br>➨ Oral cavity is not rinsed |

# Course Requirements

During this session, students will practice sizing, fitting and The following is an overview of the course requirements and the protocol followed for laboratory and clinical practice, the written and clinical examination.

**Minimum Number of Satisfactory Performances**

All students will perform at a minimum the following procedures in order to achieve minimum competence in the various protocols used in the sizing, fitting and cementing orthodontic bands.

On a typodont and patients, the student will perform the following under OSHA and DBC guidelines:

- On the typodont: Sizing, fitting and cementing orthodontic bands will be completed at the very least on four posterior first molars a minimum of two times, with two used for a practical exam according to the specified criteria.
- On the patient: Identify teeth for sizing, fitting and cementing orthodontic bands using appropriate technique with the focus on safety and comfort of the patient. Sizing, fitting and cementing orthodontic bands on four posterior first molars on at least two patients according to the specified criteria with one of each of the four times used for a practical examination with 75% accuracy.

Students are required to meet the specified minimal number of satisfactory performances as indicated above. The student operator grades his/her own performance, the student assistant grades the performance of the student operator and the instructor will assess the student operator's performance and the grading method of both students.

When the student reaches the 75% minimum performance for sizing, fitting and cementing orthodontic bands and 100% performance on all infection control protocol, the instructor evaluates the procedure for the minimal number of satisfactory performances. If a student does not fulfill the minimum grade for the number of satisfactory performances additional laboratory and/or clinical practice procedures will be assigned.

**Objective Evaluation Criteria**

Objective evaluation criteria shall be provided to each student prior the performance of any procedure. The student will receive information provided by the instructor prior to performing any laboratory or clinical procedures. The instructor shall supply the student with general program, individualized cognitive and psychomotor objectives and criteria for evaluation. Objective criteria will be utilized in the performance of all laboratory and clinical requirements.

**Preparation Criteria (Prior to Sizing, Fitting & Cementing Orthodontic Bands)**

1. Will review the medical/dental history, make a general assessment, and oral inspection on each patient prior to treatment, checking for information that may contraindicate the performance of the procedure
2. Will set up the required armamentaria for band removal and cement removal with a hand instrument
3. Will use aseptic techniques according to OSHA and DBC throughout performance on all patients
4. Will place protective barriers, seat and position the patient
5. Will evaluate the teeth scheduled for sizing, fitting and cementing orthodontic bands
6. Will explain to patient the treatment planned for that day
7. Will perform sizing, fitting and cementing orthodontic bands
8. Will isolate four posterior first molars for sizing, fitting and cementing orthodontic bands on two patients

**Fitting and Sizing of Orthodontic Bands Criteria**

1. Will identify teeth for fitting and sizing
2. Will fit and size orthodontic bands using appropriate armamentarium
3. Will proceed safely and with the patient's comfort as a primary focus
4. Will identify special circumstances that require adaptation to treatment to ensure no damage results to tissues or restorations

**Cementing of Orthodontic Bands Criteria**

1. Will isolate quadrant with dry angles, retractors and cotton rolls as needed
2. Will rinse and dry and prepare to place bands
3. Will evenly place cement free of voids or excess inside of the orthodontic band
4. Will seat band initially with finger pressure followed by full seating with band pushers and bite sticks
5. Will take care when removing excess cement
6. Will be meticulous in monitoring debris to prevent swallowing or aspirating residual cement
7. Will take care not to injure soft or hard tissues

**General Criteria**

1. Will provide pertinent and individualized patient education
2. Will provide follow up appointment as identified in the treatment plan
3. Will meet ethical and legal requirements for this procedure
4. Will provide accurate chart entries for this procedure
5. Will utilize OSHA and DBC guidelines for instrument processing, removing waste and cleaning/disinfecting treatment area

The above criteria will be used to evaluate and access appropriate fitting, sizing and cementing orthodontic bands with a minimum of 75% accuracy for laboratory and clinical patients.

**General Clinical Practice Protocol**

Students will complete procedures on two clinical patients. The following general procedures will occur:

***Patient Selection Criteria***

The following criteria must apply for each patient:

1. Patient must be an active orthodontic patient
2. Patient must be in good health (medical history form will be completed prior to treatment, reviewed and approved by the instructor)
3. Each patient will have a minimum of two posterior first molars for fitting, sizing and cementing orthodontic bands

The student will function as an operator, an assistant and a patient. Working as partners (operator and assistant) an operator will perform the procedure, the assistant will observe, and evaluate each step of the procedure. When complete each student will do the procedure, observe and evaluate.

The following general procedures will occur for each of the patients:

1. Operatory will be set up following the infection control guidelines
2. Medical history will be completed by the patient prior to seating
3. Equipment and supplies will be checked by the student
4. Patient will be seated and prepared for treatment
5. Student operator will review the medical history and perform a visual exam
6. The instructor will review the medical history and perform a visual exam
7. Instructor will accept the patient for fitting, sizing, and cementing orthodontic bands
8. Student operator will perform the following according to the stated criteria:
    a. Identify teeth for sizing, fitting and cementing orthodontic bands
    b. Remove separators
    c. Pumice teeth prior to sizing, fitting and cementing orthodontic bands
    d. Size, fit and cement orthodontic bands
    e. Rinse and remove isolation products
    f. Evaluate the product
    g. Provide individualized patient education
    h. Dismiss the patient
    i. Make appropriate chart notes
    j. Perform operatory clean-up/instrument processing according to infection control guidelines

After sizing fitting and cementing orthodontic bands procedure, the student operator, student assistant and the instructor complete evaluation using the worksheet and product evaluation form.

During this time period, the following will occur:

1. Student operator will evaluate his/her own work according to stated criteria using worksheet and product evaluation forms
2. Student assistant will assist, observe, evaluate operator's performance according to stated criteria using the worksheet and product evaluation forms
3. The instructor will evaluate both students' work according to stated criteria using the worksheet and product evaluation forms. Results will be discussed

A 75% must be obtained for passage of sizing, fitting and cementing bands.

**General Examination Protocol**

***Written Examination***

A comprehensive written examination of 42 questions on the entire curriculum will be administered. The student must receive a minimum score of 75% on the examination to pass the class. One hour has been reserved for the written examination.

***Clinical Final Examination***

The clinical final examination occurs during the process of working on the two active orthodontic patients during the sizing, fitting and cementing of orthodontic bands on four posterior first molars following patient selection criteria and procedures outlined in the module's clinical practice protocol.

# Written Examination

1. Modern orthodontic band features include:
   a. Fine medical grade stainless steel
   b. Smooth surface and comfortable fit
   c. Permanent laser marking for size and tooth location
   d. Anatomical form corresponds to the morphology of tooth
   e. a and b
   f. b and d
   g. a, b, c, and d
2. The band is first seated on the _____ aspect when being sized for mandibular premolars and molars.
   a. Buccal
   b. Lingual
   c. Mesial
   c. Distal

Match the definitions to their corresponding terms:

3. Separating pliers _____
4. Band removing pliers _____
5. Band pusher _____
6. Mechanical band seater _____
7. Bite stick _____
8. Howe pliers _____
9. Band crimping pliers _____
   a. High impact plastic with varied tip design preferred method for band seating
   b. Sometimes used for holding a band and bracket combination, seating and assisting with crimping the band
   c. Specialized plier to hold and place separators
   d. Specialize plier for crimping gingival aspect of band to improve fit
   e. Handled instrument with solid serrated tip to push bands into place and assist in gross contouring
   f. Hammer device similar to band pusher
   g. Pliers with specialized tips with one tip with a plastic stop placed on occlusal cusp of tooth for leverage

10. Classifications of cements used for orthodontic band cementation are:
    a. Water-based
    b. Resin-modified glass ionomer
    c. Resin-based
    d. a and c
    e. a, b and c
11. Cementation armamentarium includes a mixing slab or pad, mixing spatula and a plastic instrument.
    a. True
    b. False
12. Mixing orthodontic band cements varies considerably with the type of luting cement mixed. To increase mixing time a warm glass slab should be used.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
13. Zinc phosphate is a water-based cement that is used for orthodontic band cementation. Since zinc phosphate is water-soluble and susceptible to dissolving it can lead to loss of cement and possible decalcification of enamel.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
14. Documentation in the chart regarding size used for each banded tooth is not necessary when cementing bands.
    a. True
    b. False
15. The assistant should arrange all bands in order of cementation according to the orthodontist's preference. Each band is placed on a square of masking tape with the gingival side down.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false

16. During isolation for band cementation the assistant should place cotton rolls and dry the teeth using an air syringe.
    a. True
    b. False
17. With the advent of brackets the use of orthodontic bands has decreased. Despite the broad use of bonded brackets, there are a number of circumstances where bands remain a preferred option.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
18. Orthodontic bands provide:
    a. Foundation for supporting passive appliances in the mixed dentition
    b. A platform to solder appliances for arch expansion
    c. a and b
19. Orthodontic bands must fit the tooth and offer resistance to:
    a. Bite sticks
    b. Chewing forces
    c. Corrosion
    d. a, b and c
20. Today most orthodontic bands are fabricated using:
    a. Precious metal alloys
    b. Stainless steel
    c. Gold alloy
    d. a and b
    e. a, b and c
21. Bands must possess reduced sensitivity or allergy in the majority of patients.
    a. True
    b. False

Match the terms to their corresponding definitions:

22. Malleability _____
23. Ductility _____
24. Stiffness _____
25. Work hardening _____
    a. Material property that resists deforming with mastication, seating bands & tooth movement
    b. A materials ability to be compressed into a thin sheet by hammering or rolling without forming or fractures
    c. Describes the property by which a metal or alloy fractures when continually bent
    d. Typically have the property of being able to be drawn or stretched without breakage to form thin wires and sheets.
26. Stainless steel orthodontic bands are:
    a. .005-.007 inches thick
    b. 1/2 inches tall
    d. a and b
27. Manufacturers offer preformed bands in progressive sizes. They are designed to fit both anterior and posterior maxillary and mandibular teeth.
    a. The first statement is true the second is false
    b. Both statements are true
    c. Both statements are false
    d. The first statement is false and the second is true
28. A well-fitted band encompasses the height of contour of the tooth with the occlusal aspects of the band located at the height of the marginal ridges both mesial and distal.
    a. True
    b. False
29. You should be able to remove the band easily with fingers prior to cementing.
    a. True
    b. False
30. Fitting the band also includes adapting the occlusal and gingival margin of the band.
    a. True
    b. False

31. Loose bands will lead to:
    a. Thick cement lines reducing retention
    b. Cement washout
    c. a and b
32. Initial sizing of bands is always done in the patient's mouth. The initial sizing of bands can occur utilizing the study model.
    a. The first statement is true and the second is false
    b. The first statement is false and the second is true
    c. Both statements are true
    d. Both statements are false
33. Bands not selected for use but have been placed in the mouth are sterilized and placed back into inventory.
    a. True
    b. False
34. When fitting bands the tendency is to select a final band, which is too small. This is common when the separation is insufficient and the band is forced through the contact
    a. The first statement is true and the second is false
    b. The first statement is false and the second is true
    c. Both statements are true
    d. Both statements are false
35. The orthodontic band is merely the foundation for a large number of different attachments or accessories. Orthodontists order bands with specific attachments or plain bands depending on the application required.
    a. The first statement is true and the second is false
    b. The first statement is false and the second is true
    c. Both statements are false
    d. Both statements are true

Match the following attachments that are available preassembled on the orthodontic band:

36. Brackets _____
37. Lingual sheaths _____
38. Cleats or seating lugs _____
39. Buttons and hooks _____
    a. These attachments have pads that can be welded to individual bands in the office using an orthodontic spot welder
    b. Include single, double and triple tube configurations, headgear tube and rectangular slot combinations.
    c. Are welded to the lingual aspect of maxillary and mandibular molars
    d. Provide a positive seat for bite sticks
40. Water-based cements used for cementing orthodontic bands include:
    a. Zinc Phosphate
    b. Zinc polycarboxylate
    c. Glass Ionomer
    d. Resin-modified Glass Ionomer Cement
    e. All of the above
    f. a, b and c
41. _____was developed in 1972 and releases fluoride.
    a. Zinc Phosphate
    b. Zinc polycarboxylate
    c. Glass Ionomer
42. Dental cements are:
    a. Hard
    b. Brittle
    c. Some are viscous materials that harden by light-curing
    d. All of the above

# Written Examination Answer Key

1. g
2. b
3. c
4. g
5. e
6. f
7. a
8. b
9. d
10. e
11. a
12. b
13. c
14. b
15. b
16. a
17. c
18. d
19. d
20. b
21. a
22. b
23. d
24. a
25. c
26. a
27. b
28. a
29. b
30. a
31. c
32. b
33. a
34. b
35. d
36. b
37. c
38. d
39. a
40. e
41. c
42. d

# Module 3

# Removal of Orthodontic Bands and Cement Removal with a Hand Instrument

*By: Matt Molitor*

**PERFORMANCE OBJECTIVES**

**After completing the following areas of didactic, laboratory, and clinical instruction in removing orthodontic bands and removing cement with a hand instrument, the student will be able to:**

1. Identify who may legally remove orthodontic bands and residual supragingival cement
2. Identify teeth with orthodontic bands
3. Remove orthodontic bands using appropriate armamentarium
4. Describe techniques and steps for orthodontic band removal
5. Describe steps for identifying residual cement
6. Describe steps for supra-gingival cement removal
7. Remove orthodontic bands from an orthodontically banded typodont and cement a minimum of four times with one of the four times used for a practical examination to a 75% minimum proficiency level
8. Maintain patient safety and comfort during removal of bands and residual cement
9. Remove orthodontic bands and residual cement on at least two patients to a 75% minimum proficiency level
10. Student, partner and instructor will evaluate the process according to the stated criteria. Identify techniques to improve and or modify
11. Maintain infection control to standards defined by OSHA and DBC

**On typodont teeth and patients, the student will be able to:**

1. Assemble appropriate armamentarium for orthodontic band removal and cement removal with a hand instrument.
2. Determine the teeth where bands will be removed.
3. Identify residual cement.
4. Remove bands from typodont teeth at least four times with one of the four times used for a practical examination according to specific criteria to a 75% level.
5. Remove residual cement supragingival from typodont teeth at least four times with one of the four times used for a practical examination according to specific criteria to a 75% level.
6. Evaluate and assess appropriate orthodontic band removal and cement removal with a hand instrument.
7. Provide appropriate patient education.
8. Maintain appropriate infection control during orthodontic band removal and cement removal with a hand instrument.

# Outline

**DIDACTIC SESSION**

***4 Hours***

1. Identifying Teeth with Orthodontic Bands
    a. Teeth most likely to have bands
    b. Differentiating bands from other orthodontic appliances
    c. Components of an orthodontic band and attachments
2. Removal of Orthodontic Bands
    a. Instruments used (armamentarium)
    b. Technique for removal of bands
3. Patient Safety and Comfort during Removal of Bands
    a. Explain the procedure and patient experience
    b. Prevention of swallowing/aspiration
    c. Special care for soft and hard tissues
4. Special Circumstances
    a. Crowns, fillings, possibility of fracture or damage
    b. Inflamed tissue
    c. Patients with limited opening
5. Identifying residual cement
    a. Types of band cement
    b. Differentiating from stain/discoloration
    c. Identifying decalcification or white spots and proper action to take
    d. Factors influencing amount of residual cement (etched teeth, bands)
    e. Likely places to find residual cement (band space, interproximal areas, etc.)
6. Supragingival removal of residual cement with a hand instrument
    a. Instruments used (armamentarium)
    b. Technique for removal of residual cement
7. Patient safety and comfort during removal of cement
    a. Prevention of swallowing/aspiration (use of suction)
    b. Special care for soft and hard tissues
    c. Patient home care instruction to reduce inflammation and hypertrophy

**LABORATORY SESSION**

***2 Hours***

During this session, students will practice the removal of orthodontic bands as well as the techniques for removal of cement with a hand instrument on a typodont.

**PRECLINICAL SESSION**

***2 Hours***

During this session, students will practice the removal of orthodontic bands as well as the techniques for removal of cement with a hand instrument on each other after bands were cemented in the second module. Students will work with a partner during the process of these procedures; the assisting student will observe each stage of the process for evaluation.

**WRITTEN FINAL EXAMINATION**

***1 Hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

**CLINICAL INSTRUCTION**

***4 Hours***

During this session, the students will participate in the removal of excess cement supra gingivally from orthodontic bands with a hand instrument on at least two active patients.

# Didactic Material

**IDENTIFYING TEETH WITH ORTHODONTIC BANDS**

An orthodontic band is a specific orthodontic appliance made of stainless steel that

attaches to the teeth circumferentially like a "ring" around the tooth. It is generally only used on posterior teeth, usually molars. It differs from a bracket that attaches directly to the facial surface of the tooth.

Though this is rudimentary, let's review how to identify a band utilizing several different means. When viewed from the occlusal aspect, the dark rim of the band can be seen to go all the way around the tooth. Another way to identify a band is by looking at the facial surface. Some bands will have attachments like a headgear tube that will protrude farther from the tooth. When viewing from the facial surface, look mesial and distal to the attachment to see if the metal ends and tooth structure is evident. If enamel can be seen on the mesial and distal aspect, this would indicate that the appliance is a bracket and is bonded only to the facial surface. However, if the metal continues mesially and distally toward the interproximal surface then it is likely to be a band. It may also be helpful to look on the lingual aspect of the tooth. Seeing metal going around the tooth, especially on the lingual aspect of the tooth is a good indicator a band is present. There are sometimes brackets or attachments bonded directly to the enamel on the lingual surface, so it is important to use the same criteria as looking from the facial aspect to differentiate between a bracket/attachment and a band.

Bands can have a variety of components and attachments. It usually has a "bracket" portion that is welded to the buccal aspect of the band. There is not one standard shape or configuration of the bracket portion so it should be identified generally and not by specific size or shape. However, the bracket portion generally consists of at least one slot that is located roughly in the middle portion of the band occluso-gingivally. This is the slot where the archwire passes during traditional fixed orthodontic treatment. There may also be one or more auxiliary slots. These buccal slots are multi-purpose but are commonly used for things like headgears, intrusion arches, overlay wires, etc. There may also be vertical slots that allow for attachments to be inserted from the occlusal aspect. These slots may also be convertible. This means that buccal aspect of the archwire slot can be removed creating an open slot.

Bands often have welded lingual attachments. This can be in the form of a "slot" that can be used for a variety of lingual/palatal appliances such as lingual arch, transpalatal arch, W-arch or quadhelix. Or, the lingual welded attachment may be a simple tab of metal called a seating lug. There may also be an appliance directly soldered to the lingual aspect of the band as in the case of a rapid palatal expander or soldered lingual arch.

**USE OF INSTRUMENTS IN REMOVAL OF ORTHODONTIC BANDS**

The primary instrument used in the removal of orthodontic bands is the band removing pliers (see figures 1, 2). This instrument is designed to safely remove the band from the tooth with minimal pressure and discomfort to the patient.

*Figure 1*

*Figure 2*

One side of the pliers has a soft, padded portion that is designed to go on the occlusal aspect of the tooth. This should not contact the band at any portion since its function is to use the tooth as a leverage point for removing the band. The other side of the pliers has a sharp edge that curves toward the padded portion. This is designed to grab the gingival edge of the band (or an attachment). Once this end has engaged the gingival aspect of the band, by squeezing the pliers gently, the band is lifted occlusally (see figures 3, 4). There is often a popping of cracking sound that occurs when the seal of the cement is broken.

*Figure 3*

*Figure 4*

Warn the patient that he or she will hear this sound and not to worry. Once the cement seal is broken, the band removing pliers can be used to lift the band occlusally. Never try to use the instrument if the plastic pad is missing. You could fracture the tooth. Make sure your inventory includes replacement pads.

This technique should be used at multiple points on the band before the band is lifted off the tooth. Trying to remove the band from a single point is not desirable for many reasons. It usually creates a situation where the band rolls on the tooth. That is, as one portion of the band is lifted occlusally, the opposite side moves gingivally. Usually it pivots around the contact point with the adjacent tooth. This can be very uncomfortable for the patient since it is creating excessive force on the tooth and can push a portion of the band into the gingival tissue. Trying to remove the band from a single point on the tooth can also result in the band bending or splitting which can make the band more difficult to remove. This is why it is important to break the seal initially and then move the pliers to another portion of the band to gradually move the band occlusally in an even manner.

It is sometimes difficult to engage the gingival aspect of the band. This can be due to the shape of the tooth and band, position of the band, or tissue inflammation that has caused the gingival aspect of the band to be subgingival. In these cases it may be helpful to engage, with the blade of the band remover, one of the attachments on the band. The pliers can be used on both buccal and lingual attachments. It can also be used on soldered and welded connectors such as lingual arches, rapid palatal expanders, transpalatal arches, quadhelices, etc)

Once the cement seal is broken and the band has been moved occlusally from multiple points around the band, it is now time to remove the band from the tooth. This is a critical part of the procedure and must be done with the utmost care and attention. The removal of the band is accomplished initially by using the same motion described above. As the pliers are closed together, the band will break free of the tooth (see figure 5).

*Figure 5*

When this occurs, the pliers must be closed together so the sharp potion and the padded portion are in contact for the first time since the procedure began. The band will then slide over the padded portion of the bracket like a ring (see figure 6). This is a safety feature of the pliers that prevents the band from falling off the tooth into the patient's mouth where it could be swallowed or aspirated (inhaled). These are serious complications that should be avoided at all costs and if either of them occurs, the orthodontist should be notified immediately. It is important to be sure that the two sides of the pliers are contacting each other and the band is secured around the arm of the pliers before any attempt is made to remove the band from the mouth.

*Figure 6*

**PATIENT SAFETY AND COMFORT**

The safety of the patient during this procedure is the primary focus. Prevention of swallowed or aspirated bands as well as the prevention of damage to the oral hard and soft tissues is the most important part of the entire process.

When a band is removed from a tooth, the tooth is often sensitive. Having undergone orthodontic movement, the tooth can be slightly mobile and sensitive to any pressure. In addition there can be inflammation of the soft tissue, especially if the oral hygiene has not been adequate during active orthodontic treatment. This can lead to additional discomfort and bleeding during the removal of the band. The orthodontic assistant must be sensitive to these issues and to what the patient is feeling in order to make the removal of the band as comfortable as possible.

**SPECIAL CIRCUMSTANCES**

The removal of orthodontic bands requires special care in cases where the banded teeth have restorations. Particular care must be taken when the banded tooth has been restored with a crown. The margin of the crown (where the crown meets the natural tooth structure) is usually very close to the gingival edge of the band. The assistant must be extremely careful that the band remover engages the gingival portion of the band and not the margin of the crown.

Teeth with fillings can have margins that are close to the gingival edge of the band so the same care must be taken as with crowned teeth to only engage the gingival edge of the band and not the restoration. In addition, teeth with fillings are often weaker than unrestored teeth and therefore special care must be taken to avoid excessive forces when removing bands as this could fracture the tooth.

As mentioned previously, the removal of orthodontic bands is more challenging when the gingival tissues are inflamed. Inflamed tissue will naturally sit more occlusal than tissue that is healthy. This makes access to the gingival edge of the band for removal more difficult. In addition the assistant must expect that inflamed tissue will tend to bleed when contact is made with the instrument and the band.

Patients with diminished opening related to TMJ derangements or individual anatomical variations limit visibility and access for placement of debanding pliers. Additional care in these circumstances is necessary to position the plier especially when attempting to remove bands on second molars.

In extreme circumstances where the limited opening or the strength of the tooth is in question it may be more effective to section the orthodontic band before attempting to remove it. Orthodontic pliers are available to sever or split the band vertically. As an alternative the orthodontist can use a high-speed drive to section the band.

**IDENTIFYING RESIDUAL CEMENT**

There are many types of band cements used in orthodontics today. The most common type is a mixture of composite resin and glass ionomer. This gives the cement the strength that is desirable for retention of the band as well as fluoride release from the glass ionomer that helps prevent caries around the band.

Cements come in different colors while others are similar to the natural color of tooth enamel. This has esthetic benefits b ut makes these more difficult to identify during removal. When removing cements it is important to use an instrument to "feel" for residual cement since visual inspection may not be reliable. For cements that are a different color than enamel (i.e. blue) a combination of visual and tactile inspection can be used to identify residual band cement.

It is also useful to use compressed air to help identify residual cement. This dries the surfaces and changes the appearance of the cement in contrast with the enamel. Compressed air should be used on the occlusal, facial, lingual and interproximal surfaces.

A dental explorer can help detect residual cement. The explorer tip should be carefully moved along the surfaces to detect any edges or ridges that could be indicative residual cement.

Be aware that teeth can have areas of discoloration and/or rough surfaces that are not residual cement. Therefore, the assistant should be cautious when using visual and tactile means to identify residual cement since anatomical variations can mimic the look and feel of residual cement. Examining the pre-orthodontic records is helpful in determining what discolorations and anatomical variations existed before the band was placed.

There are many factors that influence how much cement is left on a tooth following the removal of a band. When a band is cemented, there is either a bond between the band and the cement or a bond between the cement and the tooth. Whether the cement adheres to the tooth or the band when removed is dependent on the type of cement used and the preparations at the time of cementation. The effectiveness of tooth isolation and degradation of the cement over time can affect how much cement remains on the tooth.

Acid etching the enamel will increase the bond strength of some cements to the enamel leading to the necessity of more residual cement removal from the tooth. In contrast bands that are micro-etched have a greater bond between the cement and the band than those not sand blasted prior to cementation. This tends to leave less residual cement on the tooth since most of it remains bonded to the band.

The lingual and interproximal surfaces can be more difficult to see and feel for cement and more apt to have residual cement lodged. Considering access during cementation and debanding inspect these areas. There will be a natural interproximal space when the band is removed. Residual cement can be "hiding" there and if not removed could lead to gum irritation and periodontal problems.

## SUPRAGINGIVAL REMOVAL OF RESIDUAL CEMENT WITH A HAND INSTRUMENT

Following the removal of an orthodontic band, the residual cement is usually removed with a scaler. There are many types of scalers but the most common one used in orthodontics for the removal of supragingival cement is the curved sickle scaler (see Figure 7). The sickle scaler has two straight cutting edges that join to form the pointed tip of the instrument.

*Figure 7*

Sickle scalers may be used on the occlusal, buccal, lingual and interproximal surfaces to remove excess cement. During the removal of cement, it is recommended that the patient wear eye protection to prevent eye injury in the event that a piece of cement inadvertently enters the eye during scaling.

A modified pen grasp is used to hold the scaler (see Figure 8). This grasp is very stable because it creates a tripod effect around the handle of the scaler. The modified pen grasp is created by placing the pad of the middle finger on the handle (shank) of the instrument and the index finger is bent at the second joint from the fingertip and is positioned well above the middle finger on the same side of the handle.

*Figure 8*

A stable intraoral finger rest is needed in order to use this sharp instrument safely. By stabilizing the hand, the finger rest enhances control so that the assistant will be less likely to accidentally slip. The finger rest also acts like a fulcrum. By resting the tip of the ring finger on a stable surface, such as the teeth, the hand can pivot around this point in any direction.

The blade of the scaler is used to detect and dislodge cement. When the blade is applied to the tooth, the angle between the instrument and the tooth should be less than 90 degrees but no less than 45 degrees. They are designed to follow around the surface of the enamel and detect and remove anything that is not tooth enamel (i.e. cement). The cement is engaged and removed with a pull stroke. This creates a peeling motion that is used to dislodge the residual cement from the enamel surface. Most cements will come off the enamel in sheets as opposed to small fragments. This makes debris easy to suction as it breaks free.

## PATIENT SAFETY AND COMFORT DURING REMOVAL OF CEMENT

As with the removal of bands, when removing residual cement the comfort and safety of the patient is the primary focus. This is particularly true when the gingival tissues are inflamed and/or there is poor access to the teeth. The sickle scaler is not meant to be used subgingivally nor should the assistant place any portion of a scaler subgingivally. If there is cement that extends subgingivally, the orthodontist will be required to remove it.

Occasionally the cement will be sufficiently bonded to the tooth that removal with a scaler or any hand instrument is not possible. Excessive force should never be used with a scaler. If the cement cannot be removed with a scaler and minimal force, the orthodontist may have to remove the residual cement with a handpiece.

### When to Ask the Orthodontist for Assistance

Ask for assistance:

- When you are not sure if the particle you detect is band cement or enamel
- When removal of the band or the cement is so challenging that you think you may fracture the tooth or injure the patient if you proceed
- When the patient asks you not to proceed further
- When you judge that subgingival band cement remains

# Laboratory, Preclinical and Clinical Instruction

**LABORATORY SESSION**

***2 Hours***

During this session, students will practice the removal of orthodontic bands as well as techniques for removal of cement with a hand instrument on a typondont. Students will work in pairs during these procedures. One student will be the operator while the other will assist the operator. The assisting student will observe each stage of the process for subsequent evaluation. Once the first operator is finished, the students will switch duties.

**Laboratory Instructions**

The following is a step-by-step description of the procedures that should be followed during the laboratory practice session:

1. Each student will set up his/her armamentaria for removal of bands and residual cement.
2. Student will be provided with a typodont with banded posterior teeth (cemented) and a bench mount.
3. Instructor will review procedures for removal of bands and excess cement.
4. Instructor will provide ideal examples that will be passed around for viewing.
5. Student will remove the bands from the typodont tooth while partner observes, evaluates and records on worksheet. Student will also evaluate him/herself on the procedure. Instructor evaluates the removal of the bands as well as the cement removal.
6. The bands will be re-cemented for further practice as needed based on instructor's evaluation.
7. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
8. Students will complete a minimum of four band removals and cement removals with one of the four times used for a practical examination.
9. Partners then switch places—the operator becomes the evaluating assistant, and the former evaluating assistant becomes the operator so both student partners have completed four typodont teeth.
10. The worksheets and product evaluation forms are then reviewed and discussed by students and instructor.

**PRECLINICAL SESSION**

***2 Hours***

During this session, students will practice the removal of orthodontic bands as well as the techniques for removal of cement with a hand instrument on each other after bands were cemented in the second module. Student partners work on each other in simulation as previously described and demonstrated by instructor.

The following general procedures will occur:

1. Each student will set up his/her armamentaria for removal of bands and residual cement.
2. Each student will serve as the patient with the previously cemented banded posterior teeth.
3. Instructor will review procedures for removal of bands and excess cement.
4. Instructor will provide ideal examples that will be passed around for viewing.
5. Student will remove the bands from the partner while the partner observes in a patient mirror and records evaluation on worksheet. Student will also evaluate him/herself on the procedure.
6. Instructor evaluates the removal of the bands as well as the cement removal.
7. The bands will be re-cemented for further practice as needed based on instructor's evaluation.
8. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
9. Band removal and cement removal will be completed a minimum of four times with one of the four times used for a practical examination.
10. Partners switch places, the operator becomes the patient, and the patient becomes the operator.
11. The worksheets and product evaluations will be evaluated by the students and instructor.

**WRITTEN EXAMINATION**

***1 Hour***

**CLINICAL SESSION**

***4 Hours***

During this session, the students will participate in the removal of excess cement supra gingivally from orthodontic bands with a hand instrument on at least two active patients.

1. Each student will set up his/her armamentaria for removal of bands and residual cement.
2. Student will be provided with two patients.
3. Instructor will review procedures for removal of bands and excess cement.
4. Student will remove the bands from the patients while partner observes, evaluates and records on worksheet.
5. Student will also evaluate him/herself on the procedure.
6. Instructor evaluates the removal of the bands as well as the cement removal. The entire process will continue to be evaluated on the worksheet by the student, partner/ assistant and instructor.
7. Students will complete a minimum of four band removals and cement removals with one of the four times used for a clinical examination.
8. Partners switch places, the operator becomes the assistant, and the assistant becomes the operator, both student partners have completed at this point four teeth on each patient.
9. The worksheets are then evaluated by the students and instructor.

# Worksheets

**LABORATORY & CLINICAL PATIENT WORKSHEETS**

**General Information on Worksheets**

The student operator, student assistant, and instructor use these forms. Each of these individuals will watch the performance of the specified steps of the given procedure and then identify if any of these steps are not followed and/or inadequately performed by the student operator. During the learning process, errors can and will occur. Students and clinical instructors identify common errors encountered during each step of the entire procedure utilizing the worksheets. Worksheets are not grade sheets, but they assist the student to identify his or her own errors during performance of these steps. They are used for measuring student's progress toward attainment of clinical proficiency.

**General Procedures**

An important part of the learning experience in the process of orthodontic band removal and cement removal with a hand instrument is the ability to identify technique errors, understand their causes and find solutions. Equally important is to determine the degree of error and when it constitutes a need to redo an inadequately cemented band. The first step in this process is to identify the error(s). Using the Removal of Orthodontic Bands and Cement Removal Laboratory and Clinical Patient Worksheets does this. The worksheets are not grade sheets but are documents that are used to assist students in learning to identify common technique errors related to the procedures associated with orthodontic band removal and cement removal with a hand instrument. The student uses this form in the following manner:

The worksheet consists of a column titled Procedure-Laboratory and Procedure-Clinical, which is the step-by-step description of the procedures associated with preparing teeth for bonding brackets. The procedures are subdivided into the following categories:

- Infection Control/Patient Safety
- Assemble Armamentaria
- Band and Cement Removal
- Identify Residual Cement
- Patient Education
- Infection Control/Patient Safety/Clean-up

**How Worksheets Are Used by Student Operator and Student Assistant**

1. When performing multiple procedures either in the laboratory or on clinical patients, all of the errors from these series are placed on one worksheet.
2. Each laboratory/clinical experience is graded in a different column.
3. When an error occurs in any of the individual steps described in the Procedure column, a check is placed in the box corresponding to the laboratory/clinical experience.

For example, on the clinical patient worksheet there would be a box for each step of the clinical practice patients. For the laboratory worksheet, there would be a box for the typodont teeth. With worksheet check-offs, the student can identify a clustering pattern of errors in any particular step. When an instructor evaluates the student's performance, he/she cannot only see how a student performs, but whether or not the student can identify errors that he/she makes.

**How the Student Identifies Cause and the Correction of Errors**

After the student identifies the error(s) performed, he/she will write the cause of the error and how it shall be rectified. The student then identifies whether the error is significant enough to require re-sizing, re-fitting, re-cementing. During this process, the student will review the criteria for successful band removal and cement removal with a hand instrument.

**How the Instructor Uses the Worksheets**

The instructor watches the student operator during the entire process of band removal and cement removal with a hand instrument. The instructor will check the appropriate box on the same worksheet used by the student operator and the student assistant. The instructor observes both students, and then evaluates the grading completed by both students for accuracy. The instructor reviews the worksheets for information related to: cause, solution and whether any part of the procedure requires additional steps. The instructor can provide additional assistance where needed. This process of identification of errors, causes and solutions will ensure the student will progress towards clinical competence and expected course objectives will be met. This process will continue throughout all laboratory and clinical requirements. When the clinical final exam is administered the student should be clinically competent in orthodontic band removal and cement removal with a hand instrument.

**Satisfactory Performances of Psychomotor Skills**

Students will practice psychomotor skills during the laboratory and preclinical sessions until they reach a competence level of 75% utilizing the documented criteria evaluated using the behaviorally anchored rating scale. Students must achieve a passing score on a minimum of two typodont teeth or natural teeth before progressing on to successive laboratory, preclinical and clinical sessions.

# Worksheet – Laboratory/Preclinical

**REMOVAL OF BANDS/CEMENT WITH HAND INSTRUMENT**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Minimum of 4 anterior teeth banded with cement removal. Record tooth number(s):

Minimum of 4 posterior teeth banded with cement removal. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| 5. Low-speed hand piece with disposable prophy angle | | | |
| 6. Pumice/prophy paste with fluoride | | | |
| 7. Isolation products-long and short cotton rolls, cheek retractors, tongue guard/ etc. | | | |
| 8. Band Removing Pliers | | | |
| 9. Sickle Scaler | | | |

| | | | |
|---|---|---|---|
| 10. Typodont with appropriate teeth and bench mount/pole | | | |
| 11. High speed hand piece/fluted bur/green stone (DDS use only) | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Band and Cement Removal | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 12. Verify teeth for band removal | | | |
| 13. Use band-removing pliers to safely remove the band from the tooth with minimal pressure and discomfort to the patient | | | |
| 14. Primary focus is patient safety, prevention of swallowed or aspirated bands | | | |
| 15. Teeth that have restorations takes special care when removing bands | | | |
| 16. Inflamed tissue bleeds easily; suction should be employed to remove blood and excess saliva | | | |
| **Identify Residual Cement** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 17. Use an instrument to "feel" for visual inspection may not be reliable | | | |
| 18. Use explorer to detect residual cement | | | |
| 19. Inspect the interproximal areas where residual cement may be hiding | | | |
| 20. Use modified pen grasp to remove residual cement using a sickle scaler while employing a secure fulcrum | | | |
| 21. The blade of the scaler is used to detect and dislodge cement. Apply blade at less than 90 degrees but no less than 45 degrees. Employ pull stroke | | | |
| 22. Suction small fragments as they are removed | | | |
| 23. If residual cement cannot be removed with a hand instrument the orthodontist should use the high-speed hand piece and bur for final removal | | | |
| 24. Rinse and suction remaining debris | | | |

| | | | |
|---|---|---|---|
| 25. Polish using prophy paste with fluoride | | | |
| 26. Remove any remaining isolation materials and rinse well | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 27. Give post-operative instructions to the patient or parent | | | |
| 28. Document procedure in patient chart to include: date, HH review or update, teeth where bands and or cement were removed, products used, problems encountered, operator signature, and instructor or DDS signature | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 29. Surface disinfect | | | |
| 30. Prepare and institute sterilization procedures | | | |
| 31. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 32. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Worksheet – Clinical Patient

**REMOVAL OF BANDS/CEMENT WITH HAND INSTRUMENT**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Circle one: Patient #1 Patient #2

Patient Name:

Minimum of 4 anterior teeth banded with cement removal. Record tooth number(s):

Minimum of 4 posterior teeth banded with cement removal. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| 5. Low-speed hand piece with disposable prophy angle | | | |
| 6. Pumice/prophy paste with fluoride | | | |
| 7. Isolation products-long and short cotton rolls, cheek retractors, tongue guard/ etc. | | | |

| | | | |
|---|---|---|---|
| 8. Band Removing Pliers | | | |
| 9. Sickle Scaler | | | |
| 10. High speed hand piece/fluted bur/green stone (DDS use only) | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Band and Cement Removal | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 11. Verify teeth for band removal | | | |
| 12. Use band-removing pliers to safely remove the band from the tooth with minimal pressure and discomfort to the patient | | | |
| 13. Primary focus is patient safety, prevention of swallowed or aspirated bands | | | |
| 14. Teeth that have restorations takes special care when removing bands | | | |
| 15. Inflamed tissue bleeds easily; suction should be employed to remove blood and excess saliva | | | |
| **Identify Residual Cement** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 16. Use an instrument to "feel" for visual inspection may not be reliable | | | |
| 17. Use explorer to detect residual cement | | | |
| 18. Inspect the interproximal areas where residual cement may be hiding | | | |
| 19. Use modified pen grasp to remove residual cement using a sickle scaler while employing a secure fulcrum | | | |
| 20. The blade of the scaler is used to detect and dislodge cement. Apply blade at less than 90 degrees but no less than 45 degrees. Employ pull stroke | | | |
| 21. Suction small fragments as they are removed | | | |
| 22. If residual cement cannot be removed with a hand instrument the orthodontist should use the high-speed hand piece and bur for final removal | | | |
| 23. Rinse and suction remaining debris | | | |

| | | | |
|---|---|---|---|
| 24. Polish using prophy paste with fluoride | | | |
| 25. Remove any remaining isolation materials and rinse well | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 26. Give post-operative instructions to the patient or parent. | | | |
| 27. Document procedure in patient chart to include: date, HH review or update, teeth where bands and or cement were removed, products used, problems encountered, operator signature, and instructor or DDS signature. | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 28. Surface disinfect | | | |
| 29. Prepare and institute sterilization procedures | | | |
| 30. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 31. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Product Evaluation Forms

**REMOVAL OF BANDS/CEMENT WITH HAND INSTRUMENT**

**General Procedures**

Product evaluation evaluates the end result of any performance, not the steps. This facility utilizes the behaviorally anchored rating scale (BARS) system. This 10-point system clusters the critical incidents into categories. The instructor can score objectively the end result of sizing, fitting and cementing orthodontic bands by choosing the criteria specified in each point level. Performance is assessed according to established criteria for each of these procedures. The points are then converted to a pass or fail grade.

**How Instructor Uses Product Evaluation Form**

A product evaluation form will be used for each patient. In the "scores" area on the form you will note that an open box rather than specific grids occurs. This open box allows you to enter a score for each of the posterior first molars.

**The student must maintain a minimum point value of 7.5 on all clustered critical incidences per tooth. He/she must receive this minimum score for all four posterior first molars selected for orthodontic band removal and cement removal with a hand instrument in order to pass this module. A grade of 7.5 represents a 75% passing score.**

**Product Evaluation Point Conversion**

The student will receive points for a given level of achievement from the point scale utilized for product evaluation.

**POINT SYSTEM TO A PASS/ FAIL SCORE**

***Conversion***

| Points | Grades |
|---|---|
| **10** | ➨ Pass-Excellent |
| **7.5** | ➨ Pass |
| **5** | ➨ Fail-Critical Error(s) |
| **3** | ➨ Fail-Critical Errors-no concept |

# Product Evaluation/Practical Examination – Lab Session

**REMOVAL OF BANDS/CEMENT WITH HAND INSTRUMENT**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

1 first molar band removed and cement removed with a hand instrument. Record tooth number(s):

**BAND REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth | | |

**CEMENT REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Identify cement to be removed<br>B. Remove cement safely and comfortably<br>C. Removal of residual cement complete<br>D. Coronal polish<br>E. Provide individualized patient education | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Preclinical Session

**REMOVAL OF BANDS/CEMENT WITH HAND INSTRUMENT**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

1 first molar band removed and cement removed with a hand instrument. Record tooth number(s):

**BAND REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth | | |

**CEMENT REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Identify cement to be removed<br>B. Remove cement safely and comfortably<br>C. Removal of residual cement complete<br>D. Coronal polish<br>E. Provide individualized patient education | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Clinical Session

**REMOVAL OF BANDS/CEMENT WITH HAND INSTRUMENT**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

1 first molar band removed and cement removed with a hand instrument. Record tooth number(s):

**BAND REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Assemble armamentarium<br>B. Remove separators<br>C. Pumice teeth | | |

**CEMENT REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Identify cement to be removed<br>B. Remove cement safely and comfortably<br>C. Removal of residual cement complete<br>D. Coronal polish<br>E. Provide individualized patient education | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation Documented Criteria

| BAND REMOVAL | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Teeth identified correctly<br>➨ Band removing pliers used appropriately<br>➨ Band removed safely<br>➨ Care was taken for a banded tooth with special circumstances<br>➨ Patient's comfort was considered |
| **7.5 Points** | ➨ Teeth identified correctly<br>➨ Band removing pliers varies slightly from ideal<br>➨ Band removed safely<br>➨ Care was taken for a banded tooth with special circumstances<br>➨ Patient's comfort was considered |
| **5 Points** | ➨ Teeth identified incorrectly<br>➨ Band removing pliers used inappropriately<br>➨ Band removal varies from ideal<br>➨ Care was not taken for a banded tooth with special circumstances<br>➨ Patient's comfort was not considered |
| **3 Points** | ➨ Teeth identified incorrectly<br>➨ Band removing pliers used inappropriately<br>➨ Band removal varies more than slightly from ideal<br>➨ Care was not taken for a banded tooth with special circumstances<br>➨ Patient's comfort was not considered |

# Product Evaluation Documented Criteria

| CEMENT REMOVAL WITH A HAND INSTRUMENT | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Cement identified using an explorer, buccal, lingual, and interproximally<br>➨ Cement is removed safely supra-gingivally with a scaler using a fulcrum<br>➨ Care was taken for a tooth with special circumstances<br>➨ Patient's comfort was considered and maintained<br>➨ Debris/cement is identified/removed completely<br>➨ Tooth coronally polished to restore luster (coronal polish class taken) |
| **7.5 Points** | ➨ Cement identified using an explorer, buccal, lingual, and interproximally<br>➨ Cement is removed safely supra-gingivally with a scaler using a fulcrum<br>➨ Care was taken for a tooth with special circumstances<br>➨ Patient's comfort was considered and maintained<br>➨ Debris/cement is identified and removed completely<br>➨ Tooth coronally polished to restore luster (coronal polish class taken) |
| **5 Points** | ➨ Difficulty identifying cement with explorer<br>➨ Removal of cement using an inadequate fulcrum making this step unsafe<br>➨ Patient is uncomfortable during cement removal<br>➨ Debris/cement is not identified or completely removed<br>➨ Tooth is polished but not well (coronal polish class taken) |
| **3 Points** | ➨ Unable to identify residual cement with a scaler<br>➨ Uses explorer in an attempt to remove residual cement<br>➨ Patient is uncomfortable during cement removal<br>➨ Debris/cement is not identified or completely removed<br>➨ Tooth is polished but not well (coronal polish class taken) |

# Course Requirements

The following is an overview of the course requirements and the protocol followed for laboratory and clinical practice, the written and clinical examination.

**Minimum Number of Satisfactory Performances**

All students will perform at a minimum the following procedures in order to achieve minimum competence in the various protocols used in the removal of bands and cement removal with a hand instrument.

On a typodont and patients, the student will perform the following under OSHA and DBC guidelines:

- On the typodont: band removal will be completed at the very least on four posterior first molars a minimum of two times, with one used for a practical exam according to the specified criteria.
- On the patient: Identify teeth with bands that will be removed with band removal pliers using proper technique with the focus on safety and comfort of the patient. Removing four posterior first molar bands on at least two patients according to the specified criteria with one of each of the four times used for a practical examination with 75% accuracy.

Students are required to meet the specified minimal number of satisfactory performances as indicated above. The student operator grades his/her own performance, the student assistant grades the performance of the student operator and the instructor will assess the student operator's performance and the grading method of both students.

When the student reaches the 75% minimum performance for removal of bands and cement removal with a hand instrument and 100% performance on all infection control protocol, the instructor evaluates the procedure for the minimal number of satisfactory performances. If a student does not fulfill the minimum grade for the number of satisfactory performances additional laboratory and/or clinical practice procedures will be assigned.

**Objective Evaluation Criteria**

Objective evaluation criteria shall be provided to each student prior the performance of any procedure. The student will receive information provided by the instructor prior to performing any laboratory or clinical procedures. The instructor shall supply the student with general program, individualized cognitive and psychomotor objectives and criteria for evaluation. Objective criteria will be utilized in the performance of all laboratory and clinical requirements.

**Preparation Prior to Band Removal**

1. Will review the medical/dental history, make a general assessment, and oral inspection on each patient prior to treatment, checking for information that may contraindicate the performance of the procedure
2. Will set up the required armamentaria for band removal and cement removal with a hand instrument
3. Will use aseptic techniques according to OSHA and DBC throughout performance on all patients
4. Will place protective barriers, seat and position the patient
5. Will evaluate the teeth scheduled to have band removal and cement removal with a hand instrument
6. Will explain to patient the treatment planned for that day
7. Will perform band removal and cement removal with a hand instrument
8. Will isolate four posterior first molars in preparation for band removal and subsequent cement removal with a hand instrument on two patients

**Removal of Orthodontic Bands Criteria**

1. Identify teeth with orthodontic bands
2. Will remove the orthodontic bands using appropriate armamentarium
3. Will proceed safely and with the patient's comfort as a primary focus
4. Will identify special circumstances that require adaptation to treatment to ensure no damage results to tissues or restorations

**Removal of Cement with Hand Instrument Criteria**

1. Will remove residual cement with a hand instrument following band removal
2. Will explore areas where residual cement will be found (band space). These areas will be on the buccal, lingual and interproximal
3. Will remove residual cement supra-gingivally with a hand instrument
4. Care will be taken to use a stable fulcrum
5. Care will be taken while using a pull stroke with the sickle scaler when removing residual cement
6. Will be meticulous in monitoring debris to prevent swallowing or aspirating residual cement
7. Will take care not to injure soft or hard tissues

**General Criteria**

1. Will provide pertinent and individualized patient education
2. Will provide follow up appointment as identified in the treatment plan
3. Will meet ethical and legal requirements for this procedure
4. Will provide accurate chart entries for this procedure
5. Will utilize OSHA and DBC guidelines for instrument processing, removing waste and cleaning/disinfecting treatment area

The above criteria will be used to evaluate and access appropriate removal of bands with subsequent removal of residual cement with a hand instrument with a minimum of 75% accuracy for laboratory and clinical patients.

**General Clinical Practice Protocol**

Students will complete procedures on two clinical patients. The following general procedures will occur:

***Patient Selection Criteria***

The following criteria must apply for each patient:

1. Patient must be an active orthodontic patient
2. Patient must be in good health (medical history form will be completed prior to treatment, reviewed and approved by the instructor).
3. Each patient will have a minimum of four posterior first molars with bands.

The student will function as an operator, an assistant and a patient. Working as partners (operator and assistant) an operator will perform the procedure, the assistant will observe, and evaluate each step of the procedure. When complete each student will do the procedure, observe and evaluate.

The following general procedures will occur for each of the patients:

1. Operatory will be set up following the infection control guidelines
2. Medical history will be completed by the patient prior to seating
3. Equipment and supplies will be checked by the student
4. Patient will be seated and prepared for treatment
5. Student operator will review the medical history and perform a visual exam
6. The instructor will review the medical history and perform a visual exam
7. Instructor will accept the patient for band removal and subsequent cement removal with a hand instrument
8. Student operator will perform the following according to the stated criteria:
    a. Identify teeth with orthodontic bands
    b. Remove orthodontic bands
    c. Remove residual cement with a hand instrument
    d. Coronal polish
    e. Rinse and remove isolation products
    f. Evaluate the product
    g. Provide individualized patient education
    h. Dismiss the patient
    i. Make appropriate chart notes
    j. Perform operatory clean-up/instrument processing according to infection control guidelines

After band removal and subsequent removal of residual cement with a hand instrument procedures, the student operator, student assistant and the instructor complete evaluation using the worksheet and product evaluation form.

During this time period, the following will occur:

1. Student operator will evaluate his/her own work according to stated criteria using worksheet and product evaluation forms.
2. Student assistant will assist, observe, evaluate operator's performance according to stated criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work according to stated criteria using the worksheet and product evaluation forms. Results will be discussed.

A 75% must be obtained for passage of removal of bands and removal of residual cement with a hand instrument.

**General Examination Protocol**

***Written Examination***

A comprehensive written examination of 20 questions on the entire curriculum will be administered. The student must receive a minimum score of 75% on the examination to pass the class. One hour has been reserved for the written examination.

***Clinical Final Examination***

The clinical final examination occurs during the process of working on the two active orthodontic patients during the removal of orthodontic bands for subsequent removal of residual cement with a hand instrument on four posterior first molars following patient selection criteria and procedures outlined in the module's clinical practice protocol.

# Written Examination

1. An orthodontic band is:
    a. A fixed appliance
    b. Stainless steel
    c. Used only on anterior teeth
    d. Generally used on posterior teeth
    e. a, b and d
    f. a, b and c
2. Orthodontic bands attach to the teeth circumferentially like a "ring" around the tooth. Seeing a band going around the tooth especially on the lingual aspect confirms it is a bracket and not a band.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
3. Orthodontic bands can have a variety of components and attachments. Which of the following are an attachment or component of orthodontic bands?
    a. Bracket or tube that is welded to the band on the buccal
    b. Welded lingual attachments
    c. Rapid palatal expander that is directly welded to the lingual
    d. All of the above
4. Orthodontic brackets are made of stainless steel, translucent ceramic or acrylic.
    a. True
    b. False
5. The primary instrument used in the removal of orthodontic bands is the band removing plier.
    a. True
    b. False
6. The band-removing plier is designed to safely remove the band from the tooth with minimal pressure and discomfort to the patient.
    a. True
    b. False
7. The band-removing plier has a soft, padded portion that is designed to go on the occlusal aspect of the tooth. The other side has a sharp edge that is designed to grab the gingival edge of the band.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
8. During band removal teeth are often sensitive and may be slightly mobile. In addition, the soft tissue may be inflamed.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
9. Special care does not have to be taken when removing bands from teeth when they have restorations.
    a. True
    b. False
10. Patients with limited opening can make the use of band removing instruments more difficult because the access to the band is more limited.
    a. True
    b. False
11. Cements used to cement orthodontic bands include glass ionomer that releases fluoride to prevent caries around the band.
    a. True
    b. False
12. The cements used resemble the natural color of tooth structure making it more difficult to identify residual cement. The assistant should use an instrument to feel for residual cement since visual inspection may not be reliable.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false

13. The easiest surface to inspect is usually the lingual surface
    a. True
    b. False
14. Residual cement may be hidden. If it is not removed it could lead to periodontal problems.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
15. Following band removal the residual subgingival cement is removed with a scaler.
    a. True
    b. False
16. Scalers generally have dull tips. Finger rests (fulcrums) are not necessary while removing residual cement.
    a. The first statement is false and the second is true
    b. The first statement is true and the second is false
    c. Both statements are true
    d. Both statements are false
17. Most cements will come off the enamel in large pieces.
    a. True
    b. False
18. Patients should wear safety glasses during cement removal to protect their eyes.
    a. True
    b. False
19. Our primary focus during band removal and residual cement removal is the patient's comfort and safety
    a. True
    b. False
20. If cement cannot be removed with a scaler the assistant may use the high speed handpiece with a bur.
    a. True
    b. False

# Written Examination Answer Key

1. e
2. b
3. d
4. a
5. a
6. a
7. c
8. c
9. b
10. a
11. a
12. c
13. b
14. c
15. a
16. d
17. a
18. a
19. a
20. b

# Module 4

# Preparing Teeth for Bonding

*By: Michael Payne*

**PERFORMANCE OBJECTIVES**

**After completing the following areas of didactic, laboratory and clinical instruction in preparing teeth for bonding, the student will be able to:**

1. Identify basic key terms and concepts of etching and bonding dental materials
2. Identify the characteristics of etchant and bonding materials and the manipulation and storage of materials
3. Identify the legal requirements associated with etching and bonding application
4. Describe the goals of preparing teeth for bonding of orthodontic brackets
5. Identify the precautions taken to protect the operator and patient related to the bonding materials
6. Describe the role of the bonding materials in the orthodontic practice
7. Describe and identify the armamentaria used for preparation and placement of bonding materials
8. Demonstrate the steps involved in the appropriate preparation, acid etching and bonding of four anterior and four posterior typodont teeth according to the stated criteria
9. Prepare, etch, apply bonding agents, and bond anterior and posterior teeth on a minimum of two clinical patients to a 75% minimum proficiency level
10. Student, partner, and instructor will evaluate all etchant and bonding applications according to the stated criteria. Identify the techniques to improve and or modify faulty placement
11. Maintain infection control protocol, to include operator protection, operatory, surface disinfection or barrier placement and instrument processing/sterilization related to tooth preparation according to standards defined by OSHA and DBC
12. Identify the emergency procedures for the dental training facility, which includes the classroom, laboratory and clinical training areas

**On typodont teeth and patients, the student will be able to:**

1. Assemble appropriate armamentaria for preparing the tooth for bracket placement
2. Perform coronal polish on the teeth that will be prepared for bracket placement
3. Isolate and dry teeth in areas where teeth will be prepared for bracket placement
4. Prepare etchant and bond according to the manufacturer's recommendations
5. Apply etchant, bonding agent to the four anterior and four posterior typodont teeth four times according to the specified criteria with 75% accuracy (Preparing teeth for bonding and placement of brackets)
6. Apply etchant, bonding agents and composite material on brackets for two active orthodontic patients according to specified criteria with 75% accuracy
7. Evaluate and assess appropriate etchant, bonding agent placement and bracket preparation and placement for laboratory and clinical patient experience with 75% accuracy
8. Maintain appropriate infection control protocol throughout all procedures
9. Protect him/herself and the patient from hazardous situations as defined in the MSDS sheets for etchant and primer

# Outline

**DIDACTIC SESSION**

***4 Hours***

1. Understanding the Factors for Bonding Success
2. General Concepts in Bonding to Enamel Surfaces
3. Armamentarium
4. Patient Assessment and Education
5. Cleaning Tooth Surfaces
6. Isolation and Moisture Control
7. Acid Etching
8. Acid Etch Removal
9. Rinsing Tooth Surfaces
10. Drying Tooth Surfaces
11. Application of Bonding Primers and Resins
12. Bonding to Enamel vs. Restorative Materials

**LABORATORY SESSION – 1**

***1 Hour***

During this session, students will practice the preparation of teeth for bonding with the application materials on typodont teeth using appropriate etchants/primers according to type of enamel or restorative material simulated to be bonded. Students will practice procedures and product applications on a minimum of four typodont teeth for each assigned tooth materials to include enamel, porcelain and plastic tooth materials.

**LABORATORY SESSION – 2**

***1 Hour***

Laboratory practice on typodont teeth continues, including specialized products used for bonding atypical enamel, porcelain, plastic, gold etc. and practice protocol for contaminated teeth and indirect bonding. Students will practice applications on a minimum of four typodont teeth for each assigned tooth material to include enamel, porcelain, and plastic tooth materials with one serving as a practical examination.

**PRECLINICAL SESSION**

***2 Hours***

During this session, students will practice the preparation of teeth for bonding working on each other in simulation. Taking turns, each student functions as an operator and applies etchant (faux) and bonding materials on four posterior and four anterior teeth with one procedure used as a practical examination.

**WRITTEN FINAL EXAMINATION**

***1 Hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

**CLINICAL INSTRUCTION**

***4 Hours***

During this session, the instructor will demonstrate the sequence of tooth preparation for bonding on active patients.

# Didactic Material

**PREPARING TEETH FOR BONDING**

Successful bonding technique is an absolute necessity in orthodontics and a very important skill for every orthodontic assistant. The concepts related to bonding to enamel of adults and children, as well as the variations in bonding required for gold crowns, porcelain crowns and resin or plastic materials utilized in dentistry are essential. The goal of tooth preparation is to create an optimum surface to attach brackets to the teeth utilizing bonding materials. Well bonded brackets remain in place despite everyday chewing and functioning. Broken brackets lead to clinical inefficiency, emergencies which negatively affect the schedule, as well as inconveniences to patients and parents. With a thorough understanding of bonding, you will avoid pitfalls that lead to bracket failures.

**Understanding the Factors for Bonding Success**

What are the important factors in effective bonding of orthodontic brackets to teeth?

The orthodontic professional: Your ability—understanding of the processes, and attention to detail—will assure brackets have adequate bond strength to hold the brackets in place during normal incising and mastication. Of all the factors resulting in bond failures, technique is the most critical factor and the one that you can control.

Materials: A great deal of research and development has focused on designing better bonding materials to effectively bond brackets to tooth surfaces. The critical factor in achieving a strong bond still remains the knowledge and skill of the operator in properly utilizing these materials. Consistency and repetition have shown to reduce errors in execution.

Location: The ease of isolating certain teeth and the adverse effects from the oral environment varies depending where in the mouth you are preparing a tooth for bonding. Can you easily apply etching agents? Is the tooth more likely contaminated by saliva or debris from a cheek or seepage from the gingival crevice of a short tooth? Is the tooth more highly mineralized with proximity of the salivary ducts which bathe the surface of the tooth with more minerals?

Clean material surface: In order to create an effective bond, you must start with a clean surface. You cannot effectively bond to a surface laden with surface debris, calculus, plaque, blood, or saliva. Additionally, a surface recently treated with fluoride will not allow effective bonding. You must understand and be able to identify a pristine tooth surface.

Patient: Is the patient cooperative and is it easy to access all the teeth scheduled for bonding? Do they have excess saliva or tight lips or cheeks limiting access to the tooth surfaces? Are they more likely to contaminate a prepared tooth surface with saliva or contact with an active tongue or cheek?

**General Concepts in Bonding to Enamel Surfaces**

The goal of preparing teeth for bonding is to create a material surface which will mate chemically with bonding materials that are placed on the bracket bases. The common element in the composite materials used to adhere brackets to teeth is made of a resin chemical structure. This resin is present in the bracket bonding composite and also in the unfilled resin known as the bonding agent, primer, or bonding resin. Another goal is to create a thin surface layer of bonded resin on the tooth that is tightly bound and sealed.

This can be achieved by pressing the bracket gently against the tooth to allow excess material to be extruded. This layer of material will in turn chemically bond to the material that is applied to the orthodontic bracket since it is made of the same or a similar material. No matter whether the tooth surface is composed of gold, porcelain, plastic, or enamel, the goal is the same, to end with a surface layer of bonding resin that will bond chemically to the material placed on the back of the bracket.

***Mechanism of Bonding to Enamel***

The idea of using phosphoric acid on dental surfaces was first introduced by Buonocore (1955), who observed that adhesion to metal surfaces by paints improved when acids were used to etch the metal surface increasing the strength of the bond. An unprepared enamel surface is a poor surface to bond with mechanically or chemically which leads to poor adherence of the brackets. (Figure1). Placing an acid on the enamel surface changes the surface of the enamel by dissolving some of the calcium salts increasing the number and size of microscopic depressions (Figures 2 and 3). The liquid resin found in orthodontic bonding agents penetrates into the depressions and over the projections left from the etching process. Once the bonding agent is cured typically with a light curing unit, these fingerlike projections of resin are tightly bound to the enamel surface. The surface of the enamel is now covered with a thin resin which chemically bonds to the more viscous (thicker) composite bonding materials placed on the back of the brackets. Since the mechanical lock of the resin into the enamel is critical, proper preparation and protection of this prepared enamel surface is critical to successful bonding of brackets.

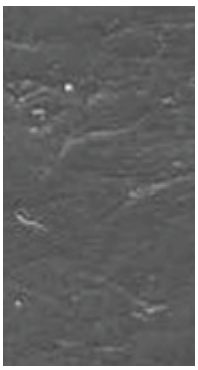


*Figure 1: An unprepared enamel surface*

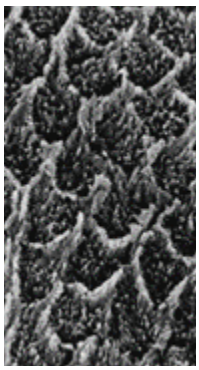


*Figure 2: Enamel surface etched with 37% phosphoric acid*

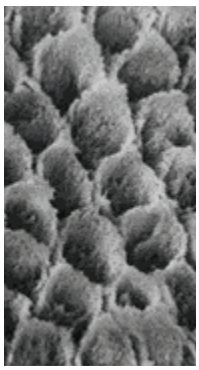


*Figure 3: Enamel surface etched with 37% phosphoric acid*

**Acid Etchants**

No alternative that has yet been tested is as efficient and as effective as phosphoric acid for etching tooth structure. Phosphoric acid etchants come in two basic forms, a viscous, thick gel and in a liquid. The acid etchants are either clear or colored to easily identify on the tooth surface. There are advantages to gel etchants as these can more easily be controlled and remain where originally placed on the tooth. The etchants main component is phosphoric acid in a 10-50% strength with 37% a common strength used in orthodontics. Compared to a neutral PH of 7, a 37% concentration of phosphoric acid is over 1,000,000 times more acidic. The acid dissolves the calcium salts from the tooth when in contact with the tooth for 20-60 seconds. If 30 seconds is the optimum time to etch the tooth surface opening the crevices for the resin to fill, is tripling the etch time better? In fact, extending the time of the acid etch on a typical enamel surface actually reduces the bond strength. As the acid remains in contact with the tooth beyond the optimum time, more calcium salts are dissolved which end up filling the crevices with additional debris thus reducing the places the liquid resin can flow into and shortening the resin tags which give the bond strength.

***Acid Etchant Precautions and Patient Safety***

Phosphoric Acid etchants are a moderate strength acid. Etchant dangers should be understood by all dental staff members who use these materials as well as the precautions and means by which to mitigate the effects to the gums and mucosal tissues.

1. All dental staff should wear gloves when handling these materials.
2. Patient precautions should include methods to isolate skin, oral mucosa, and the eyes from accidental contact with etchant.
3. Avoid contact with the eyes with the use of safety glasses. Avoid passing items over the patient face.
4. The longer the etchant is in contact with tissue the greater the damage from the acid.
5. Remain vigilant and watchful of where the acid etchant is placed and practice good isolation in the oral cavity to limit contact of the acid etchant with oral mucosa.
6. If the etchant comes in contact with the oral mucosa or the eyes, immediately rinse with water.

***Review the MSDS for the etchant and bonding materials.***

**Armamentarium**

*Figure 4*

A list of typical materials and instruments is included. Different offices will vary their procedures and can subtract or add additional materials they find helpful in successful bonding.

1. Prophy paste- pumice without fluoride
2. Prophy angle and slow speed handpiece

3. High speed drill (for use by orthodontist when indicated for surface preparation)
4. High speed evacuation and tip
5. Air water syringe and tip
6. Saliva ejector and tip
7. Mouth mirror
8. Scaler or explorer
9. Lip retractors
10. Tongue guard and saliva ejector assembly
11. Short and long cotton rolls
12. 2 x 2 gauze
13. Dry angles
14. Individual brushes/applicators
15. Liquid wells or disposable sheets for dispensing agents
16. Acid etchant in bottle or syringe
17. Bonding agent/primers
18. Additional etchants and primers for bonding to dental restorations

**Patient Assessment**

Take the time to examine your patient and plan for the best techniques to isolate the teeth for bonding. Assessing your patient will give you valuable information before you decide how best to manage their bonding experience. This step also allows you to discuss what you are planning before you start and prepare them for how they can best help.

***Patient Assessment***

Examine the patient to anticipate challenges in the bonding process. Some patients have small mouths and taut tissues increasing the methods necessary to control the oral environment from contamination.

The patient assessment should answer a number of questions:

1. Does the patient produce an excessive amount of saliva? The average person can produce up to 1.5 liters of saliva in 24 hours produced predominantly from the parotid glands in the cheeks and the submandibular glands in the floor of the mouth. Many times, it appears the 1.5 liters is flowing all at one time!
2. Does the patient have an active tongue and excess head movement?
3. Are the lips and cheeks loose or taut and is access to the labial surfaces of the teeth difficult?
4. Are the vestibules deep and will these areas accommodate a cotton roll and maintain the cotton rolls without the muscles dislodging these isolation aids?

**Cleaning Tooth Surfaces**

The oral cavity is replete with microorganisms, debris, salivary pellicle, and bathed with serous and mucous fluids. These materials accumulate on the tooth surface. You cannot reliably etch and bond to a debris laden surface. Recognize that acquired coatings are present on the tooth surfaces and may affect bond strength. These materials should be removed prior to preparing the tooth for bonding:

a. Salivary Pellicle: a clean tooth surface is quickly coated with salivary proteins and glycoproteins forming a very thin layer. This protein layer easily reforms when the surface of the tooth is in contact with saliva.

b. Dental Plaque: the plaque is made up of inorganic compounds, bacteria, other microorganisms, and salivary constituents

c. Calculus: bacterial plaque can become mineralized forming hardened deposits which are not easily worn away.

Cleaning the tooth surface is designed to provide a bare enamel surface on which to bond brackets. Prophylaxis of the enamel surfaces removes plaque, food particles, and some surface minerals.

a. The surface of the tooth can be cleaned with an abrasive applied manually with a hand instrument and prophy cup or more efficiently with a slow speed hand piece and prophy angle, micro-etcher.

b. The prophy paste for orthodontics is composed of pumice in a glycerin liquid for ease of application. Fluoride or other additives are not components of orthodontic prophy pastes as these can inhibit bonding.

c. Once the surfaces are pumiced and the mouth is thoroughly rinsed, inspect the tooth surfaces with a scaler or explorer for residual plaque or calculus. If calculus is found the area will need scaling to expose clean enamel surface for etching and successful bonding.

***Review examples of prophy angles, scalers, hand instruments, active picture of prophy material.***

**Isolation and Moisture Control**

Once the surfaces of the teeth have been rinsed, dried, and thoroughly inspected for residual plaque and calculus, the teeth are ready for isolation in preparation for etching. The isolation of the teeth serves a number of functions:

a. Utilizing isolation materials creates a barrier which partitions the oral mucosa avoiding contact with the teeth.

b. Isolation of the soft tissue gives better visualization of the teeth and lessens the chance of mucosa contacting the etchant materials applied to the teeth.

c. Placement of cotton products and shields helps control saliva and reduces the challenge of protecting the tooth surface from recontamination with saliva and salivary pellicle.

d. A properly placed cotton roll or retractor can free an operator's hands and focus back to preparation of the tooth for bonding.

*Figure 5*

*Figure 6*

***Materials for Isolation and Moisture Control***

1. Cotton roll isolation is effective in some patients to retract the cheeks and lips.

   a. Select the cotton roll lengths that will best fit and remain in the vestibule.

   b. In some patients (many children) the vestibule is not deep enough to passively hold the cotton roll. When you place it, a short time later you will see that it has migrated from the mucosa to the tooth level.

   c. Longer cotton rolls sometimes work best, and an extra mouth mirror may be used to hold the cotton roll in place.

2. Cheek retractors are available from a number of manufactures to retract the lips and cheeks.

   a. Retractors can free the hands from continually holding a mirror to retract the cheek or lip.

   b. Retractors are designed either as a universal size or scaled for the size of the patient. Consider a child size retractor for small children as this will provide a more comfortable experience.

   c. Some retractor designs include optional tongue guards as well as saliva ejection tubing.

3. Dry angles can also assist with moisture control from the parotid salivary ducts (Stensen's ducts adjacent to the maxillary first molars).

4. Auxiliary saliva ejectors can prove helpful for patients with excessive saliva production.

5. High speed evacuation is routinely used to suction the majority of the saliva from the oral cavity as well as to remove etchant and water spray. To reduce etchant from dispersing throughout the mouth, first suction excess etchant and then rinse/suction.

6. Some orthodontists also use anti-sialagogues such as Pro-Banthine to control saliva flow. These medications given typically in pill form 15 minutes prior to a bonding appointment shut down saliva flow drying the mouth substantially. These medications have side effects and there are patients with medical conditions which prevent their use. Only the orthodontist should prescribe or provide these medications after thorough evaluation of the patient's medical history. Considering the many systems for retracting the lips and suctioning of saliva, antisialagogues (medications which reduce salivary flow) are not needed in most patients.

***Acid Etchant Placement***

Once the patient teeth have been thoroughly cleaned, inspected and isolated the operator is ready to etch the tooth enamel surface.

1. If using a syringe delivery for the first time, dispense a small amount of etch from the application syringe to prevent any etchant gel spurting out into the patient's mouth due to air or solids lodged in the application syringe tip.

2. Dry the tooth surface then apply etch to the enamel covering an area larger than the bracket base and in the area where the bracket will be placed. Cover the area thoroughly while avoiding excess amounts which may slough or if overly thick may come in contact with the patient's soft tissues.

3. If using liquid etchants, be very careful with placement to avoid excess amounts which may flow off the tooth and onto vital structures.
4. When using etchants, avoid excess amounts over areas of the tooth where the bracket will not be bonded, for example the interproximal areas of the teeth. Coverage of the general area of the tooth where the brackets are to be placed is permissible as it will not harm the tooth. These etched areas will remineralize especially if patients utilize fluoride rinses as recommended.
5. With gel etchants the goal is to cover the tooth surface while limiting a buildup of etchant in thickness. A thick ball of etchant will not increase the effectiveness of the etching process, wastes material, and will increase the likelihood the etchant will contact the cheek, lip, or tongue. Excess etchant can transport to areas of the mouth in quantities that can cause chemical burns to the tissue if left unidentified for an extended period of time.

***Time Factors***

37% phosphoric acid is the standard etchant material from which the recommended time for etching teeth is derived. Most manufacturers recommend 15-30 seconds etch time for an average enamel surface.

While 15-30 seconds is average, increasing the time to a few minutes does not improve bond strength, it actually will reduce bond strength as the calcium salts from the extended etching time clog the enamel surface limiting penetration of the bond resin into the tooth.

Etching time should be increased in specific circumstances. The enamel structure of the primary teeth is not as consistent as that of the adult teeth. Some orthodontists recommend removing the top aprismatic enamel common on primary teeth by removal with a carbide bur or sandblasting followed by etching for 30-60 seconds with phosphoric acid 37%. Succedaneous (adult) teeth may have aprismatic enamel or hypocalcified enamel which would also benefit from additional surface preparation and extended etch time.

**Rinsing Tooth Surfaces**

At the end of the etching time the etching gel is suctioned off and then rinsed off with forceful water spray. The goals are to remove the etchant AND precipitated products of the etching.

a. Focus on rinsing off the etchant while effectively suctioning the liquid to avoid pooling and recontamination of the etched surfaces.
b. Once the etchant is removed, switch to forceful spray of an oil-free water for 15 seconds to improve surface cleaning removing etchant debris.
c. Remember rinsing not only removes the etchant, it is also critical to continue rinsing to remove the calcium salts and open up the depressions in the enamel to accept the bonding agent.
d. At the end of rinsing and high-speed suction the etchant will have been completely eliminated along with excess fluids, while the teeth will remain wet.

**Drying Teeth**

At the end of the rinse cycle, before air drying the teeth, inspect the oral cavity for residual enchant in contact with the tissue or remaining on the teeth. Removing the etchant at this time can eliminate prolonged contact of acid with soft tissue and subsequent chemical irritation of the tissue.

Reevaluate the oral cavity and eliminate any pooled saliva or water before starting to dry the teeth. The goal is to avoid blowing saliva or debris on to the etched surface reducing bond strength.

If cotton rolls are in place and saturated, either dry with the high-speed suction or carefully replace the cotton rolls avoiding contact with the tooth surfaces when removing the cotton rolls.

The drying step is critical to the strength of the bond as effective drying allows for deeper penetration of the resin increasing the length of the resin tags that mechanically lock the bonding agent to the enamel.

Once the teeth are well isolated and no saliva or water is present which might blow onto the clean tooth surface, it is time to dry the surface.

1. The air water syringe is a common instrument for drying the teeth with certain provisions.
2. Make sure the air water syringe stops the flow of water when the air is pressed separately. Observe for the presence of water vapor in the syringe and rewetting of the tooth surface. There are rubber seals in the housing of the syringe which can be replaced if moisture continues to escape from the syringe tip.
3. Air dryers designed for orthodontics also can efficiently dry the teeth.
4. The high-speed evacuation will pull moisture from the tooth surface, but may leave some residual moisture.
5. While drying the enamel, continue suctioning near the air water syringe tip periodically suctioning the oral cavity to avoid pooled saliva as before.
6. Properly conditioned enamel should exhibit a dull, matte, chalky, frosty-white appearance; if not, repeat etching procedure for an additional 15 to 20 seconds.
7. Take the time to adequately dry the teeth.

**Contamination of the Tooth Surface with Saliva or Crevicular Fluids**

Occasionally despite best efforts an etched and dried enamel surface is contaminated by saliva before the bonding agent is applied. Once contaminated, do not proceed with the bonding process until the contamination has been corrected. The saliva deposits debris in the irregularities of the enamel surface not allowing the resin to penetrate the enamel surface and create the strong mechanical bond. You must etch the surface again. The depressions in the enamel with removal of the calcium salts occurred with the 30 second etching. A 10 second etch will clean the surface of the debris and once again allow full penetration of the resin. The best way to protect the etched surface is to apply and cure the bonding agent.

***Contamination of the Resin Bonded Surface***

After the tooth surface is sealed with resin and ready for bonding of orthodontic brackets, we are relying on a chemical bond between the resin on the tooth surface and the resin within the bonding composite placed on the bracket. If the surface of the light cured resin placed on the prepared enamel is contaminated with saliva, the bond strength would be reduced by this smear layer of protein and associated debris.

The smear layer must be cleaned from the resin surface prior to placing a bracket loaded with composite. Rinse to remove the smear layer, dry the surface, and reapply bonding agent thinning with air stream and light cure. At this point the resin is ready to accept the composite loaded bracket.

***Are there different steps and materials for bonding to dental restorative materials?***

Preparing enamel for bonding has been described as a progression of steps to create a mechanical connection of the bonding resin to the enamel surface. A general description of bonding to different restorative materials is provided to give an understanding of concepts specific to bonding to gold, porcelain, and plastic or composite fillings. Review the instructions from the manufacturer and discuss the steps with the orthodontist. In most cases the common material is some form of primer that will prepare the surface to accept the normal bonding agents.

As with enamel, the ultimate the goal is to create a strongly bonded surface layer of bonding resin that will readily bond to the composite bonding paste on the back of the orthodontic bracket. Some of the following steps and materials may be needed to bond effectively. Become familiar with the different materials and memorize the order of these steps and when each is used. Create cards for the steps required for each material. The table provides general guidelines for each restorative material. Review instructions from the manufacturers to individualize the steps for the materials used in your orthodontic office.

| Dental Material | Surface Cleaning or Roughening | Etching | Primers | Bonding Agents |
|---|---|---|---|---|
| Enamel | Pumice Surface | 37% phosphoric acid | None | √ |
| Porcelain | Occasional removal of glaze using micro etch or bur roughening | 10% Hydrofluoric Acid | Porcelain primer | √ |
| Gold | Micro etching or Bur roughening | None | 4 Meta metal primer | √ |
| Amalgam | Micro etching or Bur roughening | None | 4 Meta metal primer | √ |
| Plastic | Roughen surface with bur | Only enamel areas | Plastic Conditioner | √ |
| Composite | Roughen surface with bur | Only enamel areas | Plastic Conditioner | √ |


*Figure 7: Bonding Agents*

**Porcelain Bonding Preparation**

The process to bond to a porcelain crown is dependent on a chemical and/or mechanical bond between the porcelain surface and the resin bonding agent. Studies have shown that the highest bond strength combines both mechanical retention and chemical bonding of the porcelain and the bonding resin.

Porcelain as a special crystalline material requires a special acid and longer etching time to dissolve the surface creating irregularities for a mechanical bond. Hydrofluoric acid is used to alter the porcelain surface. This is a VERY corrosive material which will damage tissue and must be handled carefully with good isolation and control of acid placement.

To create the chemical bond between the porcelain and the bonding resin a Silane coupling agent or "porcelain primer", is used after etching and allowed to chemically prepare the porcelain surface before air drying. The typical preparation of porcelain involves cleaning of the porcelain surface, etching with hydrofluoric acid or phosphoric acid (less effective etching), porcelain primer application, and placement of the bonding resin, and finally bracket placement with the bonding paste. The steps for a manufacturer's products should be reviewed and practiced prior to working with patients. This must include additional considerations for safety when using hydrofluoric acids including close attention to isolation techniques.

*Figures 8 and 9:*
*Porcelain Primer and Hydrofluoric Acid used for porcelain crowns.*

***Gold Crown Preparation***

Gold crowns create some unique challenges as we are working with a material not of a crystalline structure that does not readily dissolve with acid. Gold crowns are also impenetrable to light, a factor when considering curing of the composite coated brackets after placement on the gold crown. Surface preparation for gold crowns includes roughening of the gold surface to create some mechanical retention with the bonding agent. The surface is prepared with a carbide or diamond bur by the orthodontist. An alternative with better mechanical retention involves micro etching the gold surface with a portable sandblasting unit.

Once the surface is prepared, increasing retention relies on a primer specific to metal or some of the universal materials designed to bond to varied materials. The metal primer is placed on the gold crown for a specified time by each manufacturer as well as the number of primer applications and then air dried. The resin bonding agent is then applied over the metal primer creating the universal bonding surface that will create the chemical bond with the composite bonding paste placed on the back of the brackets. Recognize that light transmitting from the light curing unit is limited by the metal bracket as well as the gold crown requiring additional curing time and curing at different angles and locations to compensate. Some orthodontists may prefer a chemical curing bonding paste that does not require light curing when bonding to metal.


*Figure 10*

*Figure 11*

***Plastic Crown Preparations***

The plastic crowns and composite restorations need cleansing and roughening of the surface before proceeding. The orthodontist can roughen the surface with a diamond or carbide bur. Temporary plastic crowns and composites require a special primer formulated for plastics.

Just as with the other primer, solutions for porcelain and gold, the primer remains on the surface and is air dried. The bonding resin chemically bonds to the primed plastic surface. Once light cured, the surface will again bond chemically with the composite paste on the back of the brackets.

***Hyper-mineralized Teeth***

Teeth near the salivary ducts may have an excessive layer of minerals on the surface of the enamel. The typical etching time with phosphoric acid will not dissolve these surface minerals quickly and penetrate the enamel sufficiently to create the long resin tags necessary for good mechanical retention. When encountered, it is necessary to increase the etching time to at least 60 seconds to dissolve the additional minerals on the surface as well as the calcium salts of the enamel.

**Primary Teeth Enamel Bonding**

The primary enamel structure is not as organized as with adult teeth. It is recommended that the surface layer of aprismatic enamel be removed prior to etching with a carbide bur by the orthodontist. The primary enamel may require additional etching time to provide adequate bond strength.

***Self Etching Primers***

Self etching primers continue the progression of simplifying the bonding process by combining the etching and bonding materials in a single solution. Self etching primers were designed to streamline the bonding step and reduce some of the technique sensitive steps prone to contamination and a reduction in bond strength.

Typically, these materials are housed in a delivery system to protect the volatile materials from evaporating when exposed to air. The materials are designed with compartmentalized materials requiring mixing to activate which provides convenience though a limited period in which to use the hybrid bonding agents. The variation of the delivery systems and protocols requires individual evaluation and study, coordinating with the orthodontist before using these products.

**Patient Protection**

Acid etchant contact with soft tissue can cause injury.

1. Continually monitor patients for location of etchant and remove immediately when in contact with soft tissue.
2. Thoroughly rinse soft tissue for up to 15 minutes when etchant is in contact with the soft tissue for an extended period of time can reduce the severity of etchant damage.
3. Avoid eye exposure to acid with proper control of material and safety glasses.
4. Be aware of eye wash station location and operation.
5. Review safety procedures with orthodontist.

# Glossary

***bond failures –*** bond failures directly relate to bond strengths. When any of the steps to a strong bond are missed or inadequately followed, the brackets will dislodge prematurely.

***bond strength –*** when we discuss bond strength, there is a minimum strength one would expect for a bonded bracket to remain on the tooth during normal function. On the other end of the range there is a maximum bond strength that when it fails will not tear away enamel. Modern composite materials and bonding agents are designed with bond strengths within this range.

***bonding agents –*** liquids designed for application to a prepared dental surface in order to create a mechanical or chemical bond with this surface as well as possessing components which also will bond with brackets adhesives. The majority of these used today harden or cure with light curing units while some are composed of two parts which cure chemically.

***bonding composites –*** bonding pastes or bonding composites are "composed" or contain the resins or liquid portions found in bonding agents as well as particles that give composites strength. When composites and bond agents are in contact, light curing will chemically bond these to components together.

***bonding primers –*** similar to the painting process where it is recommended to place a "primer paint" to improve the bond of the paint to the wall, bonding primers improve the bond of the composite bonding agents and materials to the tooth.

***etchant –*** an acid designed to clean and etch the tooth surface. Etchants are different formulations of acid depending on the type of surface you are preparing.

***filled resins –*** the same as bonding composites, filled resins are made of the liquid resins found in bonding agents as well as the "filler" which is the hard particles that give the bonding composites strength and a thicker more viscous composition. This allows the filled resins to effectively stick to the tooth surface when applying a bracket to the tooth.

***pellicle –*** a mixture of protein and plaque that coats the surface of teeth. The pellicle will instantly coat the tooth when the surface is contaminated by saliva, when contacted by the tongue or when in contact with the lip or cheek. The pellicle will inhibit a good bond to enamel if it contacts the freshly etched enamel surface of a tooth.

# Laboratory, Preclinical and Clinical Instruction

**Students will complete study material for Module 4 (preparing teeth for bonding) and Module 5 (bracket placement) prior to proceeding with the laboratory section which will include instruction in the continuum of both procedures.**

**LABORATORY SESSION 1**

*1 Hour*

During this session, students will practice the preparation of teeth for bonding with the application of materials on typodont teeth using appropriate etchants and primers according to type of enamel or restorative material being bonded.

**Typodont Experience**

- Practice protocol for bonding to enamel
- Practice protocol for bonding to porcelain
- Practice protocol for bonding to plastic
- Practice protocol for bonding to gold/metal
- Practice protocol for bonding to atypical enamel
- Practice protocol for contaminated tooth

**Laboratory Instructions**

Students will work with a partner during the process of these procedures. The assisting student will observe each stage of the process for evaluation. The following is a step-by-step description of the procedures that should be followed during the laboratory practice sessions:

1. Each student will set up his/her armamentaria for etchant and bonding placement.
2. Student will be provided with a typodont, a bench mount and four anterior and four posterior typodont teeth. In addition, the student will be provided with individualized packets that will include:
    a. Description of packet
    b. Etchant material in disposable syringe or bottle
    c. Brushes/applicators for etchant application
    d. Liquid wells or disposable sheets for dispensing materials
    e. Bonding agent/primer in bottle or disposable syringe
3. Instructor will review procedures and present information on how to use worksheet for etchant and bonding placement.
4. Instructor will present criteria for ideal etchant, bonding resin placement. Instructor will provide ideal examples that will be passed around for viewing.
5. Student will place etchant on typodont tooth, partner observes, evaluates and records on worksheet. Student will also evaluate him/herself on the procedure. Instructor evaluates the etching process. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
6. Partners switch places, the operator becomes the assistant, and the assistant becomes the operator. Both students complete three typodont teeth.
7. Instructor will now present product evaluation form and how it is used to evaluate final etchant and bonding application.
8. Using the product evaluation form, the student operator and the student assistant and instructor grade the final etchant, bonding process for each other.
9. Discussion on product evaluation is conducted in small groups

**LABORATORY SESSION 2**

*1 Hour*

Laboratory practice on typodont teeth continues but now for specialized products used for bonding atypical enamel, porcelain, plastic, gold etc. and practice protocol for contaminated teeth.

**PRECLINICAL SESSION**

***2 Hours***

During this session, student partners work on each other in simulation as described and demonstrated by instructor. The following general procedures will occur:

Working with a partner, each student functions as an operator and applies etchant (faux) and bonding materials. Student will then function as an assistant, observe and evaluate placement with partner.

The following general procedures will occur for each patient:

1. Operatory will be set up following the infection control guidelines.
2. Medical history will be completed by student/patient prior to seating.
3. Equipment and supplies will be checked by student.
4. Student/patient will be seated and prepared for treatment.
5. Student operator will review medical history and perform a patient assessment; instructor will follow-up with same procedures.
6. Patient is given instructions/explanation of procedures.
7. Student operator will perform the following according to the stated criteria:
    a. Perform coronal polish
    b. Isolate one quadrant and dry
    c. Perform etchant (faux/simulated product) application procedures
    d. Suction "etchant" from tooth
    e. Rinse and dry etched tooth/teeth
    f. Apply primer/bonding material(s)
    g. Cure material (2 seconds only during simulation for easy removal)
    h. Apply composite resin material
    i. Cure composite resin material
    j. Evaluate product using ideal criteria
    k. Give patient post-op instructions
    l. Dismiss patient
    m. Perform operatory clean-up according to infection control guidelines

During the procedure, the following will take place:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/assistant will assist, observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both student's work/performance using stated criteria using the worksheet and product evaluation forms. Discussion on results will be conducted.
4. The instructor will demonstrate and explain clinical examination protocol. When student performs last procedure on student partner it will be termed "mock exam" in preparation for the final exam on a clinical patient.

**WRITTEN FINAL EXAMINATION**

***1 hour***

**CLINICAL SESSION – MODULE 4 AND 5**

***4 hours***

During this session, the instructor will demonstrate the sequence of tooth preparation for bonding on active patients.

The following procedures will be demonstrated:

1. Perform coronal polish
2. Isolate one quadrant and dry
3. Perform etchant application procedures
4. Suction etchant from tooth
5. Rinse and dry etched tooth/teeth
6. Apply primer/bonding material(s)
7. Cure material
8. Apply composite resin material
9. Cure composite resin material

Student experience on active patients will include preparation for subsequent bracket bonding on four anterior and four posterior teeth a minimum of four times each, with one of each of the four times used for a practical exam.

The following general procedures will occur for each patient:

1. Operatory will be set up following the infection control guidelines.
2. Medical history will be completed by the patient prior to seating.
3. Equipment and supplies will be checked by student/operator.
4. The patient will be seated and prepared for treatment.
5. Student operator will review medical history and perform a patient assessment; instructor will follow-up with same procedures.
6. Patient is given instructions/explanation of procedures.
7. Student operator will perform the following according to the stated criteria:
    a. Perform coronal polish
    b. Isolate one quadrant and dry
    c. Perform etchant application procedures
    d. Suction etchant from tooth.
    e. Rinse and dry etched tooth/teeth
    f. Apply primer/bonding material(s)
    g. Cure material
    h. Apply composite resin material
    i. Cure composite resin material
    j. Evaluate product using ideal criteria
    k. Give patient post-op instructions
    l. Dismiss patient
    m. Perform operatory clean-up according to infection control guidelines

**After the student operator completes the sequence of procedures, the student operator, the assistant and the instructor will evaluate the performance of the student operator using the worksheet and product evaluation.**

During this time period the following procedures will occur:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/assistant will assist, observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work/performance using stated criteria using the worksheet and product evaluation forms. Discussion on results will be conducted.

# Worksheets

**LABORATORY & CLINICAL PATIENT WORKSHEETS**

**General Information on Worksheets**

The student operator, student assistant, and instructor use these forms. Each of these individuals will watch the performance of the specified steps of the given procedure and then identify if any of these steps are not followed and/or inadequately performed by the student operator. During the learning process, errors can and will occur. Students and clinical instructors identify common errors encountered during each step of the entire procedure utilizing the worksheets. Worksheets are not grade sheets, but they assist the student to identify his or her own errors during performance of these steps. They are used for measuring student's progress toward attainment of clinical proficiency.

**General Procedures**

An important part of the learning experience in the processes of preparing teeth for bonding and bracket placement and removal is the ability to identify technique errors, understand their causes and find solutions. Equally important is to determine the degree of error and when it constitutes a need to redo the procedure. The first step in this process is to identify the error(s). Using the Laboratory and Clinical Patient Worksheets does this. The worksheets are not grade sheets but are documents that are used to assist students in learning to identify common technique errors related to the procedures associated with preparing teeth for bonding and bracket placement and removal. The student uses this form in the following manner:

The worksheet consists of a column titled Procedure-Laboratory and Procedure-Clinical, which is the step-by-step description of the procedures associated with preparing teeth for bonding and bracket placement and removal. The procedures are subdivided into the following categories:

- Infection Control/Patient Safety
- Assemble Armamentaria
- Fitting
- Trimming
- Ligating
- Patient Education
- Infection Control/Patient Safety/Clean-up

**How Worksheets Are Used by Student Operator and Student Assistant**

1. When performing multiple procedures either in the laboratory or on clinical patients, all of the errors from these series are placed on one worksheet.
2. Each laboratory/clinical experience is graded in a different column.
3. When an error occurs in any of the individual steps described in the Procedure column, a check is placed in the box corresponding to the laboratory/clinical experience.

For example, on the clinical patient worksheet there would be a box for each step of the clinical practice patients. For the laboratory worksheet, there would be a box for the typodont teeth. With worksheet check-offs, the student can identify a clustering pattern of errors in any particular step. When an instructor evaluates the student's performance, he/she cannot only see how a student performs, but whether or not the student can identify errors that he/she makes.

**How the Student Identifies Cause and the Correction of Errors**

After the student identifies the error(s) performed, he/she will write the cause of the error and how it shall be rectified.

**How the Instructor Uses the Worksheets**

The instructor watches the student operator during the entire process. The instructor will check the appropriate box on the same worksheet used by the student operator and the student assistant. The instructor observes both students, and then evaluates the grading completed by both students for accuracy. The instructor reviews the worksheets for information related to: cause, solution and whether any part of the procedure requires additional steps. The instructor can provide additional assistance where needed. This process of identification of errors, causes and solutions will ensure the student will progress towards clinical competence and expected course objectives will be met. This process will continue throughout all laboratory and clinical requirements. When the clinical final exam is administered the student should be clinically competent in the stated procedure.

**Satisfactory Performances of Psychomotor Skills**

Students will practice psychomotor skills during the laboratory and preclinical sessions until they reach a competence level of 75% utilizing the documented criteria evaluated using the behaviorally anchored rating scale. Students must achieve a passing score on a minimum of two typodont teeth or natural teeth before progressing on to successive laboratory, preclinical and clinical sessions.

**Modules 4 and 5 have been combined on the laboratory and preclinical worksheets as these procedures would be combined in the educational setting and bracket bonding would be followed by bracket removal.**

# Worksheet – Laboratory/Preclinical

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Minimum of 4 anterior teeth to be prepared, brackets bonded and removed. Record tooth number(s):

Minimum of 4 posterior teeth to be prepared, brackets bonded and removed. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

*** = Critical error**

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| 5. Low-speed hand piece with disposable prophy angle | | | |
| 6. Pumice/prophy paste without fluoride or oil | | | |

| | | | |
|---|---|---|---|
| 7. Isolation products-long and short cotton rolls, dri-aids, dry angles, cheek retractors, tongue guard, etc. | | | |
| 8. Etchant, primer, bonding agent, materials required for bonding to dental restorations | | | |
| 9. Curing light, tinted safety glasses or shield | | | |
| 10. Typodont with appropriate teeth and bench mount/pole | | | |
| 11. High speed hand piece for roughening surface of restoration | | | |
| 12. Micro-etcher for roughening surface of restoration | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Tooth Preparation | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 13. Verify teeth to be prepared for bonding* | | | |
| 14. Remove plaque/pellicle from teeth with non-fluoridated/flavored prophy paste = orthodontic prophy paste | | | |
| 15. Rinse and suction<br>Use explorer to check surface of the tooth to be sure there is no calculus or remaining pumice<br>Rinse again and dry | | | |
| 16. Isolate with appropriate cotton rolls, holders etc.* | | | |
| 17. Completely dry teeth and maintain isolation | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Etchant Placement | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 18. Place etchant onto surface to be sealed, covering an area larger than the bracket base, avoiding excessive amounts* | | | |
| 19. Allow etchant to remain on teeth 15-30 seconds or increase for highly mineralized enamel and or primary teeth | | | |

| | | | |
|---|---|---|---|
| 20. Thoroughly rinse, removing etchant, while keeping teeth isolated<br>If teeth become contaminated, re-etch 10-15 seconds | | | |
| 21. Thoroughly rinse surface for 20-30 seconds followed by drying for at least 20 seconds*<br>Etch pattern should appear frosty or a matte finish for enamel<br>Etch pattern will not appear on typodont teeth | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Bonding and Curing | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 22. Apply thin layer of bonding agent to the prepared surface where the bracket will be placed*<br>Apply light stream of air for 10 seconds | | | |
| 23. Polymerize the bonding agent*<br>Hold curing light as close to surface without actually touching material<br>Standard curing light 10 seconds, high-energy light-5 seconds | | | |
| 24. Apply bracket cement to base working into bracket mesh* | | | |
| 25. Polymerize the composite resin material *<br>Standard curing light 20 seconds, high- energy light-10 seconds once position confirmed by orthodontist | | | |
| 26. Bracket is bonded to tooth as stated in bonding bracket module/section* | | | |
| 27. Check for voids in composite resin material and proper placement of bracket | | | |
| 28. Remove isolation materials, rinse and dry | | | |
| 29. Patient education (not provided for typodont but student could practice dialogue that would be used during clinical experience) | | | |

| Bracket Removal | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 30. Prepare patient for bracket removal with instructions on what patient may experience during procedure | | | |
| 31. Will remove brackets with bracket removing pliers | | | |
| 32. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket | | | |
| **Patient Education** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 33. Give post-operative instructions to the patient or parent | | | |
| 34. Document procedure in patient chart to include: date, HH review or update, materials used, operator signature, and instructor or DDS signature | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 35. Remove barriers from chair, light, air- water syringe, hoses, HVE, saliva ejector, handpiece | | | |
| 36. Surface disinfect | | | |
| 37. Prepare and institute sterilization procedures | | | |
| 38. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 39. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Worksheet – Clinical Patient

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name

Circle one: Patient #1 Patient #2

Patient Name:

Minimum of 4 anterior teeth to be prepared, brackets bonded and removed. Record tooth number(s):

Minimum of 4 posterior teeth to be prepared, brackets bonded and removed. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

*** = Critical Error**

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| 5. Low-speed hand piece with disposable prophy angle | | | |
| 6. Pumice/prophy paste without fluoride or oil | | | |
| 7. Isolation products-long and short cotton rolls, dri-aids, dry angles, cheek retractors, tongue guard, etc. | | | |

| | | | |
|---|---|---|---|
| 8. Etchant, primer, bonding agent, materials required for bonding to dental restorations | | | |
| 9. Curing light, tinted safety glasses or shield | | | |
| 10. High speed hand piece for roughening surface of restoration | | | |
| 11. Micro-etcher for roughening surface of restoration | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Tooth Preparation | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 12. Verify teeth to be prepared for bonding* | | | |
| 13. Remove plaque/pellicle from teeth with non-fluoridated/flavored prophy paste = orthodontic prophy paste | | | |
| 14. Rinse and suction<br>Use explorer to check surface of the tooth to be sure there is no calculus or remaining pumice<br>Rinse again and dry | | | |
| 15. Isolate with appropriate cotton rolls, holders etc.* | | | |
| 16. Completely dry teeth and maintain isolation | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Etchant Placement | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 17. Place etchant onto surface to be sealed, covering an area larger than the bracket base, avoiding excessive amounts* | | | |
| 18. Allow etchant to remain on teeth 15-30 seconds or increase for highly mineralized enamel and or primary teeth | | | |
| 19. Thoroughly rinse, removing etchant, while keeping teeth isolated<br>If teeth become contaminated, re-etch 10-15 seconds | | | |

| | | | |
|---|---|---|---|
| 20. Thoroughly rinse surface for 20-30 seconds followed by drying for at least 20 seconds*<br>Etch pattern should appear frosty or a matte finish for enamel<br>Etch pattern will not appear on typodont teeth | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Bonding and Curing | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 21. Apply thin layer of bonding agent to the prepared surface where the bracket will be placed*<br>Apply light stream of air for 10 seconds | | | |
| 22. Polymerize the bonding agent*<br>Hold curing light as close to surface without actually touching material<br>Standard curing light 10 seconds, high-energy light-5 seconds | | | |
| 23. Apply bracket cement to base working into bracket mesh* | | | |
| 24. Polymerize the composite resin material *<br>Standard curing light 20 seconds, high- energy light-10 seconds once position confirmed by orthodontist | | | |
| 25. Bracket is bonded to tooth as stated in bonding bracket module/section* | | | |
| 26. Check for voids in composite resin material and proper placement of bracket | | | |
| 27. Remove isolation materials, rinse and dry | | | |
| 28. Patient education (not provided for typodont but student could practice dialogue that would be used during clinical experience) | | | |
| **Bracket Removal** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 29. Prepare patient for bracket removal with instructions on what patient may experience during procedure | | | |
| 30. Will remove brackets with bracket removing pliers | | | |
| 31. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket | | | |

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 32. Give post-operative instructions to the patient or parent | | | |
| 33. Document procedure in patient chart to include: date, HH review or update, materials used, operator signature, and instructor or DDS signature | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 34. Remove barriers from chair, light, air- water syringe, hoses, HVE, saliva ejector, handpiece | | | |
| 35. Surface disinfect | | | |
| 36. Prepare and institute sterilization procedures | | | |
| 37. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 38. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Product Evaluation Forms

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

**General Procedures**

Product evaluation evaluates the end result of any performance, not the steps. This facility utilizes the behaviorally anchored rating scale (BARS) system. This 10-point system clusters the critical incidents into categories. The instructor can score objectively the end result of each procedure by choosing the criteria specified in each point level. Performance is assessed according to established criteria for each of these procedures. The points are then converted to a pass or fail grade.

**How Instructor Uses Product Evaluation Form**

A product evaluation form will be used for each patient. In the "scores" area on the form you will note that an open box rather than specific grids occurs. This open box allows you to enter a score for each of the posterior first molars.

**The student must maintain a minimum point value of 7.5 on all clustered critical incidences per tooth. He/she must receive this minimum score for all four posterior first molars selected for orthodontic band removal and cement removal with a hand instrument in order to pass this module. A grade of 7.5 represents a 75% passing score.**

**Product Evaluation Point Conversion**

The student will receive points for a given level of achievement from the point scale utilized for product evaluation.

**POINT SYSTEM TO A PASS/ FAIL SCORE**

***Conversion***

| Points | Grades |
|---|---|
| **10** | ➨ Pass-Excellent |
| **7.5** | ➨ Pass |
| **5** | ➨ Fail-Critical Error(s) |
| **3** | ➨ Fail-Critical Errors-no concept |

# Product Evaluation/Practical Examination – Lab Session 1

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

4 anterior teeth to be prepared for bonding brackets. Record tooth number(s):

4 posterior teeth to be prepared for bonding brackets. Record tooth number(s):

**PREPARATION AND ETCHANT**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Teeth are free of stains/plaque<br>B. Coronal polish/teeth pre-cleaning<br>C. Isolation of selected area<br>**Etching**<br>A. Etchant application<br>B. Etchant removal | | |

## PLACEMENT OF MAETIALS FOR BONDING BRACKETS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Bonding/Primer/Composite Application**<br>A. Assemble armamentarium<br>B. Identify and select bracket types for each tooth<br>C. Properly clean tooth surface<br>D. Avoid contamination of bracket bases<br>E. Apply bonding material to bracket base<br>F. Preposition brackets<br>G. Brackets cured after evaluation by instructor<br>H. Postoperative instructions reviewed<br>I. Prepare patient for bracket removal with instructions of what patient may experience during procedure<br>J. Will remove brackets with bracket removing pliers<br>K. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Lab Session 2

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

4 anterior teeth to be prepared for bonding brackets. Record tooth number(s):

4 posterior teeth to be prepared for bonding brackets. Record tooth number(s):

**PREPARATION AND ETCHANT**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Teeth are free of stains/plaque<br>B. Coronal polish/teeth pre-cleaning<br>C. Isolation of selected area<br>**Etching**<br>A. Etchant application<br>B. Etchant removal | | |

## PLACEMENT OF MAETIALS FOR BONDING BRACKETS

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Bonding/Primer/Composite Application**<br>A. Assemble armamentarium<br>B. Identify and select bracket types for each tooth<br>C. Properly clean tooth surface<br>D. Avoid contamination of bracket bases<br>E. Apply bonding material to bracket base<br>F. Preposition brackets<br>G. Brackets cured after evaluation by instructor<br>H. Postoperative instructions reviewed<br>I. Prepare patient for bracket removal with instructions of what patient may experience during procedure<br>J. Will remove brackets with bracket removing pliers<br>K. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Preclinical Session

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

4 anterior teeth to be prepared for bonding brackets. Record tooth number(s):

4 posterior teeth to be prepared for bonding brackets. Record tooth number(s):

**PREPARATION AND ETCHANT**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Teeth are free of stains/plaque<br>B. Coronal polish/teeth pre-cleaning<br>C. Isolation of selected area<br>**Etching**<br>A. Etchant application<br>B. Etchant removal | | |

**PLACEMENT OF MAETIALS FOR BONDING BRACKETS**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Bonding/Primer/Composite Application**<br>A. Assemble armamentarium<br>B. Identify and select bracket types for each tooth<br>C. Properly clean tooth surface<br>D. Avoid contamination of bracket bases<br>E. Apply bonding material to bracket base<br>F. Preposition brackets<br>G. Brackets cured after evaluation by instructor<br>H. Postoperative instructions reviewed<br>I. Prepare patient for bracket removal with instructions of what patient may experience during procedure<br>J. Will remove brackets with bracket removing pliers<br>K. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Clinical Session

**BRACKET PREPOSITIONING, BOND CURING & REMOVAL OF ORTHODONTIC BRACKETS**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

4 anterior teeth to be prepared for bonding brackets. Record tooth number(s):

4 posterior teeth to be prepared for bonding brackets. Record tooth number(s):

**PREPARATION AND ETCHANT**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Preparation of Field**<br>A. Teeth are free of stains/plaque<br>B. Coronal polish/teeth pre-cleaning<br>C. Isolation of selected area<br>**Etching**<br>A. Etchant application<br>B. Etchant removal | | |

**PLACEMENT OF MAETIALS FOR BONDING BRACKETS**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores *(Enter a score for anterior/posterior)* | Comments |
|---|---|---|
| **Bonding/Primer/Composite Application**<br>A. Assemble armamentarium<br>B. Identify and select bracket types for each tooth<br>C. Properly clean tooth surface<br>D. Avoid contamination of bracket bases<br>E. Apply bonding material to bracket base<br>F. Preposition brackets<br>G. Brackets cured after evaluation by instructor<br>H. Postoperative instructions reviewed<br>I. Prepare patient for bracket removal with instructions of what patient may experience during procedure<br>J. Will remove brackets with bracket removing pliers<br>K. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation Documented Criteria

PREPARING TEETH FOR BONDING

| PREPARATION & ETCHING | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Teeth are clean and coronally polished<br>➨ Field is totally isolated and maintained dry throughout procedure<br>➨ Etchant is carefully applied and time is precisely monitored<br>➨ Etchant is carefully and completely rinsed<br>➨ Enamel surface appears white, opaque, and frosty |
| **7.5 Points** | ➨ Teeth are relatively clean and coronal polish is acceptable<br>➨ Field is isolated and maintained dry during procedure<br>➨ Etchant timing and placement vary slightly from ideal<br>➨ Etchant removal is adequate<br>➨ Enamel surface appears adequately white, opaque and frosty |
| **5 Points** | ➨ Teeth have not been cleaned<br>➨ Isolation of tooth is faulty and saliva penetrates area<br>➨ Etchant placement and timing are careless/Gingival areas are involved in etching process<br>➨ Removal of etchant is careless and inadequate<br>➨ Enamel surface appears either smooth or normal color |
| **3 Points** | ➨ Teeth have not been cleaned and stain remains. Debris and plaque are plainly visible.<br>➨ Saliva washes over field during etching. Isolation fails.<br>➨ No attempt is made to time etchant application/No attempt is made to confine etchant to application area/Gingival areas are grossly affected by etching material<br>➨ Removal of solution is very poor.<br>➨ Enamel surface appears grossly mottled, pitted, or irregular. |

# Product Evaluation Documented Criteria

BRACKETS PREPOSITIONING, BOND CURING & BRACKET REMOVAL

| MATERIAL PLACEMENT | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Material is carefully prepared according to manufacturer's directions<br>➨ Contamination of bracket base avoided with careful technique<br>➨ Material is evenly applied well incorporated into bracket mesh<br>➨ Polymerization time is carefully monitored<br>➨ Confinement of material within bracket base ideal |
| **7.5 Points** | ➨ Material is prepared to manufacturer's directions reasonably accurately<br>➨ Contamination of bracket base avoided<br>➨ Material is acceptably incorporated into bracket mesh/Thickness may vary slightly from ideal<br>➨ Polymerization time is adequate<br>➨ Material placed within confines of bracket base with minor discrepancies |
| **5 Points** | ➨ Material is carelessly handled<br>➨ Student touches bracket base contaminating surface<br>➨ Material is not well incorporated into bracket mesh/Thickness is uneven, irregular, or in excess<br>➨ Material goes outside boundaries of bracket base<br>➨ Polymerization time is not monitored/composite not completely hardened |
| **3 Points** | ➨ Material is crudely manipulated and dispensed<br>➨ Student touches bracket base contaminating surface<br>➨ Material placement in bracket mesh poor/The coverage area is insufficient which will result in bracket failure<br>➨ Material goes outside boundaries of bracket base<br>➨ Poor attention to polymerization times |

# Product Evaluation Documented Criteria

BRACKETS PREPOSITIONING, BOND CURING & BRACKET REMOVAL

| BRACKET REMOVAL | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Clear description for bracket removal given to prepare patient<br>➨ Properly support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket |
| **7.5 Points** | ➨ Clear description for bracket removal given to prepare patient<br>➨ Adequately support teeth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket |
| **5 Points** | ➨ Adequate description for bracket removal given to prepare patient<br>➨ Provided support to tooth though mild patient discomfort while applying pliers pressure and occlusal rotation to remove bracket |
| **3 Points** | ➨ Poor description for bracket removal given to prepare patient<br>➨ Tooth unsupported during bracket removal causing discomfort to patient with inadequate occlusal rotation to remove bracket |

# Course Requirements

The following is an overview of the course requirements and the protocol followed for laboratory and clinical practice, the written and clinical examination.

**Minimum Number of Satisfactory Performances**

All students will perform at a minimum the following procedures in order to achieve minimum competence in the various protocols used in the preparation of teeth for bonding brackets:

On a typodont and patients, the student will perform the following under OSHA and DBC guidelines:

- On the typodont: apply etchant and other appropriate materials for subsequent bracket bonding on four anterior and four posterior typodont teeth a minimum of four times each, with one used for a practical exam according to the specified criteria.
- On the patient: Apply etchant in preparation for bracket bonding on four anterior and four posterior teeth a minimum of four times each on at least two patients according to the specified criteria with one of each of the four times used for a practical examination with 75% accuracy.

Students are required to meet the specified minimal number of satisfactory performances as indicated above. The student operator grades his/her own performance, the student assistant grades the performance of the student operator and the instructor will assess the student operator's performance and the grading method of both students.

When the student reaches the 75% minimum performance for preparing the tooth for subsequent bracket bonding and 100% performance on all infection control protocol, the instructor evaluates the procedure for the minimal number of satisfactory performances. If a student does not fulfill the minimum grade for the number of satisfactory performances additional laboratory and/or clinical practice procedures will be assigned.

**Objective Evaluation Criteria**

Objective evaluation criteria shall be provided to each student prior the performance of any procedure. The student will receive information provided by the instructor prior to performing any laboratory or clinical procedures. The instructor shall supply the student with general program, individualized cognitive and psychomotor objectives and criteria for evaluation. Objective criteria will be utilized in the performance of all laboratory and clinical requirements.

**Preparation Prior to Etching**

1. Will review the medical/dental history, make a general assessment, and oral inspection on each patient prior to treatment, checking for information that may contraindicate the performance of the procedure. Criteria for choosing specific materials for preparing surface for bonding brackets:
    a) Indications
        i) Enamel
        ii) Gold
        iii) Porcelain
        iv) Amalgam
        v) Plastic/composite
    b) Contraindications
        i) Tooth surface with caries
2. Will set up the required armamentaria for coronal polish, etchant and other bonding materials for subsequent bracket bonding
3. Will use aseptic techniques according to OSHA and DBC throughout performance on all patients
4. Will place protective barriers, seat and position the patient
5. Will evaluate the teeth scheduled to be prepared for bonding for subsequent bonding of brackets
6. Will explain to patient the treatment planned for that day
7. Will perform coronal polish on the teeth, ensuring a completely cleaned surface
8. Will isolate, thoroughly clean and dry, four anterior teeth and four posterior teeth prior to application of etchant and bonding materials for subsequent bonding brackets

**Etching Criteria**

1. Will apply etchant material according to the manufacturer's directions covering the target area of the tooth while avoiding excess amounts over areas of the tooth where the bracket will not be bonded (interproximal); the etchant shall remain in place for 15-30 seconds (average)
2. Will rinse thoroughly etched area for 20-30 seconds with a steady stream of water
3. Will dry thoroughly for at least 20 seconds
4. Will ensure that the etched surface appears dull, matte, chalky, frosty-white

Placing Bonding Agents Criteria

1. Isolated and etched teeth will be rechecked prior to subsequent application of bonding agents
2. Materials will be prepared/dispensed according to manufacturer's directions
3. Overuse of all materials will be avoided
4. Care will be taken to use thin layer of bonding agents
5. Holding the curing light as close as possible without touching the material expose the bond agent for polymerization as directed by manufacturer
6. The isolation material will be removed
7. If excess material is present, it will be removed with a hand instrument or an ultrasonic scaler
8. Will evaluate etchant and preparation of teeth for bonding with subsequent bracket placement procedures, identify problem-solving methods to improve or modify procedures

**General Criteria**

1. Will provide pertinent and individualized patient education
2. Will provide follow up appointment to evaluate bracket retention
3. Will meet ethical and legal requirements for this procedure
4. Will provide accurate chart entries for this procedure
5. Will utilize OSHA and DBC guidelines for instrument processing, removing waste and cleaning/disinfecting treatment area

The above criteria will be used to evaluate and assess appropriate use of materials with subsequent bracket placement with a minimum of 75% accuracy for laboratory and clinical patients.

**General Clinical Practice Protocol**

Students will have their first clinical practice by preparing four anterior and four posterior teeth a minimum of four times each, with one of each of the four times used for a clinical exam. They will also complete procedures on two clinical patients. The following general procedures will occur:

***Patient Selection Criteria***

The following criteria must apply for each patient:

1. Patient must be an active orthodontic patient
2. Patient must be in good health (medical history form will be completed prior to treatment, reviewed and approved by the instructor).
3. Each patient will have a minimum of four anteriors and four posteriors per arch for tooth preparation with subsequent bonding of brackets

The student will function as an operator, an assistant and a patient. Working as partners (operator and assistant) an operator will perform the procedure, the assistant will observe, and evaluate each step of the procedure. When complete each student will do the procedure, observe and evaluate.

The following general procedures will occur for each of the patients:

1. Operatory will be set up following the infection control guidelines
2. Medical history will be completed by the patient prior to seating
3. Equipment and supplies will be checked by the student
4. Patient will be seated and prepared for treatment
5. Student operator will review the medical history and perform a visual exam
6. The instructor will review the medical history and perform a visual exam
7. Instructor will accept the patient for preparation of teeth for subsequent bonding

8. Student operator will perform the following according to the stated criteria:
    a. Perform coronal polish
    b. Isolate and dry
    c. Perform etchant application and procedure
    d. Rinse and dry etched tooth/teeth
    e. Employ additional bonding materials for specific needs
    f. Cure bonding resin for subsequent bracket placement
    g. Evaluate the product
    h. Provide individualized patient education
    i. Dismiss the patient
    j. Make appropriate chart notes
    k. Perform operatory clean-up/instrument processing according to infection control guidelines

After etchant and bonding for subsequent bracket bonding procedures, the student operator, student assistant and the instructor complete evaluation using the worksheet and product evaluation form.

During this time period, the following will occur:

1. Student operator will evaluate his/her own work according to stated criteria using worksheet and product evaluation forms.
2. Student assistant will assist, observe, evaluate operator's performance according to stated criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work according to stated criteria using the worksheet and product evaluation forms. Results will be discussed.

A 75% must be obtained for passage of preparing teeth/ bonding brackets on a practice patient and a minimum of two clinical patients.

**General Examination Protocol**

***Written Examination***

A comprehensive written examination of 50 questions on the entire curriculum will be administered. The student must receive a minimum score of 75% on the examination to pass the class. One hour has been reserved for the written examination.

***Clinical Final Examination***

The clinical final examination occurs during the process of working on the two active orthodontic patients during the preparation of teeth for subsequent bonding following patient selection criteria and procedures outlined in the module's clinical practice protocol.

# Written Examination

1. A patient history is always necessary before coronal polishing because patients might have or be:
   a. Immunosuppressed
   b. Respiratory or pulmonary diseases
   c. Allergies
   d. All of the above
2. The following ingredient should not be included in polishing paste when performing a coronal polish prior to placing etchant:
   a. Fluoride
   b. Silicon dioxide
   c. Glycerin
   d. Pumice
3. Successful bonding technique is an absolute necessity in orthodontics.
   a. True
   b. False
4. The goal is to create a thin surface layer of bonded resin on the tooth that is tightly bound and sealed.
   a. True
   b. False
5. No option that has yet been tested is as efficient and as effective as phosphoric acid for etching tooth structure.
   a. True
   b. False
6. The phosphoric acid strength commonly used in orthodontics is 50%.
   a. True
   b. False
7. Prophylaxis of the enamel surfaces removes plaque, food particles and surface minerals.
   a. True
   b. False
8. The Wharton's duct opens adjacent to the maxillary second molars.
   a. True
   b. False
9. The Stenson's duct opens under the tongue adjacent to the lower anterior teeth:
   a. True
   b. False
10. The following are major salivary glands found in the oral cavity except the:
    a. Sublingual gland
    b. Parotid gland
    c. Lachrymal gland
    d. Submandibular gland
11. The vestibule lies between the tongue and the mandible.
    a. True
    b. False
12. The parotid gland is more of an isolation concern when preparing teeth for bracket placement on tooth number 3 and 14. If a dri-aid or dry angle is used it should not be an issue.
    a. Both statements are true
    b. Both statements are false
    c. The first statement is true the second is false
    d. The first statement is false the second is true
13. Bond failures are directly related to:
    a. Bond strengths
    b. When any of the steps are missed or inadequately followed
    c. Brackets dislodging prematurely
    d. All of the above
14. After tooth surfaces are polished, plaque forms within minutes.
    a. True
    b. False
15. Buonocore observed adhesion to metal surfaces by paints improved when acids were used to etch thus increasing strength of bond in:
    a. 1940
    b. 1945
    c. 1950
    d. 1955

16. When using acid etch the operator should wear safety glasses and gloves. The patient should wear safety glasses and be allowed to lick the etchant.
    a. Both statements are true
    b. Both statements are false
    c. The first statement is true and the second is false
    d. The first statement is false and the second is true
17. Important factors related to effective bonding of brackets include understanding processes and ability to maintain good isolation. The patient's cooperation and good access into the mouth also determines success of bonding brackets.
    a. Both statements are false
    b. The first statement is true the second is false
    c. The first statement is false the second is true
    d. Both statements are true
18. Methods of isolation prior to bracket placement include:
    a. Cheek retractors and cotton rolls
    b. Tongue guards and saliva ejectors
    c. Dry angles
    d. All of the above
    e. a and b only
19. During the etching process the etchant comes in contact with the eyes, the first aid measures should include rinsing with copious amounts of water for:
    a. Five minutes
    b. Ten minutes
    c. Fifteen minutes
    d. Twenty minutes
20. The etchant used for etching enamel in orthodontics include all of the following except:
    1. 50% Phosphoric Acid
    2. 10% Phosphoric Acid
    3. 37% Phosphoric Acid
    4. 10% Hydrofluoric Acid
    5. Plastic conditioner
    a. Only number 4
    b. 1, 2, and 3
    c. 2, 3, and 4
    d. 1, 2, 3, 4, and 5
    e. 1, 2, 4, and 5
21. You have just bonded a bracket on tooth number 30 and when checked you determine the bracket is easily dislodged from the tooth. Which of the following are likely causes:
    1. Saliva contamination occurred following the etching procedure
    2. The pumice used to clean the tooth surface contained fluoride
    3. The pumice you used contained glycerin liquid
    4. The light-curing unit was not producing enough light
    a. 1, 2, 3 and 4
    b. 1, 2, and4
    c. 2, 3, and 4
    d. 3 and 4
    e. 1, 3 and 4
22. If a tooth becomes contaminated after etchant removal, but before bonding you would proceed with bonding; a little saliva should not be a problem.
    a. True
    b. False

23. After acid etching the tooth an appropriate amount of time the tooth surface should appear:
    1. Chalky
    2. Glossy
    3. Dull
    4. Frosty-white
    5. Matte
        a. 1 only
        b. 1, 2 and 3
        c. 1,3,4 and 5
        d. 2, 4 and 5
24. For optimal cured bonded brackets the curing-light tip is placed:
    a. Should contact the band/bonding material
    b. Should contact the bonding material
    c. 3-5 mm from the bonding material
    d. 1-2 mm from the bonding material
25. The curing light/shield characteristics include which of the following?
    1. Shield is surface disinfected after use
    2. Used to harden or cure dental materials
    3. Hardened material can remain on the tip with no adverse effects
    4. Hardened material must be removed from tip regularly
    5. During use the curing light should be protected with a plastic barrier
        a. 1, 2 and 4
        b. 1, 2, 4 and 5
        c. 1, 2, 3 and 4
26. Universal precautions must be used in all patient care, including the bonding of brackets. Under universal precautions, saliva of all patients is considered potentially infectious for:
    1. HIV
    2. HBV
    3. Other blood-borne pathogens
        a. 1 only
        b. 1 and 2
        c. 1, 2 and 3
        d. None of the above
27. One guideline for the use of protective masks include that they should be changed every third patient. Additionally, the mask should contact the mouth when worn.
    a. Both statements are false
    b. Both statements are true
    c. The first statement is true the second is false
    d. The first statement is false and the second is true
28. Face shields provide adequate eye protection. They also provide enough protection so that a mask need not be worn.
    a. The first statement is true the second is false
    b. The first statement is false and the second is true
    c. Both statements are false
    d. Both statements are true
29. When bonding material is placed it should be:
    1. Handled carefully and prepared according to manufacturer's directions
    2. Material is evenly applied without air bubbles/voids
    3. Polymerization time is carefully monitored
    4. Confined to the entire facial/buccal surface of the tooth
        a. 1, 2 and 4
        b. 1, 2 and 3
        c. 1, 2, 3 and 4
        d. 1, 3 and 4
        e. 2, 3 and 4
30. What type of gloves should be worn when opening drawers during dental procedures?
    a. Sterile gloves
    b. Utility gloves
    c. Over-gloves
    d. Powder-free latex gloves
31. An example of PPE is:
    a. Dental dam
    b. Gloves
    c. Suction tip
    d. Patient bib

32. When bonding brackets to porcelain the surface is prepared in the following way:
    1. Removal of glaze
    2. Pumice surface
    3. Use of 10% Hydrofluoric acid
    4. Micro-etch
    5. Porcelain primer
        a. 1, 2, 3 and 5
        b. 1, 2 and 3
        c. 1, 3 and 4
        d. 1, 3 and 5
33. Self-etching primers are designed to streamline the bonding steps. Self-etching primers combine the etching and bonding materials in a single solution.
    a. The first statement is true the second is false
    b. The first statement is false and the second is true.
    c. Both statements are false
    d. Both statements are true
34. Contaminated waste is waste that has been in contact with blood or other body fluids:
    a. Appropriate PPE should be worn while handling
    b. Includes used barriers and patient napkins
    c. a and b
35. When should utility gloves be worn?
    a. While taking out the trash
    b. While disinfecting the treatment area
    c. While preparing instruments for sterilization
    d. b and c
36. Gold crowns require special preparation to bond brackets to them. First the surface must be prepared by the orthodontic assistant with a carbide or diamond bur or micro-etcher.
    a. The first statement is true the second is false
    b. The first statement is false and the second is true
    c. Both statements are false
    d. Both statements are true
37. The appropriate steps in order for gold crown preparation include:
    a. Pumice, bur prep, metal primer, bonding paste
    b. Micro-etch or bur prep, metal primer, bonding agent, bonding paste
    c. Micro-etch or bur prep, bonding paste
38. Hyper-mineralized teeth have an excessive layer on the enamel due to:
    1. Tooth is located near the salivary gland ducts
    2. Etching time remains the same
    3. Using hydrofluoric acid etching time must be increased
    4. Using phosphoric acid etching time should be at least 60 seconds
        a. 1 and 4
        b. 1 and 2
        c. 1 and 3
39. For patient protection during the etching process the location of the etchant should be monitored at all times. If the etchant comes in contact with oral soft tissue it can cause injury.
    a. The first statement is false and the second is true
    b. Both statements are false
    c. Both statements are true
    d. The first statement is true and the second is false
40. If the etchant comes in contact with the oral soft tissue the tissue should be rinsed for:
    a. 1-2 minutes
    b. 5 minutes
    c. 10 minutes
    d. 15 minutes
41. Additional measures for the patient's protection includes the use of safety glasses to avoid eye exposure.
    a. True
    b. False
    c. The patient doesn't need to wear glasses but should know where the eye wash station is located and know how to operate it.

42. Isolation should include all of the following except:
    1. Protection of soft and hard tissues
    2. Prevention of moisture contamination
    3. Cotton rolls should be effective for all patients in the retraction of cheeks and lips
    4. Select the cotton roll lengths that will best fit and remain in the vestibule
    5. Dry angles/dri-aids can assist with moisture control from Wharton's ducts

    a. 5, 3 and 2

    b. 5 and 3

    c. 5, 4, 3 and 2

    d. 5, 3 and 1

43. Cheek retractors are available to aid in retraction of the cheeks and lips. Tongue guards and saliva ejectors also provide additional moisture control.

    a. The first statement is true the second is false

    b. The first statement is false and the second is true

    c. Both statements are false

    d. Both statements are true

44. Occasionally despite following procedures an etched and dried enamel surface may become contaminated by saliva prior to placement of the bonding agent. If this occurs the next step would be:

    a. Bond and continue with procedure

    b. Etch the surface again; etching for 30 seconds

    c. Contamination must be corrected, etch for 10-15 seconds

    d. Clean the enamel surface with pumice, etch for 15 seconds and continue with procedure

45. OSHA is the federal regulatory agency that ensures the safety and health of America's workers.

    a. True

    b. False

46. Hazardous chemical is defined as any chemical that can cause a physical or a health hazard.

    a. True

    b. False

47. Primary enamel structure is organized, as is the enamel of the permanent adult tooth. The primary enamel requires the same amount of time for etching to provide adequate bond strength.

    a. The first statement is true the second is false

    b. The first statement is false and the second is true

    c. Both statements are false

    d. Both statements are true

48. At the end of the rinse cycle (after etching) before air-drying the teeth and the oral cavity should be inspected for residual etchant material. Removing the etchant at this time can eliminate prolonged contact and subsequent chemical irritation.

    a. Both statements are false

    b. Both statements are true

    c. The first statement is true the second is false

    d. The first statement is false and the second is true

49. The following is/are true regarding hand washing:
    1. Hands are washed prior to glove placement
    2. Hands are washed immediately after glove removal
    3. Liquid soap should be used
    4. Bar soap may be used
    5. Hands should be completely dry before placement of gloves.

    a. 1, 2, 3, 4 and 5

    b. 1, 2 and 5

    c. 1, 2, 3 and 5

    d. 1, 2, 4 and 5

50. Etchant material has potential health effects to the skin, upon ingestion or inhalation. Repeated contact to the skin may lead to burns and rashes.

    a. Both statements are false

    b. Both statements are true

    c. The first statement is true the second is false

    d. The first statement is false and the second is true

# Written Examination Answer Key

1. d
2. a
3. a
4. a
5. b
6. b
7. a
8. b
9. b
10. c
11. b
12. a
13. d
14. b
15. d
16. c
17. d
18. d
19. c
20. e
21. b
22. b
23. c
24. d
25 b
26. c
27. a
28. a
29. b
30. c
31 b
32. d
33. d
34. c
35 d
36. a
37. b
38. a
39. c
40. d
41. a
42. b
43. d
44. c
45. a
46. a
47. d
48. b
49. c
50. b

# Module 5

## Bracket Placement & Removal

*By: Greg Nachaljian*

**PERFORMANCE OBJECTIVES**

**After completing the following areas of didactic, laboratory and clinical instruction in preparing teeth for bonding, the student will be able to:**

1. Understand the concepts of bracket design
2. Describe the key concepts of bracket placement on teeth
3. Know the different materials used for bonding brackets to teeth
4. Describe the steps for placing and curing brackets on teeth
5. Describe the proper technique for placing bonding material on a bracket base
6. Describe the armamentarium and steps involved in bracket placement
7. Describe direct bonding and indirect bonding and their differences
8. Know the instrumentation and steps in removing brackets from teeth

**On typodont teeth and patients, the student will be able to:**

1. Assemble appropriate armamentaria for bracket placement, curing and removal
2. Confirm the type of bracket to be used
3. Verify teeth that will receive brackets
4. Prevent contamination of the bracket base by not touching it with hands or gloves
5. Identify the properly positioned bracket
6. Orient the bracket to four different dimensions: vertical, horizontal, tip, and torque
7. Choose bonding material
8. Follow application techniques and curing times
9. Place and cure brackets by quadrant
10. Evaluate product using ideal criteria with 75% accuracy
11. Provide appropriate patient education
12. Maintain appropriate infection control throughout all procedures

# Outline

**DIDACTIC SESSION**

***4 Hours***

1. Bracket Design and Bracket-Archwire Interaction
2. Bracket Placement Criteria
3. Bonding Material Characteristics, Application Techniques and Curing Time Factors
4. Armamentaria for Bracket Placement
5. Procedures for Direct Bracket Bonding with Different Materials
6. Rationale for Indirect Bracket Bonding
7. Armamentaria for Indirect Bracket Placement
8. Procedure for Indirect Bracket Bonding
9. Bracket Removal Considerations
10. Armamentaria for Bracket Removal
11. Procedures for Bracket or Tube Removal

**LABORATORY SESSION 1**

***2 Hours***

During this session, students will practice the selection, preparation of brackets, etching, prepositioning, final positioning by orthodontist and bracket removal on typodont teeth. Students will work with a partner during the process of these procedures; the assisting student will observe each state of the process for evaluation. Students will load brackets and position on a minimum of four anterior and four posterior typodont teeth, with one of each of the four times used for a practical exam.

**LABORATORY SESSION 2**

***2 Hours***

Laboratory practice on typodont teeth continues, but now for specialized techniques for direct and indirect bonding with review of considerations for products used for bonding atypical enamel, porcelain, plastic, gold etc. and practice protocol for contaminated teeth. Students working in pairs will select, etch and place orthodontic brackets followed by inspection by the orthodontist and then bracket removal. Students will practice applications on a minimum of four typodont teeth for each assigned tooth material to include enamel, porcelain, and plastic tooth materials with one serving as a practical examination.

**WRITTEN FINAL EXAMINATION**

***1 Hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

**CLINICAL INSTRUCTION**

***4 Hours***

During this session, the instructor will demonstrate the sequence of tooth preparation for bonding on active patients. Student experience on active patients will include bracket bonding on four anterior and four posterior teeth a minimum of four times each, with one of each of the four times used for a practical exam and removal of brackets on four anterior and four posterior teeth a minimum of four times each, with one of each of the four times used for a practical exam.

# Didactic Material

**BRACKET PLACEMENT & REMOVAL**

This module will educate you on the concepts of placing orthodontic brackets on teeth (Figure 1), curing them and removing them from the teeth. Upon completion, you will understand and effectively demonstrate the sequence of s teps, patient management, and the different materials used to effectively accomplish these tasks.

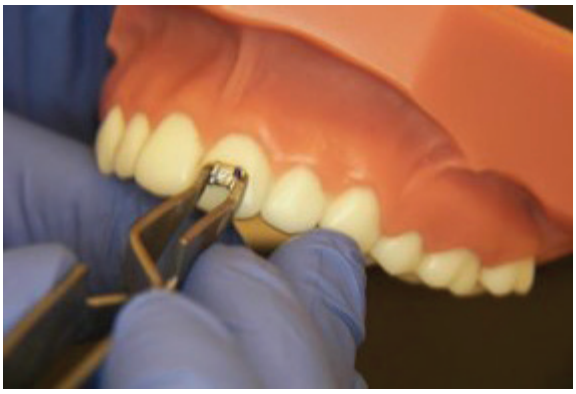
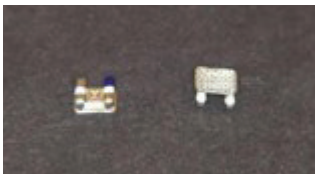


*Figure 1*

Successful bracket placement and removal techniques are essential in orthodontics and are very important skills for every orthodontic assistant. A valued and effective assistant is knowledgeable in the concepts related to bracket design, bonding material science, bracket placement on all teeth, and removal and cleanup of brackets when treatment is complete. The goal of bracket placement is to facilitate optimal tooth movement during the active part of orthodontic treatment. Well placed brackets facilitate the required movements in the most efficient manner possible. Misplaced or broken brackets lead to clinical inefficiency and repair visits, which interrupt the schedule as well as inconvenience the patients and parents. With a thorough understanding of bracket placement and removal you will avoid the pitfalls that lead to problems.

**Bracket Design and Bracket-Archwire interaction**

Proper occlusion of the teeth is developed by use of brackets attached to the teeth and connected to archwires which deliver force to the brackets to move the teeth into their optimal positions.



*Figures 2 and 3: Typical Metal Bracket Designs and Features*

A typical bracket (Figure 2) has as its base a pad, which aids the attachment of the bracket to the tooth. The rest of the bracket works as an attachment for the archwire and other auxiliary appliances used in tooth movement.

The pad is typically a rhomboid shaped piece of metal contoured to match the shape of the tooth surface where it attaches. The tooth side of the pad is usually an irregular surface designed to create a mechanical attachment to the material that is used to bond the bracket to the tooth. In most cases, there is a metal mesh welded to the back of the

pad which provides this mechanical attachment. The mesh is essentially a fine grid of wires (typically an 80 gauge mesh) with spaces between the wires to form wells for the bonding material to flow into and allow the bonding material to lock into undercuts in the mesh. The mesh is designed to increase the attachment strength of the bond to help the bracket stay attached during orthodontic treatment. Brackets that are manufactured using a metal injection molding process (the entire bracket is one solid piece), will have protrusions on the tooth side of the pad that are designed to increase the bond strength of the bracket. Brackets made of different materials (plastic, porcelain) will have mechanical features on the bracket base to improve attachment strength.

There are literally hundreds of bracket designs on the market. Most orthodontists use a variation of the straight wire edgewise technique to achieve the desired inter-arch and intra-arch relationships. The edgewise system uses brackets custom designed for each individual tooth. These brackets are generally shaped like the letter "H" (Figure 3) and have wings that protrude vertically both occlusal and gingival which provide a means for attachments to be placed to the bracket. There is a horizontal rectangular slot passing through the bracket.

Archwires, (Figure 4) round, square or rectangular in cross section, are used to move the teeth toward ideal positions. The archwire seats into the bracket slot and is held in place by a number of different methods. The act of connecting the archwire to the bracket is known as ligation. This ligation can be accomplished by stretching an elastomeric module over the wings of the bracket or by tying a small diameter soft steel wire ligature around the wings. In some "self-ligating" bracket designs (Figure 2), the ligation is accomplished by shifting a moveable portion of the bracket into position to hold the wire to the bracket. It is important that the clinical assistant be well trained in all ligation techniques used in orthodontics as all are used regularly in clinical practice for different reasons.

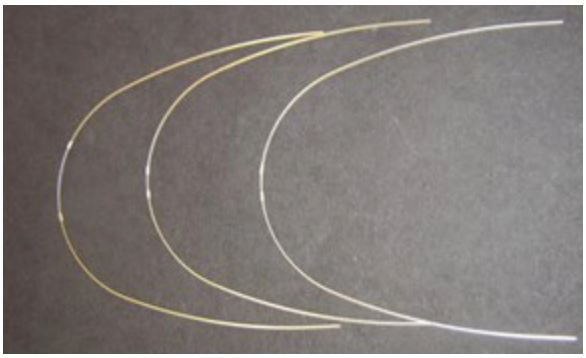


*Figure 4*

The wire-to-bracket relationship is the key interface of the system. In the straight wire technique, the archwire slot is cut into the brackets in such a way that a flat semi-circular wire with a rectangular cross section would help guide the teeth into their correct positions. Ideally, an archwire with a rectangular cross-section similar in size to the bracket slot, with a correct arch form would fit fully seated in all brackets and influence the teeth to achieve their proper relationships to one another and the opposing arch of teeth. For this system to work as planned, each bracket must be correctly placed on the surface of each tooth.

**Bracket Placement**

The goal of correct placement of the orthodontic brackets (Figure 5) on teeth is to aid the movement of the teeth to achieve the intended treatment results. Orthodontic treatment goals include maximum function, stability and esthetics, which are dependent upon developing the proper tooth relationship.

A bracket that is incorrectly positioned will result in a tooth that is not positioned correctly. There are two solutions to this problem: reposition the bracket to a more ideal position or make a compensating bend in the archwire.

If the bracket position is corrected, a flat archwire will guide the tooth toward its ideal position. If a compensating bend is placed, every following archwire will require the same compensating bend. This can require a great deal of the doctor's time at the chair, especially if multiple bends need to be made. Therefore, brackets placed correctly help treatment visits and overall treatment go faster. However, in every case, compensating bends will need to be placed to finalize the tooth positions.

*Figure 5*

Every bracket must be properly oriented to the tooth in four different dimensions:

- Vertical – the occlusal/gingival position
- Horizontal – the mesial/distal position
- Tip – the mesial/distal tilt of the bracket
- Torque – the facial/lingual tilt of the bracket

As we've mentioned there are many different bracket designs made by many different manufacturers. Each bracket "system" is unique. Each has specific requirements for bracket placement. The following bracket placement instructions are general rules that are shared by many of the brackets currently in use in orthodontics. It is important to understand that there are differences between bracket systems and that there is no truly ideal bracket or wire system. Please make sure you completely understand the nuances of the system you are using and apply the bracket positioning "rules" specific to that system.

***Vertical***

The vertical location of a bracket is determined by the bracket brand, type and tooth it is placed upon. Perhaps the largest determinant is the doctor's personal preference. For an ideal tooth without wear or damage, the typical location is roughly centered occlusal-gingivally. Upper central incisors are typically placed .5 mm more gingivally than upper laterals, and cuspids are generally.5 mm to 1.0 mm more gingival than the laterals as well for proper position and function. This places the lateral incisal edge slightly shorter than the central and cuspid to avoid collision with the lower incisors during lateral jaw movements. The height of the bracket slot as measured from the incisal edge is referred to as the "k-distance". There are k-distance gauges available which measure the distance in .5 mm increments to aid the bracket placement.

For buccal segment teeth, it is often helpful to look at adjacent teeth and their marginal ridge location for clues to proper height of the bracket. It is a goal to get the marginal ridges aligned at the same height.

It is important to analyze both dental arches prior to placing the brackets. Variations of tooth form such as a chipped or worn tooth, a short restoration, an atypically shaped tooth or a tooth covered on the facial surface by excessive gingiva will present local problems that must be accounted for. Planned adjunctive procedures such as crown lengthening or restorative care will modify the desired vertical position of the bracket. For the lower arch, it is common that the upper teeth will bite onto the lower braces. This potential for occlusal interference is a significant concern. The doctor will prescribe the need for a bite opening auxiliary device as well as specific instructions regarding bracket placement. In some cases, it may be necessary to leave a particular bracket off until the bite has changed enough to place the bracket without the upper teeth biting onto it.

***Horizontal***

The bracket should generally be placed in the center of the tooth mesio-distally. If the teeth are crowded, this position can be difficult to achieve. In many cases it is necessary to place the bracket in a less than ideal position, with the knowledge that at some time later in the treatment, the bracket will be repositioned to achieve its optimal position. Always view the bracket position from multiple directions to ensure the bracket is well placed.

***Tip***

Placing the bracket with the proper tip or angulation is often a significant challenge. The goal is to line up the bracket with the long axis of the tooth crown and root. To do so, you must envision the position of the root as well as the crown. Referring to the full mouth x-ray or panoramic x-ray is useful. Orthodontists note where a tooth's incisal edge or biting surface is worn, as this can alter the perceived bracket position.

***Torque***

Most torque considerations are built into the archwire slot of the bracket. However, if the contour of the pad does not match the contour of the tooth in an occlusal-gingival direction, a decision needs to be made whether to seat the pad closer to the tooth at the gingival or at the occlusal. This is more significant when the bracket is being placed on a restoration which may have very different contours than the original unrestored tooth. Often compensatory archwire bends are necessary where tooth shapes differ to match the adjacent unrestored teeth.

**Bonding Material Characteristics, Application Techniques & Curing Time Factors**

There are numerous bracket adhesives with different characteristics which provide the clinician with choices when attaching brackets to teeth. We will review several different bonding materials and their uses, and explain the differences in use, application and handling. Most of the following discussion will focus on composite materials and their use for attaching brackets to teeth.

***Composite Material Characteristics***

All composites have bonds that are primarily micromechanical in nature. Micromechanical bonds are the strongest attainable bonds to tooth structure, whereas chemical bonds are typically weaker. Clinical success relative to each bonding method is clearly dependent on the choice of appropriate resin material and on the proper manipulative technique involved in the use of the material. Composite materials consist of two major components, namely, the resin binding matrix and the inorganic fillers.

The resin binding matrix used in most composites is bisphenol A-Glycidyl methacrylate (Bis- GMA). Composites differ mainly in their inorganic filler component. Common filler materials include colloidal silica, ceramic, Kevlar, mica and other glass-ceramic materials. The type of filler, the size of the particles and the amount of filler used determine the clinical performance of a particular composite material. In general, small sized fillers are more polishable and lead to a smoother surface, while increasing the amount of filler is associated with a stronger, more fracture-resistant material.

***Hardening Process***

There are two primary types of composite bonding materials most commonly used for bracket bonding to teeth. Self-cured composites are materials that once prepared will harden by themselves given enough time. Light-cured composites require the use of a bright light of a specific wavelength, to catalyze the reaction that cures the material. There are other materials that cure utilizing heat or materials that are quite different in their chemical composition (e.g.: glass ionomer cement and hybrids). We will focus our attention primarily on the two most common categories: self-cure and light-cure composite adhesives.

***Self-Cured Composites***

The self-curing mechanism involves the interaction between a catalyst paste (benzoyl peroxide) and an accelerator paste (tertiary aromatic amine) to create free radicals. The free radicals free the unsaturated carbon bonds in the methacrylate groupings to provide an activated or receptive site for bonding with other activated groups. Polymerization into molecular chains continues until it is fully cured. This polymerization achieves approximately ninety percent of its strength in about two minutes, and it takes up to 24 hours to achieve a complete cure. It is critical that you wait up to 5 minutes after bonding before attaching the archwire, as the wire force may dislodge the bracket if it has not finished curing.

Most self-cured composites (Figure 6) are comprised of two separate containers with different pastes (paste A and paste B) which, when mixed together in equal portions, catalyze the reaction to begin the hardening process. Curing time is determined by the composition of materials, though curing times can be extended significantly by mixing the materials on a cold slab, which slows the chemical reaction. Some self-cured composites have a single paste that is activated by a liquid catalyst.

*Figure 6*

Material strength of self-cured composite is affected by a number of process-related problems. Unequal portions mixed together will reduce the bond strength. Poorly mixing the two pastes also can reduce the bond strength. If the doctor takes too long to finalize the position of the bracket on the tooth beyond the time when the polymerization has begun (approx 20-40 seconds), the bond strength will be reduced. Finally, contaminants on the mixing surface may also affect bond strength. It is imperative that excellent technique be used to get the highest bond strength possible.

***Light-Cured Composites***

Light-cured composites (Figure 7) require a different initiator to catalyze the reaction that hardens the material. The mechanism involves the same generation of free radicals, but instead of a chemical source of energy, the photon energy from lamps act on a photosensitive chemical ether mixed into the composite resin. The amount of time required for a complete cure, the type of light used and the wavelength of the light needed for activation vary by material and determine the cure time.

*Figure 7*

Light-cured composites are hardened by exposing them to a curing light (Figure 8) of 430-490nm wavelength. Curing lights may be halogen, light emitting diode (LED), plasma arc or laser, and have intensities greater than 1000mw/sq cm. Typically the light is placed as close as possible to the bracket to initiate the curing process. In most cases, the light must be directed from the occlusal, gingival, mesial or distal directions, as the bracket is opaque and will not transmit light. It is important to place the light as close as possible to the tooth. *The intensity of the light drops off dramatically as it moves further from the composite to be cured.* At 1mm away from the bracket 15% curing intensity loss occurs and at 2mm up to 60% loss can occur.

*Figure 8*

Light-cure units must be checked regularly. The life of the average halogen bulb is 20 hours. Care must be taken to protect the patient's eyes from the bright light used to cure this material. For safety, patients are given glasses with orange lenses to absorb the very bright blue light most often used to cure these materials, making it safe to look at the light.

There are three significant advantages light-cured composites have over self-cured composites for bonding orthodontic brackets. First, the material has a much longer working time before polymerization. In a controlled environment, the doctor should have nearly unlimited time to place and adjust the bracket position. Once the bracket position is finalized, the light is applied and the position fixed. Second, since there is a single paste, there are no mixing-related problems. Typically, the material is expressed right out of a dispenser onto the bracket base mesh to minimize potential contaminants. Finally, the material is fully cured after light exposure so there is no need to wait before engaging the wire.

***Glass Ionomer Cements***

Glass ionomer cements (Figure 9 ) usually are comprised of a powder and a liquid that when mixed form the cement. The powder is principally an aluminosilicate glass powder with fluoride flux. The liquid is polyacrylic acid. When the powder and liquid are mixed, a calcium polycarboxylate gel is formed, and this provides the initial chemical bond to tooth structure by means of reactive carboxyl groups. Within 24 hours, an aluminium polycarboxylate gel forms, and this provides a stronger physicochemical bond to tooth structure. The bond does not reach its highest strength for 24 hours.

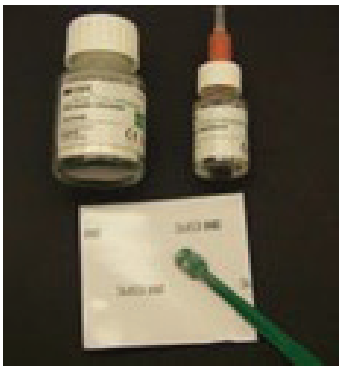


*Figure 9*

The glass ionomer cements have a few clinical advantages. First, they chemically bond to dentin, cementum and enamel with a high degree of reliability. Second, the glass ionomer cements are anticariogenic since they have an inherent built-in slow fluoride release mechanism. Finally, glass ionomer cements are micromechanically bondable to composite materials and metals. Generally, the bond strength of glass-ionomer cements is lower than composites, a significant drawback. Also, since this material forms a chemical bond with the tooth surface, clean-up after bracket removal is more difficult than composites.

***Light-Cured Ionomer Cements***

Since glass ionomer cements bond well with composite resins, a hybrid material composed of both materials has been developed. Light-cured ionomer cements demonstrate all of the advantages of the self-cured systems and few if any disadvantages. The light-cured ionomers set in similar times to light-cured composite materials. The hybrid materials provide the strength of the composite materials with the ability to adhere to metals and enamel as well as the fluoride release of the glass ionomer cements.

***Application Techniques***

When applying composite to the bracket during the bonding process, it is necessary to firmly express or press the material into the mesh or mechanical retention of the bracket base. This is often referred to as a "buttering" of the composite onto the bracket base utilizing the composite instrument. This step pushes the composite into the mechanical retention of the bracket base to maximize the composite-to-bracket adhesion.

Similarly, when the bracket is applied to the tooth, once the doctor is satisfied with the bracket position, the bracket must be pressed firmly onto the tooth surface to express excess material from under the bracket base, and to prevent voids underneath the bracket base where food or bacteria could enter and create the potential for decalcification or caries.

***Variations for Different Bonding Surfaces***

It is common that the tooth surface that is to receive the bracket has been previously restored with one of several different dental materials. This requires the orthodontist have the ability to bond brackets to enamel, composite restorations, different types of porcelains and several types of metal (amalgam, gold, stainless steel). Each of these surfaces requires a specific preparation technique, and often the addition of chemical bonding agents to enhance the bond strength to these materials. Please refer to the module on bonding for more information about this topic.

**Armamentarium for Direct Bracket Placement**

A list of typical materials and instruments is included. Different offices will vary their procedures and subtract or add instruments and materials they find helpful in successful bonding. Since brackets are placed immediately after preparing the teeth for bonding, the same instruments and set up are used. This module assumes the teeth have been adequately cleaned, etched and sealed as covered in the bonding module.

Bonding Set-up: See Armamentaria in bonding module.

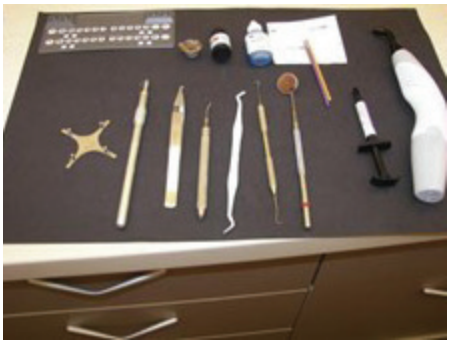


*Figure 10*

a. Specific orthodontic brackets for that patient arranged in order on a bracket organizer card
b. Bracket placement pliers (posterior and anterior)
c. K-distance gauge
d. Bonding material and dispenser
e. Plastic mixing instrument (spatula)
f. Mixing pad (with or without frozen slab)
g. Scaler
h. Explorer
i. Mouth mirror
j. Cotton pliers
k. Curing light

**Procedures for Direct Bracket Bonding with Different Materials**

***Direct Bonding – Light Cure Method***

Type: Light-cured composite (e.g.: Transbond, Lightbond)

Proper bonding techniques are critical to the success of the case. Preparation, isolation and follow through all play an important part in achieving a strong bond between the bracket and the tooth. Direct bonding is a very technique sensitive procedure, so it is important to follow instructions precisely.

Understanding Light Cure: Dispensed sealant and paste should **not** be exposed to direct light for any extended period of time as partial activation may occur, compromising bond strength. Apply adhesive to bracket immediately before using or completely shield from light. The intensity of curing lights may vary. Some lower intensity lights may require a longer activation of the paste. The bulb should be checked regularly for proper intensity. Follow instructions from the manufacturer.

Preliminary Instructions to Patient: "Today I will be placing the brackets on your teeth. (Show the patient the type of brackets they will be getting. This is also an opportunity to double check to make sure they are receiving the appropriate brackets.) None of what we will do today will hurt, yet it will feel different. First, we polish your teeth, and during bracket placement we must keep everything dry so the braces will stick. I will explain what I am doing as we go along. Do you have any questions before we get started?"

Set Up: Bonding set-up, bracket set-up (should be customized for each patient prior to the appointment), cheek retractors, adhesive, brackets, light cure unit (see Armamentaria above)

Procedure:

1. Confirm the type of braces the patient is receiving. Check the treatment notes to verify which teeth to bond. Set up the patient's brackets on a bracket holding card. *Make sure not to touch the bracket base with hands or gloves to avoid contamination.*
2. Have patient put on safety glasses.
3. Follow the procedures for preparing teeth for bonding outlined in the bonding module.
4. Teeth are usually sealed by quadrant, and then brackets are placed and cured in that quadrant before moving to the next quadrant. Throughout the procedure, do everything possible to prevent contamination of the bonding surface prior to bracket placement. Follow the recommendations in the bonding module if contamination does occur. After sealant is placed and cured (if necessary) you are ready to place brackets on the teeth.
5. Pick up the bracket with the bracket holding instrument.
6. With a plastic spatula, express a thin layer of adhesive onto the bracket base and press into the mesh. Pass to doctor in the following order: lower right molars then bicuspids, lower left molars then bicuspids, lower anterior brackets starting with lower right canine and progressing from right to left. Repeat for upper teeth in same order. Announce the bracket location as you pass the bracket. Do not use fingers or gloves to pat down the adhesive. Do not leave light cure material exposed to light.
7. Doctor will use the bracket holder to initially place and then press the bracket firmly onto the tooth, and then use the mirror and scaler or explorer to position the bracket ideally. Excess bonding material will be removed from the tooth. Have a 2X2 gauze square in your hand and use it to wipe the excess bonding material from the scaler for the doctor before proceeding to the next tooth.
8. Pass the doctor the light and cure for 3-5 seconds to fix the bracket to the tooth before moving to the next tooth. Alternatively, if you have good access to the tooth, place the light tip near the bracket and cure it yourself. Be careful not to touch the light cure tip to the bracket yet get as close as possible.
9. Repeat steps 5-8 for each tooth.

10. Before doctor leaves the chair, confirm with doctor what size archwire to place.
11. Go back to finish curing every bracket. Light cure 20 seconds total per tooth: 10 seconds mesial, 10 seconds distal. For the posterior, add 10 seconds occlusal/incisal. Clear brackets require only 10 seconds directly on the labial of the bracket. Different light cure units require different amounts of time. Make sure you are familiar with the specific light unit you will be using and follow the manufacturers recommendations.
12. Remove the cheek retractors and rinse the oral cavity thoroughly. Explain that the taste will go away in a short time.
13. Have the patient gently bite his/her teeth together to determine that the teeth are not occluding on any brackets. If so, notify doctor for further instructions.
14. Show the patient their new brackets.
15. Place and ligate the archwire to the brackets.
16. Give patient instructions to both patient and parent.
17. Confirm that today's procedure and next visit is noted on treatment card.
18. Plan to make a follow-up "Care Call" to the patient within 24 hours to find out how they are doing and to give support.

The following variations are typical for the different materials used in bonding brackets to teeth. Explain to the patient the steps that will occur throughout the procedure.

***Direct Bonding – Two Paste Self-Cure Method***

Type: A & B – Two paste plus sealant fluoride bonding system (e.g.: Concise, Phase 2)

Directions: follow initial instructions under
Direct Bonding-Light Cure Method

1. Pumice, etch, rinse and dry teeth.
2. Mix A & B sealant for 5-10 seconds and place a thin layer of sealant on tooth with a bonding brush.
3. Dispense onto a mixing pad equal numbers of small portions of A & B paste, enough for all of the teeth you are to bond (typically 24 teeth if bonding upper and lower first molars forward, or 28 teeth if bonding second molars forward).
4. For each tooth, mix equal parts of A & B paste on a pad for 10 seconds by working the two pastes into each other with a plastic instrument on the mixing pad.
5. Beginning with the upper right 2nd molar tooth, place the bracket onto the posterior bracket holder, and press the bonding material into the mesh pad of bracket. (A 1 to 1 mix ratio produces a 2-minute working time from the start of the mix. Mixing on a paper covered frozen slab may extend the set time to 4 1/2 minutes). Do not use fingers or gloves to pat down the material on the bracket base.
6. Hand the bracket to the doctor.
7. Pass the mirror and scaler to the doctor.
8. Doctor will place the bracket and clean excess adhesive with the scaler.
9. While the doctor is working, mix and place composite on the first molar pad and repeat the process. Always anticipate the next step and be prepared.
10. Once all of the brackets have been placed, wait two minutes after the last bracket has been placed then rinse the mouth and remove the check retractors.
11. Place archwire 5 minutes after last bracket is placed.

***Direct Bonding – Dual Cure Composite Method***

Type: Dual Cure (e.g.: Phase II Dual Cure)

Directions: follow initial instructions under
Direct Bonding-Light Cure Method

1. Pumice, etch, rinse and dry enamel.
2. Place a thin layer of Light Bond sealant on tooth and light cure for 10 seconds.
3. Mix equal parts of A & B paste on a pad for 10 seconds and press into mesh pad of bracket. (A 1 to 1 mix ratio produces a 4-minute working time from the start of the mix.) The mixed pasted should be shielded from intense direct light to prevent premature curing.
4. Light cure for 10 seconds from each side. Cure ceramic brackets for 15 seconds from the labial.
5. Repeat for other brackets.
6. An archwire can be placed immediately.

***Direct Bonding – No Mix Method***

Type: Self Cure single paste (e.g: Rely-A-Bond)

Directions: follow initial instructions under
Direct Bonding-Light Cure Method

1. Pumice, etch, rinse and dry enamel.
2. Place a thin coat of sealant on the bracket and the tooth, avoiding the gingival and interproximal area.
3. Make sure not to touch the bracket with hands or gloves. With a plastic spatula, press a thin layer of adhesive on bracket and pass to doctor
4. Doctor will press the bracket firmly onto the tooth surface and immediately clean excess adhesive. The bracket must be positioned within 20 seconds and held for 10 seconds.

5. Repeat for other brackets.
6. Wait 10 minutes before placing archwire.

**Rationale for Indirect Bonding**

An alternate method of placing brackets on a patient's teeth is known as indirect bonding. In this method, the brackets are first placed on a model of the patient's teeth (figure 11) following the same guidelines for placing brackets directly in the mouth. The brackets are then cured onto the model, and a tray is created which can be used to transfer the brackets from the model to the mouth (figure 12). The bonding material used to attach the brackets to the model creates a custom base for each bracket. A small amount of adhesive is added to each bracket base when placing the tray in the mouth to bond the bracket to the tooth. In this manner, all of the brackets in an arch can be placed simultaneously, greatly reducing the doctor's time at the chair. The bracket adhesive can be either light-cured or self-cured.

*Figures 11 and 12*

Advantages of the indirect method include:

- Potentially more ideal bracket placement as there is excellent visualization of each tooth from every direction
- Reduction of doctor's time at chairside
- Shortening of the initial bonding appointment for patient comfort

Disadvantages of the indirect method include:

- Limitations of placing brackets near the gingival. In the mouth, a bracket can be placed slightly below the gum line but that is not possible on a model
- Distortions in the model may introduce bracket bonding failure
- Laboratory preparation includes many steps that may introduce bracket failure or reduced bond strength (technique sensitive)

Much of the process of indirect bonding may be delegated to lab or clinical team members, freeing doctor time for seeing patients. Models used to place the brackets must be free of distortion and no tooth movement should be done prior to placing the trays. Doctor should confirm the final bracket placement prior to curing the bonding material. Care must be taken to assure the ease of bracket removal from the model and fabrication of the tray to assure easy placement in the mouth.

**Armamentaria for Indirect Bonding**

*Figures 14 ????? Figure 13 i s the same as Figure 12?*

Indirect Bonding Set-up:

a. Indirect bonding trays for that specific patient
b. Bonding material and dispenser
c. Plastic mixing instrument (spatula)
d. Mixing pad (with or without frozen slab)
e. Scaler
f. Explorer
g. Mouth mirror
h. Cotton pliers
i. Sal-Tropine
j. Curing light

The set-up for indirect bonding is similar to the direct bonding setup. Since the tray is used to place the brackets, there is no need for bracket holders. The composite used to bond the brackets is usually a flowable composite that bridges the gap between the composite base added to the bracket and the tooth surface. Also, it is very important to maintain a dry field. It is recommended that an anti-sialogogue agent be given to the patient an hour prior to the bonding appointment to temporarily reduce salivary flow. Before an anti-sialogogue is administered, the patient's health history must be checked. Asthma, glaucoma, adhesions in the eye, use of contact lenses, pregnant or nursing are examples of contraindications for this medication. Take 1-2 hours before appointment on an empty stomach.

**Procedure for Indirect Bonding**

If both arches are being bonded during the same visit, it is recommended to start with the maxillary arch. Tongue management and moisture control are easier and it allows time for the patient to relax before the lower is attempted.

Directions:

1. Pumice, etch, rinse and dry enamel.
2. Place a thin layer of sealant on tooth and light cure for 10 seconds.
3. Apply a thin layer of light-cured bonding material to the bracket bases on all teeth in the maxillary tray prior to placing it in the mouth.
4. Carefully place tray, positioning the lingual and occlusal first while holding the labial part of the tray away from the tooth. This prevents wiping the thin layer of bracket-side adhesive off the base before being seated. Use firm, even pressure while light curing.
5. Once fully cured do not remove tray, leave it on the teeth.
6. Proceed to the next arch and repeat procedure.
7. Once both arches are fully cured, remove trays by placing an explorer tip through the tray and against the bracket, simultaneously pulling the tray away just distal of that area. This helps to equalize the pressure and prevent accidental debonding.
8. Retain all bracket trays for entire treatment time. If a bracket becomes loose, the trays can be used to ensure accurate replacement of the bracket.

***Bracket Failure Rebonding Instructions***

Note: These instructions are designed for brackets using a custom resin base (indirect bonding technique)

1. If a bracket should fail at the initial bonding, lightly micro-etch custom base resin and remove any adhesive from tooth.
2. Cut that tooth section from the original tray, reposition bracket and clean with acetone.
3. Isolate, polish, acid etch and dry tooth surface.
4. Use light-cured bonding material to have the doctor re-bond that bracket to the tooth.

***Post Indirect Bonding Procedures***

After the trays are removed, immediately floss all contacts to check for sealant interproximally. Check occlusion with articulating paper to see if patient is biting on the laboratory adhesive or brackets. If so, remove excess with a carbide bur. Be sure to have doctor remove excess bonding material ("flash") from the teeth with a finishing bur in the high-speed handpiece.

**Bracket Removal Considerations**

When treatment is complete, the brackets must be removed from the teeth (Figure 15). It is important to use the utmost care when doing so, to protect the enamel surfaces from damage. Instruments used to remove the brackets and adhesive are sharp and can potentially damage the tooth enamel.

*Figure 15*

The goal of bracket removal is to return the surface of the tooth back to as natural as state as possible. All orthodontic materials must be fully removed, and the teeth cleaned and polished to restore their natural luster.

Removing the brackets and adhesive requires some force be applied to the tooth through the removal instruments. It is important to practice proper technique to minimize the forces and increase the patient comfort level during the procedure. Utilizing proper tools and techniques makes for a quick and relatively pain-free procedure.

**Armamentaria for Bracket Removal**

*Figures 16*

A list of typical materials and instruments is included. Different offices will vary their procedures and subtract or add materials they find helpful in successful bonding.

a. Prophy paste-pumice with fluoride
b. Prophy angle and slow-speed handpiece
c. High-speed drill with multi-fluted finishing bur, rubber point, green stone

d. High-speed evacuation and tip
e. Air water syringe and tip
f. Saliva ejector and tip
g. Mouth mirror
h. Scaler or explorer
i. Short and long cotton rolls
j. 2 x 2 gauze
k. Impression trays and material
l. Bracket removing plier
m. Band removing plier
n. Protective eyewear for the assistant and patient

**Procedure for Bracket or Tube Removal**

Preliminary Instructions to Patient: Share the patient's excitement for having their braces removed. "Congratulations, you are getting your braces off today! We will use special instruments to make things go as quickly and comfortably as possible. You should not expect much discomfort as we go along. Soon you can show off your beautiful new smile!" Explain the steps of bracket removal as you go along to keep the patient informed and help them understand what is happening.

Procedure:

1. Have patient checked by the doctor to confirm that the patient is ready to have the bands/brackets removed. Have the patient wear protective eyewear.
2. Leave archwires attached to brackets. Starting with the upper molar bonds, use the bracket removing plier and gently squeeze the bracket while rotating your wrist in an occlusal direction. It is important to support the lingual of the tooth with your finger to minimize pressure on the tooth. Loosen all brackets in an arch and remove together as a unit. Repeat for the lower arch.
3. If bands are present, remove them using the posterior band remover. The plastic tip is placed on the occlusal. Because of the anatomy of the teeth, it is easier and more comfortable for the patient if you loosen the lingual of the upper molars first then the buccal. On the lower, loosen the buccal first, then the lingual.
4. When removing cement, always establish a firm fulcrum and protect the hard and soft tissue. Always clean tooth toward the occlusal surface and away from the gingiva. Make sure gingival margins and interproximal areas are free from cement.
5. Remove as much adhesive as possible with the adhesive removing plier. The plastic tip is placed on the incisal edge. Starting gingival to the cement, remove the adhesive by scraping toward the incisal edge, being careful not to scratch the enamel. Rinse often and suction with high-speed evacuation.
6. Stubborn composite may be removed by the doctor with a high-speed handpiece using a multi-fluted finishing bur, followed by a rubber point to establish a high shine.
7. The doctor may choose to manicure the incisal edges for optimal esthetics utilizing the high-speed handpiece and a green stone bur.
8. Prophy the teeth to remove any residual material or staining on the surface of the teeth. Rinse often with high-speed evacuation tip.
9. Have the patient rinse and recheck all surfaces for any remaining pieces of cement or adhesive.
10. Give the patient a mirror and celebrate with them on their beautiful smile.
11. Write up treatment card.
12. Take impressions for retainers to maintain the tooth alignment.
13. Take final records, including intraoral and extraoral photos, panoramic x-ray and cephalometric x-ray, if indicated. Take impressions for final study models.

# Glossary

***bond failures –*** the arch-shaped metal wire used to move teeth

***bis-GMA –*** Short for bisphenol A-Glycidyl methacrylate, a resin and one of the two main components in most tooth adhesives

***bracket –*** the tooth attachment used to transfer the archwire force to the tooth in orthodontics

***curing –*** the process by which the adhesive bonding material between brackets and teeth is hardened. The two primary methods of curing are:

Self-Cure: a chemical reaction takes place without introduction of outside energy

Light-Cure: visible light energy is used to catalyze the hardening reaction

***bonding –*** the mechanism of attaching a bracket to a tooth using an adhesive. Two main types of bonding:

***direct bonding –*** placing the bracket/adhesive directly on the teeth

***indirect bonding –*** placing the bracket/adhesive on a model of the teeth and transferring the bracket to the teeth via a transfer tray

***debonding –*** process of removing brackets from teeth

***filler –*** a main component of composite adhesives that add strength and adjust flow characteristics of the material; fillers can be different sizes and materials

***glass ionomer –*** a non-composite adhesive that can be used for brackets which releases fluoride naturally

***k-distance –*** the distance to the bracket slot as measured from the incisal edge

***ligation –*** the act of connecting the archwire to the bracket with an elastomeric module or a fine steel wire ligature

***straight-wire edgewise archwire technique –*** the predominant technique for designing brackets such that a series of increasing sized, relatively flat wires will move teeth close to their final positions

***tip –*** the side-to-side tilt of the bracket on the tooth

***torque –*** the labial-lingual tilt of the bracket on the tooth

# Laboratory and Clinical Instruction

**LABORATORY SESSION 1**

***2 Hours***

During this session, students will practice selection, preparation of brackets, etching, prepositioning, final positioning by orthodontist, and bracket removal on typodont teeth.

**Laboratory Instructions**

Students will work with a partner during the process of these procedures. The assisting student will observe each stage of the process for evaluation. The following is a step-by-step description of the procedures that should be followed during the laboratory practice sessions:

1. Each student will set up his/her armamentaria for bonding and bracket placement.
2. Student will be provided with a typodont, a bench mount and four anterior and four posterior typodont teeth. In addition, the student will be provided with individualized packets that will include:
    a. Description of packet
    b. Bracket cements
    c. Bracket bonding instruments and supplies
3. Instructor will review procedures and present information on how to use the lab worksheet for selecting, etching, bracket positioning, bond curing and bracket removal.
4. Instructor will present criteria for ideal bracket cement loading, application techniques, and removal of orthodontic brackets. Instructor will demonstrate application techniques and provide ideal examples that will be passed around for viewing.
5. Student will load brackets and position on a minimum of four anterior and four posterior typodont teeth according to the following procedure:
    a. Select orthodontic brackets for each typodont tooth
    b. Perform coronal polish
    c. Isolate one quadrant
    d. Etch and prepare teeth for orthodontic bonding
    e. Load orthodontic brackets with bonding cement
    f. Preposition brackets on typodont teeth
    g. Orthodontist to check final positions of brackets
    h. Cure orthodontic brackets
    i. Evaluate product using ideal criteria
6. Perform bracket removal
    a. Set up appropriate armamentaria for debonding procedure
    b. Using appropriate technique, remove brackets from teeth starting with the posterior brackets and moving forward.
    c. Using composite removing plier, remove adhesive from the teeth
    d. Prophy and finish.
    e. Evaluate product using ideal criteria
7. One of each of the four times is used for a practical exam; partner observes, evaluates and records on worksheet. Student will also evaluate him/herself on the procedure. Instructor evaluates the bracket bonding techniques. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
8. Partners switch places, the operator becomes the assistant, and the assistant becomes the operator. Both students complete eight typodont teeth.
9. Instructor will now present product evaluation form and how it is used to evaluate final application of bonding materials, bracket placement techniques and the bonding process.
10. Using the product evaluation form, the student operator and the student assistant and instructor grade the application of bonding materials, bracket placement techniques and the bonding process for each other.
11. Discussion on product evaluation is conducted in small groups.

**LABORATORY SESSION 2**

***2 Hours***

During this session, students will practice selection, preparation of brackets, etching, prepositioning, final positioning by orthodontist, and bracket removal on typodont teeth.

**Laboratory Instructions**

Laboratory practice on typodont teeth continues but now for specialized techniques for direct and indirect bonding with review of considerations for products used for bonding atypical enamel, porcelain, plastic, gold etc. and practice protocol for contaminated teeth. Working with a partner, each student functions as an operator and selects, etches, and places orthodontic brackets followed by inspection by the orthodontist and then bracket removal. Student will then function as an assistant and observe and evaluate placement with partner.

**WRITTEN EXAMINATION**

***1 Hour***

**CLINICAL SESSION – MODULE 4 AND 5**

***4 Hours***

During this session, the instructor will demonstrate the sequence of tooth preparation for bonding on active patients (module 4) and the sequence of bracket positioning, bond curing and bracket removal on select patients (module 5).

The following procedures will be demonstrated:

**FROM MODULE 4**

1. Perform coronal polish
2. Isolate one quadrant and dry
3. Perform etchant application procedures
4. Suction etchant from tooth
5. Rinse and dry etched tooth/teeth
6. Apply primer/bonding material(s)
7. Cure material
8. Apply composite resin material
9. Cure composite resin material

**FROM MODULE 5**

10. Select brackets for specified teeth for bracket bonding
11. Load brackets with bonding cements
12. Preposition brackets on teeth
13. Cure brackets once position is verified by orthodontist
14. Remove brackets on selected patients

Student experience on active patients will include preparation for subsequent bracket bonding, bracket bonding and removal of brackets on four anterior and four posterior teeth a minimum of four times each, with one of each of the four times used for a practical exam.

The following general procedures will occur for each patient:

1. Operatory will be set up following the infection control guidelines.
2. Medical history will be completed by the patient prior to seating.
3. Equipment and supplies will be checked by student/operator.
4. The patient will be seated and prepared for treatment.
5. Student operator will review medical history and perform a patient assessment; instructor will follow-up with same procedures.
6. Patient is given instructions/explanation of procedures.
7. Student operator will perform the following according to the stated criteria: Somehow denote that a-j are from module 4 and k-o are from module 5
    a. Perform coronal polish
    b. Isolate one quadrant and dry
    c. Perform etchant application procedures
    d. Suction etchant from tooth.
    e. Rinse and dry etched tooth/teeth
    f. Apply primer/bonding material(s)
    g. Cure material
    h. Apply composite resin material
    i. Cure composite resin material
    j. Evaluate product using ideal criteria
    k. Select brackets for specified teeth for bracket bonding
    l. Load brackets with bonding cements
    m. Preposition brackets on teeth
    n. Cure brackets once position is verified by orthodontist
    o. Remove brackets on selected patients
    p. Give patient post-op instructions
    q. Dismiss patient
    r. Perform operatory clean-up according to infection control guidelines

After the student operator completes the sequence of procedures, the student operator, the assistant and the instructor will evaluate the performance of the student operator using the worksheet and product evaluation.

During this time period the following procedures will occur:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/assistant will assist, observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work/performance using stated criteria using the worksheet and product evaluation forms. Discussion on results will be conducted.

# Worksheets

**Students will complete study material for Module 4 (preparing teeth for bonding) and Module 5 (bracket placement) prior to proceeding with the laboratory section which will include instruction in the continuum of both procedures. See Module 4 for forms used with laboratory instruction for both modules.**

# Course Requirements

The following is an overview of the course requirements and the protocol followed for laboratory and clinical practice, the written and clinical examination.

**Minimum Number of Satisfactory Performances**

All students will perform at a minimum the following procedures in order to achieve minimum competence in the various protocols used in the preparation of teeth for bonding brackets:

On a typodont and patients, the student will perform the following under OSHA and DBC guidelines:

- On the typodont: Apply etchant and other appropriate materials preposition brackets, cure, and remove brackets on four anterior and four posterior typodont teeth a minimum of four times, with one of each of the four times used for a practical exam according to the specified criteria.
- On the patient: Apply etchant and other appropriate materials preposition brackets, cure, and remove brackets on four anterior and four posterior teeth a minimum of four times each on at least two patients according to the specified criteria with one of each of the four times used for a practical examination with 75% accuracy.

Students are required to meet the specified minimal number of satisfactory performances as indicated above. The student operator grades his/her own performance, the student assistant grades the performance of the student operator and the instructor will assess the student operator's performance and the grading method of both students.

When the student reaches the 75% minimum performance for bracket placement and removal and 100% performance on all infection control protocol, the instructor evaluates the procedure for the minimal number of satisfactory performances. If a student does not fulfill the minimum grade for the number of satisfactory performances additional laboratory and/or clinical practice procedures will be assigned.

**Objective Evaluation Criteria**

Objective evaluation criteria shall be provided to each student prior the performance of any procedure. The student will receive information provided by the instructor prior to performing any laboratory or clinical procedures. The instructor shall supply the student with general program, individualized cognitive and psychomotor objectives and criteria for evaluation. Objective criteria will be utilized in the performance of all laboratory and clinical requirements.

**Preparing and Prepositioning Brackets**

1. Will review the medical/dental history, make a general assessment, and oral inspection on each patient prior to treatment, checking for information that may contraindicate the performance of the procedure; Criteria for choosing specific materials for preparing surface for bonding brackets:
    a. Indications:
        i. Enamel
        ii. Gold
        iii. Porcelain
        iv. Amalgam
        v. Plastic/composite
    b. Contraindications:
        i. Tooth surface with caries
2. Will set up the required armamentaria for coronal polish, etchant and other bonding materials for subsequent bracket bonding
3. Will use aseptic techniques according to OSHA and DBC throughout performance on all patients.
4. Will place protective barriers, seat and position the patient
5. Will evaluate the teeth scheduled to for brackets
6. Will explain to patient the treatment planned for that day
7. Will perform coronal polish on the teeth, ensuring a completely cleaned surface
8. Will isolate, thoroughly clean and dry teeth, four anteriors and four posteriors prior to application of etchant and bonding agents for subsequent bonding brackets
9. Will select brackets specific to teeth treatment planned for bracket bonding
10. Will load bracket base with bonding cement in preparation for placement of brackets

**Bracket Loading Criteria**

1. Will apply bonding cement to mesh of brackets according to the manufacturer's directions covering the target area of the bracket, thoroughly working material into mesh, while avoiding excess amounts beyond areas of the bracket base
2. Will load bracket onto a bracket holder in preparation for placement on tooth

**Prepositioning Brackets on Teeth (with final position determined by orthodontist) Criteria**

1. Brackets will be placed by student on tooth in ideal vertical and horizontal position
2. Orthodontist will finalize bracket position and remove excess cement
3. Student will hold the curing light as close as possible without touching the bracket and will cure bracket form both mesial, distal, and occlusal for at least 20 seconds for a full cure
4. Care will be taken to avoid contact with bracket and possible alteration of final bracket position prior to curing
5. Student will vary curing times based on manufacturers recommendations for curing units and bonding cements to achieve complete polymerization
6. The isolation material will be removed.
7. If excess material is present, it will be removed with a hand instrument or an ultrasonic scaler.
8. Will evaluate bracket placement, cement integrity, and identify problem-solving methods to improve or modify procedures

**Bracket Removal Criteria**

1. Will prepare patient for bracket removal with instructions on what patient may experience during procedure
2. Will remove brackets with bracket removing pliers
3. Will support tooth to minimize patient discomfort while applying pliers pressure and occlusal rotation to remove bracket.

**General Criteria**

1. Will provide pertinent and individualized patient education
2. Will provide follow up appointment to evaluate bracket retention
3. Will meet ethical and legal requirements for this procedure
4. Will provide accurate chart entries for this procedure
5. Will utilize OSHA and DBC guidelines for instrument processing, removing waste and cleaning/disinfecting treatment area

The above criteria will be used to evaluate and assess appropriate use of materials with subsequent bracket placement with a minimum of 75% accuracy for laboratory and clinical patients.

**General Clinical Practice Protocol**

Students will have their first clinical practice by preparing four anterior and four posterior teeth a minimum of four times each, with one of each of the four times used for a clinical exam. They will also complete procedures on two clinical patients. The following general procedures will occur:

***Patient Selection Criteria***

The following criteria must apply for each patient:

1. Patient must be an active orthodontic patient
2. Patient must be in good health (medical history form will be completed prior to treatment, reviewed and approved by the instructor)
3. Each patient will have a minimum of four anteriors and four posteriors per arch for tooth preparation with subsequent bonding of brackets
4. Criteria for selected patients will apply for removal of brackets as these will likely be different patients considering the process of bracket bonding and r emoval in orthodontic treatment practices

The student will function as an operator, an assistant and a patient. Working as partners (operator and assistant) an operator will perform the procedure, the assistant will observe, and evaluate each step of the procedure. When complete each student will do the procedure, observe and evaluate.

The following general procedures will occur for each of the patients:

1. Operatory will be set up following the infection control guidelines
2. Medical history will be completed by the patient prior to seating
3. Equipment and supplies will be checked by the student
4. Patient will be seated and prepared for treatment
5. Student operator will review the medical history and perform a visual exam
6. The instructor will review the medical history and perform a visual exam
7. Instructor will accept the patient for preparation of teeth for subsequent bonding
8. Student operator will perform the following according to the stated criteria:

a. Perform coronal polish

b. Isolate and dry

c. Perform etchant application and procedure

d. Rinse and dry etched tooth/teeth

e. Employ additional bonding materials for specific needs

f. Cure bonding resin for subsequent bracket placement

g. Load and preposition brackets with final position determined by the orthodontist

h. Evaluate the product

i. Provide individualized patient education

j. Dismiss the patient

k. Make appropriate chart notes

l. Perform operatory clean-up/instrument processing according to infection control guidelines

After etchant and bonding for subsequent bracket bonding and removal procedures, the student operator, student assistant and the instructor complete evaluation using the worksheet and product evaluation form.

During this time period, the following will occur:

1. Student operator will evaluate his/her own work according to stated criteria using worksheet and product evaluation forms.
2. Student assistant will assist, observe, evaluate operator's performance according to stated criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work according to stated criteria using the worksheet and product evaluation forms. Results will be discussed.

A 75% must be obtained for passage of preparing teeth/ bonding brackets on a practice patient and a minimum of two clinical patients.

**General Examination Protocol**

***Written Examination***

A comprehensive written examination of 20 questions on the entire curriculum will be administered. The student must receive a minimum score of 75% on the examination to pass the class. One hour has been reserved for the written examination.

***Clinical Final Examination***

The clinical final examination occurs during the process of working on the two active orthodontic patients during the preparation of teeth for subsequent bonding, bracket placement and removal following patient selection criteria and procedures outlined in the module's clinical practice protocol.

# Written Examination

1. Brackets can be manufactured using composites, titanium, and stainless steel.
    a. True
    b. False
2. Bracket cements are composed of:
    a. Resin binding agents
    b. Water
    c. Inorganic fillers
    d. Tar
    e. a and b
    f. b and c
    g. a and c
    h. All of the above
3. Bracket cements polymerization is initiated with:
    a. A catalyst and accelerators
    b. Photons of light
    c. Heat
    d. Cold
    e. a and b
    f. b and c
    g. a, b and c
    h. a, b, c, and d
4. Light curing composites require the use of a curing unit that uses heat to polymerize the bonding cement.
    a. True
    b. False
5. Self-cured composites cure by initiation of a chemical reaction. This reaction hardens the material in minutes with up to 90% of the strength in the first 2 minutes.
    a. Both statements are false
    b. The first statement is true and the second statement is false
    c. The first statement is false the second statement is true
    d. Both statements are true
6. Brackets consist of the following components:
    a. Bracket base
    b. Retention mesh
    c. Band
    d. Bracket Slot
    e. Tie wings
    f. a, b and c
    g. b, c and d
    h. a, b, d and e
7. The bracket slot is where the archwire is placed.
    a. True
    b. False
8. Bonding cements can be placed on a mixing pad and left uncovered as these materials are only sensitive to high intensity lights.
    a. True
    b. False
9. Indirect bracket bonding is a technique used by al orthodontists. This method requires more time to place brackets then direct bonding.
    a. Both statements are false
    b. The first statement is true and the second statement is false
    c. The first statement is false the second statement is true
    d. Both statements are true
10. Indirect bonding has the following advantages:
    a. Reduced chairside time for the doctor
    b. Less laboratory time
    c. Shortened appointment for patient for initial bonding
    d. Potentially more accurate bracket positioning
    e. a, b and c
    f. a, c and d
    g. a, b, c and d

11. Indirect bonding has some disadvantages:
    a. More laboratory time with multiple steps to prepare bonding trays
    b. More chairside time for the doctor
    c. Distortions in the model may introduce bracket bonding failures
    d. a and b
    e. a and c
    f. a, b and c
12. Brackets are designed with a mesh material on the base. This material provides chemical retention of the bracket cement to the bracket.
    a. Both statements are false.
    b. The first statement is true and the second statement is false
    c. The first statement is false the second statement is true
    d. Both statements are true
13. The dental practice act allows dental assistants to utilize high speed burs and hand pieces to remove bracket cement.
    a. True
    b. False
14. The following instruments are routinely used for removal of orthodontic brackets:
    a. Pin cutters
    b. Bracket removing pliers
    c. Distal end cutters
    d. Band removing pliers
    e. a and b
    f. a and c
    g. c and d
15. When removing a full set of brackets, the archwires are always removed first.
    a. True
    b. False
16. Light cured bracket cements require 5 seconds for a full cure when using a conventional halogen curing light.
    a. True
    b. False
17. Ceramic brackets typically require longer curing times.
    a. True
    b. False
18. Brackets placement on the tooth is not critical as the wires are usually bent to place the tooth in the correct positions.
    a. True
    b. False
19. Self-ligating brackets were designed with a door or other mechanism to hold the archwire. Though these mechanisms are convenient for the assistant to close the components are susceptible to plaque buildup when compared to ligated brackets.
    a. Both statements are false
    b. The first statement is true and the second statement is false
    c. The first statement is false the second statement is true
    d. Both statements are true
20. Brackets provide the force in orthodontics that moves the teeth.
    a. True
    b. False

# Written Examination Answer Key

1. a
2. g
3. g
4. b
5. d
6. h
7. a
8. b
9. a
10. f
11. e
12. b
13. b
14. e
15. b
16. b
17. b
18. b
19. b
20. b

# Module 6

## Archwire Placement & Ligation

*By: Greg Adams*

**PERFORMANCE OBJECTIVES**

**After completing the following areas of didactic, laboratory and clinical instruction in the placement of archwires and ligation, the student will be able to:**

1. Describe the key concepts of archwire placement and ligation
2. Describe the different alloy types, shapes, sizes and increasing levels, forces used with archwire progression
3. Describe the different ligation systems
4. Describe the proper techniques for archwire placement and ligation
5. Describe the armamentarium and steps involved in archwire placement and ligation

**On typodont teeth and patients, the student will be able to:**

1. Assemble appropriate armamentaria for archwire placement and ligation
2. Identify and mark the midline of the archwire
3. Estimate the length of the wire prior to placement in mouth
4. Allow wire to rest buccal to the terminal bracket in the arch
5. Use distal end cutter to remove gross excess
6. Place the archwire using utility plier in the first molar tube or second if applicable
7. Confirm midline-ligate the wire to the brackets beginning from the tooth mesial to the first molar
8. Work around the arch until all teeth are secured
9. Cut excess wire length
10. Check archwire ensuring it is not too long or too short
11. Evaluate product using ideal criteria with 75% accuracy
12. Provide appropriate patient education
13. Maintain appropriate infection control throughout all procedures

# Outline

**DIDACTIC SESSION**

***2 Hours***

1. Archwire Characteristics
    a. Alloy types
    b. Shapes
    c. Dimensions
    d. Forces
2. Armamentaria
3. Procedures for Placement
4. Ligature Systems

**LABORATORY SESSION 1**

***4 Hours***

During this session, students will practice the insertion of a preformed maxillary and mandibular archwire and ligation using elastic or metal ligatures or self-ligating brackets on typodont teeth. Students will work with a partner during the process of these procedures; the assisting student will observe each state of the process for evaluation. Students will practice each skill a minimum of four times per arch with one of each of the four times used for a practical exam.

**LABORATORY SESSION 2**

***2 Hours***

During this session, students continue to practice the insertion of a preformed maxillary and mandibular archwire and ligation using elastic or metal ligatures or self-ligating brackets on typodont teeth. Students will work with a partner during the process of these procedures; the assisting student will observe each state of the process for evaluation. Students will practice each skill a minimum of four times per arch with one of each of the four times used for a practical exam.

**WRITTEN FINAL EXAMINATION**

***1 Hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

**CLINICAL INSTRUCTION**

***8 Hours***

During this session, the student will practice inserting a preformed maxillary and mandibular archwire and ligating archwires using a combination of elastic and metal ligatures or self-ligating brackets on at least two active patients, with one patient's maxillary and mandibular archwire placement used as a clinical examination.

# Didactic Material

**ORTHODONTIC ARCHWIRES**

Orthodontic archwires are the main source of tooth moving force in a modern orthodontic system. They work in close concert with orthodontic brackets and their ligating systems. The discussion of archwires can be quite complex because different alloys, shapes and sizes affect the wire's stiffness and resultant force when the wire is deflected (tied in or activated).

As with bracket systems, the rationale behind the use of different archwires by different practitioners varies according to the techniques and philosophy of treatment of each clinician. In an ideal situation, one would only need one biologically efficient archwire throughout treatment. It would not hurt, break or need any adjustment. Unfortunately, this is far from current reality. Since there are no contemporary archwires with all the above properties, we must control the force delivered by archwires by varying the alloy types, wire sizes and cross sections to meet the clinical needs of each individual patient. The choice of an archwire is primarily driven, first, by its stiffness and secondly, by its fit in the bracket slot.

**Common Archwire Alloys**

***Stainless Steel***

Stainless steel (SS) has been the most popular wire for over fifty years. A typical stainless alloy includes about 71% iron, 18% chromium, 8% nickel and less than 0.2% carbon. Although stainless has a high content of iron, it does not corrode (rust) in the mouth because it forms a thin protective oxide layer on its surface. Practitioners can easily modify the shape of a stainless steel wire with pliers as it is quite formable. It also has high stiffness, high strength and a low coefficient of friction. These characteristics make stainless a good material for opening bites, space closing archwires and for final finishing wires. For sake of comparison, remember that stainless has a comparative stiffness rating of 1.00.

***Chromium Cobalt***

Chrome cobalt (CrCo) is a specialty wire often used in lieu of stainless steel. Its typical composition is about 40% cobalt, 20% chromium, 15% nickel, 15% iron, 7% molybdenum and 2% manganese. Originally, it was developed by the Elgin Watch Company to be used as a watch mainspring (Elgiloy). CrCo is useful because it comes from the manufacturer with a low yield point. This makes it very easy to bend. Once the bending has been completed, it can be heat treated (in the office). Heat treating raises the yield point making the CrCo wire behave very similarly to untreated stainless steel. This wire is used mostly for wires with multiple loops or bends. It also is used for lab work as very large wires can be bent more easily by the lab tech. It, like stainless, is stiff, strong and has a low coefficient of friction. Chrome cobalt is slightly stiffer than stainless with a stiffness rating of 1.05.

***Nickel Titanium***

These wires have very low stiffness ratings. The typical composition of nickel titanium wire consists of almost 50% nickel and 50% titanium. Nickel titanium (NiTi) wires have a very long range of action. This property is most useful during the first stages of treatment. Conversely, nickel titanium wires are neither very formable nor very smooth. Although they can be deflected large distances, they often break before they take a permanent bend. Don't try to adjust them!

The original nickel titanium wire alloy was borrowed from the Navy Space program. Its first trade name was Nitinol (for Nickel Titanium Naval Ordnance Laboratory), where it was used to expand very compacted antennas from satellites after launching into space. It had the unusual characteristic of heat sensitive shape memory with which a cool wire could be severely deflected and yet returns to its original shape upon re-heating. Since the temperature of the mouth varies little, this memory phenomenon is of little importance in Orthodontics. NiTi's low stiffness, however, has been a tremendous boon to modern orthodontics.

These wires may also be manufactured to include super-elastic properties. Normally, as any wire is bent, its resistance to bending increases in direct proportion to how far it is bent. Super-elastic wires act the same bending forces, as do most wires, up to a point. If they are bent severely, the molecular structure starts to change into a different phase without continuing to build up even more resistance to the continued bending. Super-elastic wires can be bent to the extreme without resisting their deflection nearly as much as normal alloys. When these severely bent wires are tied into a bracket, they slowly lose their force, as the tooth moves. The force is not constant but decays more slowly than normal. A problem is only very small wires can be bent into their super-elastic state without delivering forces that are too high for normal tooth movement.

Despite these unusual characteristics, NiTi wires are very useful because of their very low stiffness. They enable the orthodontist to "fill the slot" with a much softer wire than other wire alloys would allow. The stiffness rating for NiTi wires range from 0.06 to 0.28 making it the least stiff of all alloys.

***Beta Titanium***

Beta titanium (BTi) wires are now available from multiple manufacturers. Formerly, they were only available from ORMCO under the brand name, TMA (Titanium Molybdenum Alloy). Beta titanium wire stiffness is between stainless steel and the nickel titanium wires. It retains the formability of stainless but is only 40% as stiff as stainless. A typical composition of the beta titanium wire includes 79% titanium, 11% molybdenum, 6% zirconium and 4% tin. These wires have good strength and good formability, but their sliding friction is the highest of all alloys. Since TMA wires deliver less than half the force levels for the same deflection, as compared with stainless steel, they can be used in clinical situations where force levels lower than stainless steel and higher than nickel titanium are necessary. Beta titanium stiffness rating is about 0.40.

***Gold Alloy***

The original archwires, and bands, were composed of precious metal alloys. These wires were one half the stiffness of stainless and were quite formable with good friction properties. Stainless steel became more popular in the 1950s because of its much lower cost. Gold alloys are no longer used in modern practice. The stiffness rating of gold alloys is 0.50

**Archwire Selection**

The introduction of newer wires to the profession has allowed significant clinical changes in orthodontic archwire selection and progression. Wires are always chosen to deliver an optimum force. Unfortunately, every wire delivers less and less force as the teeth move. Some newer wires can be left in the mouth for longer periods of time as their force decays more slowly with tooth movement. These less stiff wires deliver more continuous forces over a longer distance of tooth movement. During the intermediate stages of treatment, the use of larger cross-section NiTi or BTi wires enable difficult movements to be accomplished earlier and faster than was possible with the stiffer stainless steel wires.

To take advantage of the highly variable properties of currently available wires, a rational stiffness driven approach should be employed based on each particular case. The following is a list of typical wires used at different stages of treatment:

***Initial Leveling Stage***

Initial archwires require very high flexibility to adapt to very displaced brackets and tubes. This flexibility can only be obtained with a wire with low stiffness and a very high range. During the initial phase of orthodontic treatment, we are primarily interested in correcting rotations, tipping and vertical discrepancies. An archwire that allows complete bracket slot engagement with every tooth while delivering low force levels is most desirable. Archwire options include multi-strand NiTi, small diameter nickel titanium, multi-strand stainless steel, small diameter stainless steel or multi-looped stainless steel wires. The bulk of these wires are much too soft to open the bite or establish good arch form.

***Intermediate Leveling***

Further leveling and increased arch form control need stiffer archwires. Larger NiTi or Beta Titanium wires are often used. Stainless steel is better if even more force is needed to open the bite or refine arch form.

***Sliding Space Closure***

Sliding space closure requires good torque control of the anterior teeth and good arch form control while minimizing wire friction as the space closes. Stainless steel is preferred because of its high stiffness and low coefficient of friction. Do not use the rougher BTi.

***Looped Arch Space Closure***

Closing loops using lower stiffness wires can be more efficient while still delivering good force levels. Good arch form control and torque control are also important considerations. Beta titanium can be activated more while stainless wires can exert more control over torque and arch form.

***Intermediate Torque Correction***

Large dimension square nickel titanium or beta titanium wires are usually the wire of choice for beginning torque control of tooth movement. These softer alloys permit lower initial torquing forces than are possible with steel wires of the same size. Steel is often later used to finish up torque correction.

***Finishing Stages***

A finishing wire needs to be capable of final torque and arch form adjustments while most of all, be formable and of medium stiffness. The lower the stiffness, the larger any finishing adjustment can be. Stainless steel or beta titanium alloys are most often used in the finishing stages. These wires provide stability and formability for fine tooth movements and detailing.

However, flexibility is of essence during the final finishing phase to allow settling of the occlusion following space closure and idealization of tooth positions during the intermediate and early finishing stages. Sectioning the stainless steel or titanium molybdenum alloys, using light wires or multi-strand stainless steel wires are also appropriate options during this phase. Often, no wires at all, are used with vertical elastics in the posterior quadrants during final settling.

**Archwire Shapes**

Originally, all gold and stainless archwires were custom formed by the orthodontist from straight wire stock. Over time, more and more preformed archwires have become available to the point that every wire alloy comes in multiple wire dimensions and various preformed arch shapes. Nickel titanium arch forms are set during manufacturing. Since NiTi is not very formable, you have little control over its predetermined shape. Beta titanium, stainless and chrome cobalt wires, however, are quite formable so the factory delivered arch forms can be easily modified at any time.

**Archwire Sizes and Dimensions**

All archwire sizes are described in thousandths of an inch. Sometimes archwires may also be described in mils., i.e. 1 mil = .001 inches. Wires are never larger than their nominal size, but they are usually slightly smaller than their nominal size. A round archwire is described by its diameter in thousandths of an inch. For example, .016 ss wire represents a round 0.016 thousandth of an inch stainless steel wire.

For rectangular wires, both dimensions are listed. The first number is the vertical thickness while the second number is the horizontal thickness of the wire. For example, .016 x .016 ss represents a square stainless steel square wire that is .016 thousandths of an inch thick and .016 thousandths of an inch wide. A .017 x .025 ss wire represents a rectangular stainless steel wire that is .017 thousandths thick and .022 thousandths wide. A rectangular arch can be thicker than it is wide (ribbon arch). Example: .022 x .016 is a ribbon arch that is .022 in. thick and only .016 in. wide.

**Ligature Systems**

Ligation is the process of securing the wire to/within an orthodontic bracket. There are several methods of achieving this ligation. The following are the most common methods:

***Elastic Modules***

Elastic modules are small "O rings'' made of biocompatible plastic. They are normally placed under the four wings of the bracket and go over the archwire near the mesial and distal of the bracket. They normally hold the archwire firmly against the base of the bracket slot. If the tooth is rotated and the archwire is too stiff, the elastic ligature will stretch more and not hold the archwire firmly against the bracket slot base. Elastic modules can stretch more than wire ties and are therefore less likely to debond brackets. The elastic rings can be placed more quickly than stainless steel ligatures. Many of the younger patients are enthusiastic about the various available colors.

Unfortunately, the elastic modules create much more sliding friction and attract more plaque than their steel counterparts. They also deteriorate fairly quickly in the mouth losing their effective force in a relatively short period of time resulting in forces that are too low to be effective. Because of these decay properties, elastics must be changed more frequently than steel ligature ties that can remain in place almost indefinitely.

***Stainless Steel Ligatures***

Steel ligature ties are thin fully annealed (dead soft) wires which makes them very flexible and formable. The ligature wire is threaded under two tie wings, over the archwire distal to the bracket, under the other two wings while finally crossing over the archwire, again, mesial to the bracket wings. The two free ends of the ligature wire are twisted together tightly and then cut leaving a "pig tail" of 2-3 mm. The remaining "pig tail" is tucked out of the way under the archwire. Because the ligatures do not stretch, the steel ligatures' seating force does not diminish over time. This also permits using more force to seat the archwire than is possible with elastic ligatures. Full engagement of a wire with a long range of action results in a more continuous force application. Steel ligatures sliding friction can be reduced to the levels of a self-ligating bracket.

***Self-ligating Bracket***

Self-ligating brackets do not use either ligatures or elastic modules to hold the archwire within the bracket slot. Instead, they have a moveable fourth wall on the buccal surface of the bracket. When the wall is "open," wires can be either placed or removed by sliding the archwire through the buccal opening. After a new archwire is placed in the slot, the moveable wall is moved into place converting the open bracket slot into a closed tube. Closing the fourth wall usually deflects the archwire creating orthodontic forces. Some self-ligating brackets have a spring mechanism that holds the archwire closer to the slot floor that the fixed fourth wall tube systems do.

Several brands and types of ligature-less, self-ligating, low friction brackets have become available (e.g. Damon [Ormco], Innovation R [GAC Int.] and popular. Such brackets offer advantages of saving time, reducing some friction, and increasing patient comfort and oral hygiene levels.

**Armamentarium**

A list of typical materials and instruments is included. Different offices will vary their procedures and subtract or add instruments and materials they find helpful in successful archwire placement and ligation.

a. Mathieu Plier
b. Wire Cutter/Pin and Ligature Cutter
c. Distal End Cutter
d. Dental Mirror

**Archwire Placement and Ligation**

Critical steps in the procedure for archwire placement and ligation include:

1. Identify and mark the midline of the archwire.
2. Estimate the length of the wire prior to placement in the mouth.
3. Allow wire to rest buccal to the terminal bracket in the arch.
4. Use distal end cutters to remove gross excess.
5. Place the archwire using a utility plier in the first molar tube or second if applicable.
6. Confirm midline and ligate the wire to the brackets beginning from the tooth mesial to the first molar. Sometimes it helps to start by ligating the most rotated/out of alignment tooth, and work around the arch until all teeth are secured.
7. Cut excess wire length.
8. Check archwire ensuring it is not too long or too short.
9. Provide appropriate patient education.
10. Maintain appropriate infection control throughout all procedures.

# Laboratory and Clinical Instruction

**LABORATORY SESSION 1 & 2**

***6 Hours***

During lab sessions, students will practice archwire placement and ligation on typodont teeth.

**Laboratory Instructions**

Students will work with a partner during the process of these procedures. The assisting student will observe each stage of the process for evaluation. The following is a step-by-step description of the procedures that should be followed during the laboratory practice sessions:

1. Each student will set up his/her armamentaria for archwire placement and ligation on a typodont.
2. Student will be provided with a typodont and a bench mount. In addition, the student will be provided with individualized packets that will include:
    a. Description of packet
    b. Assortment of archwires and ligating materials
    c. All armamentarium for archwire placement and ligation
3. Instructor will review procedures and present information on how to use the lab worksheet for archwire placement and ligation.
4. Instructor will present criteria for ideal archwire placement and ligation. Instructor will demonstrate techniques and provide ideal examples that will be passed around for viewing.
5. Student will place maxillary and mandibular archwires and ligate on a typodont a minimum of four times.
6. One of each of the four times is used for a practical exam; partner observes, evaluates and records on worksheet. Student will also evaluate him/herself on the procedure. Instructor evaluates the archwire placement and ligation. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
7. Partners switch places, the operator becomes the assistant, and the assistant becomes the operator. Both students complete three archwire placements and ligation.
8. Instructor will now present product evaluation form and how it is used to evaluate final archwire placement and ligation.
9. Using the product evaluation form, the student operator and the student assistant and instructor grade the final archwire placement and ligation.
10. Discussion on product evaluation is conducted in small groups.

**WRITTEN FINAL EXAMINATION**

***1 hour***

**CLINICAL INSTRUCTION**

***8 hours***

During this session, the student will practice inserting a preformed maxillary and mandibular archwire and ligating archwires using a combination of elastic and metal ligatures or self-ligating brackets on at least two active patients. Student operator will perform the following according to the stated criteria:

1. Each student will set up his/her armamentaria for archwire placement and ligation.
2. Student will be provided with two patients.
3. Instructor will review procedures for archwire placement and ligation.
4. Student will place archwires and ligate on the patients while partner observes, evaluates and records on worksheet.
5. Student will also evaluate him/herself on the procedure.
6. Instructor evaluates the archwire placement and ligation. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
7. Students will complete a minimum of four times with one of the four times used for a clinical examination.
8. Partners switch places, the operator becomes the assistant, and the assistant becomes the operator, both student partners have completed at this placement of four archwires with ligation.
9. The worksheets are then evaluated by the students and instructor.

# Worksheets

**LABORATORY & CLINICAL PATIENT WORKSHEETS**

**General Information on Worksheets**

The student operator, student assistant and instructor use these forms. Each of these individuals will watch the performance of the specified steps of the given procedure and then identify if any of these steps are not followed and/or inadequately performed by the student operator. During the learning process, errors can and will occur. Students and clinical instructors identify common errors encountered during each step of the entire procedure utilizing the worksheets. Worksheets are not grade sheets, but they assist the student to identify his or her own errors during performance of these steps. They are used for measuring student's progress toward attainment of clinical proficiency.

**General Procedures**

An important part of the learning experience in the process of archwire placement and ligation is the ability to identify technique errors, understand their causes and find solutions. Equally important is to determine the degree of error and when it constitutes a need to redo the procedure. The first step in this process is to identify the error(s). Using the Archwire Placement and Ligation Laboratory and Clinical Patient Worksheets does this. The worksheets are not grade sheets but are documents that are used to assist students in learning to identify common technique errors related to the procedures associated with archwire placement and ligation. The student uses this form in the following manner:

The worksheet consists of a column titled Procedure-Laboratory and Procedure-Clinical, which is the step-by-step description of the procedures associated with archwire placement and ligation. The procedures are subdivided into the following categories:

- Infection Control/Patient Safety
- Assemble Armamentaria
- Fitting
- Trimming
- Ligating
- Patient Education
- Infection Control/Patient Safety/Clean-up

**How Worksheets Are Used by Student Operator and Student Assistant**

1. When performing multiple procedures either in the laboratory or on clinical patients, all of the errors from these series are placed on one worksheet.
2. Each laboratory/clinical experience is graded in a different column.
3. When an error occurs in any of the individual steps described in the Procedure column, a check is placed in the box corresponding to the laboratory/clinical experience.

For example, on the clinical patient worksheet there would be a box for each step of the clinical practice patients. For the laboratory worksheet, there would be a box for the typodont teeth. With worksheet check-offs, the student can identify a clustering pattern of errors in any particular step. When an instructor evaluates the student's performance, he/she cannot only see how a student performs, but whether or not the student can identify errors that he/she makes.

**How the Student Identifies Cause and the Correction of Errors**

After the student identifies the error(s) performed, he/she will write the cause of the error and how it shall be rectified. The student then identifies whether the error is significant enough to require re-fitting archwire and/or re-ligating. During this process, the student will review the criteria for successful archwire placement and ligation.

**How the Instructor Uses the Worksheets**

The instructor watches the student operator during the entire process of archwire placement and ligation. The instructor will check the appropriate box on the same worksheet used by the student operator and the student assistant. The instructor observes both students, and then evaluates the grading completed by both students for accuracy. The instructor reviews the worksheets for information related to cause, solution and whether any part of the procedure requires additional steps. The instructor can provide additional assistance where needed. This process of identification of errors, causes and solutions will ensure the student will progress towards clinical competence and expected course objectives will be met. This process will continue throughout all laboratory and clinical requirements. When the clinical final exam is administered the student should be clinically competent in archwire placement and ligation.

**Satisfactory Performances of Psychomotor Skills**

Students will practice psychomotor skills during the laboratory and preclinical sessions until they reach a competence level of 75% utilizing the documented criteria evaluated using the behaviorally anchored rating scale. Students must achieve a passing score on a minimum of two typodont teeth or natural teeth before progressing on to successive laboratory, preclinical and clinical sessions.

# Worksheet – Laboratory

**ARCHWIRE PLACEMENT & LIGATION**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Minimum of 4 Maxillary Archwires Placed. Record tooth number(s):

Minimum of 4 Mandibular Archwires Placed. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

*** = Critical Error**

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers Weingart or utility pliers, distal cutters, and Mathieu pliers or hemostats | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| **Archwire Placement** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 5. Identifies the midline of the archwire* | | | |
| 6. Estimates the length of the wire prior to placing in the mouth* | | | |
| 7. Allows the wire to rest buccal to the terminal bracket in the arch* | | | |

| | | | |
|---|---|---|---|
| 8. Uses the distal end cutter to remove gross excess* | | | |
| 9. Does not remove too much or too little* | | | |
| 10. Final length is trimmed with wire placed and ligated in bracket slots* | | | |
| 11. Uses utility plier to place archwire in the first molar tube* | | | |
| 12. Slides wire through to the second molar if applicable | | | |
| ***Ligate Archwire*** | | | |
| 13. Ligates the wire to brackets* | | | |
| 14. Begins from the tooth mesial to the first molar* | | | |
| 15. Works around the arch to the contralateral until all teeth secured* | | | |
| 16. Severely misaligned tooth ligated first* | | | |
| 17. Cuts excess wire length* | | | |
| 18. Looks and feel for wires that extend past the appliance* | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 19. Give post-operative instructions to the patient or parent | | | |
| 20. Document procedure in patient chart to include: date, HH review or update, materials used, operator signature, and instructor or DDS signature | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 21. Surface disinfect | | | |
| 22. Prepare and institute sterilization procedures | | | |
| 23. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 24. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Worksheet – Clinical Patient

**ARCHWIRE PLACEMENT & LIGATION**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Circle one: Patient #1 Patient #2

Patient Name:

Minimum of 2 Maxillary Preformed Archwires Placed. Record tooth number(s):

Minimum of 2 Mandibular Preformed Archwires Placed. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

**Critical Errors = ***

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, SP hand piece, curing light | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers Weingart or utility pliers, distal cutters, and Mathieu pliers or hemostats | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |

| Archwire Placement | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 5. Identifies the midline of the archwire* | | | |
| 6. Estimates the length of the wire prior to placing in the mouth* | | | |
| 7. Allows the wire to rest buccal to the terminal bracket in the arch* | | | |
| 8. Uses the distal end cutter to remove gross excess* | | | |
| 9. Does not remove too much or too little* | | | |
| 10. Final length is trimmed with wire placed and ligated in bracket slots* | | | |
| 11. Uses utility plier to place archwire in the first molar tube* | | | |
| 12. Slides wire through to the second molar if applicable | | | |
| ***Ligate Archwire*** | | | |
| 13. Ligates the wire to brackets* | | | |
| 14. Begins from the tooth mesial to the first molar* | | | |
| 15. Works around the arch to the contralateral until all teeth secured* | | | |
| 16. Severely misaligned tooth ligated first* | | | |
| 17. Cuts excess wire length* | | | |
| 18. Looks and feel for wires that extend past the appliance* | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 19. Give post-operative instructions to the patient or parent. | | | |
| 20. Document procedure in patient chart toinclude: date, HH review or update, materials used, operator signature, and instructor or DDS signature. | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 21. Surface disinfect | | | |
| 22. Prepare and institute sterilization procedures | | | |
| 23. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 24. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Product Evaluation Forms

**ARCHWIRE PLACEMENT & LIGATION**

**General Procedures**

Product evaluation evaluates the end result of any performance, not the steps. This facility utilizes the behaviorally anchored rating scale (BARS) system. This 10-point system clusters the critical incidents into categories. The instructor can score objectively the end result of sizing, fitting and cementing orthodontic bands by choosing the criteria specified in each point level. Performance is assessed according to established criteria for each of these procedures. The points are then converted to a pass or fail grade.

**How Instructor Uses Product Evaluation Form**

A product evaluation form will be used for each patient. In the "scores" area on the form you will note that an open box rather than specific grids occurs. This open box allows you to enter a score for each archwire placed.

**The student must maintain a minimum point value of 7.5 on all clustered critical incidences per archwire placed. He/she must receive this minimum score for all four archwires placed in order to pass this module. A grade of 7.5 represents a 75% passing score.**

**Product Evaluation Point Conversion**

The student will receive points for a given level of achievement from the point scale utilized for product evaluation.

**POINT SYSTEM TO A PASS/ FAIL SCORE**

***Conversion***

| Points | Grades |
|---|---|
| **10** | ➨ Pass-Excellent |
| **7.5** | ➨ Pass |
| **5** | ➨ Fail-Critical Error(s) |
| **3** | ➨ Fail-Critical Errors-no concept |

# Product Evaluation/Practical Examination – Lab Session 1

**ARCHWIRE PLACEMENT & LIGATION**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

1 maxillary preformed archwire placed. Record tooth number(s):

1 mandibular preformed archwire placed. Record tooth number(s):

**PLACEMENT OF ARCHWIRE**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Midline of archwire identified<br>B. Estimate length of wire<br>C. Final length is trimmed<br>D. Wire placed first molar tube (or second)<br>E. Cut precisely | | |

**LIGATION**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Ligate wire to brackets<br>B. Work around the arch-begin mesial to first molar<br>C. Works around arch until all brackets are ligated<br>D. Severely misaligned teeth are ligated first<br>E. Look and feel for wires that extend past the appliance | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Lab Session 2

**ARCHWIRE PLACEMENT & LIGATION**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

1 maxillary preformed archwire placed. Record tooth number(s):

1 mandibular preformed archwire placed. Record tooth number(s):

**PLACEMENT OF ARCHWIRE**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Midline of archwire identified<br>B. Estimate length of wire<br>C. Final length is trimmed<br>D. Wire placed first molar tube (or second)<br>E. Cut precisely | | |

**LIGATION**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Ligate wire to brackets<br>B. Work around the arch-begin mesial to first molar<br>C. Works around arch until all brackets are ligated<br>D. Severely misaligned teeth are ligated first<br>E. Look and feel for wires that extend past the appliance | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Clinical Session

**ARCHWIRE PLACEMENT & LIGATION**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

1 maxillary preformed archwire placed. Record tooth number(s):

1 mandibular preformed archwire placed. Record tooth number(s):

**PLACEMENT OF ARCHWIRE**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Midline of archwire identified<br>B. Estimate length of wire<br>C. Final length is trimmed<br>D. Wire placed first molar tube (or second)<br>E. Cut precisely | | |

**LIGATION**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Ligate wire to brackets<br>B. Work around the arch-begin mesial to first molar<br>C. Works around arch until all brackets are ligated<br>D. Severely misaligned teeth are ligated first<br>E. Look and feel for wires that extend past the appliance | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation Documented Criteria

| ARCHWIRE PLACEMENT | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ▪ Identifies the midline of the archwire<br>▪ Estimate the length of the wire prior to placing in the mouth; Allows the wire to rest buccal to the terminal bracket in the arch; Uses the distal end cutter to remove gross excess<br>▪ Does not remove too much or too little<br>▪ Final length is trimmed with wire placed and ligated in bracket slots<br>▪ Uses utility plier to place archwire in the first molar tube<br>▪ Slides wire through to the second molar if applicable |
| **7.5 Points** | ▪ Adequately identifies the midline of the archwire<br>▪ Estimates the length of the wire adequately prior to placement; Allows the wire to adequately rest buccal to the terminal bracket; Uses the distal end cutter adequately to remove gross excess<br>▪ Adequately removes enough/not too much<br>▪ Final length is trimmed with wire placed and ligated in bracket slots<br>▪ Uses utility plier adequately to place archwire in the first molar tube<br>▪ Slides wire through to the second molar if applicable |
| **5 Points** | ▪ Does not identify the midline of the archwire<br>▪ Does not estimate the length of the wire prior to placement; Does not allow the wire to rest buccal to the terminal bracket; Uses the distal end cutter to remove gross excess<br>▪ Final length is trimmed but too short<br>▪ Does not use utility pliers to place archwire in the first molar tube |
| **3 Points** | ▪ Does no identify the midline of the archwire<br>▪ Does not estimate the length of the wire prior to placement; Does not allow the wire to rest buccal to the terminal bracket; Does not use the distal end cutter to remove gross excess<br>▪ Final length is not trimmed with wire placed and ligated in bracket slots<br>▪ Does not use utility plier to place archwire in the first molar tube |

# Product Evaluation Documented Criteria

| LIGATION | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Ligates the wire to the brackets<br>➨ Begins from the tooth mesial to the first molar<br>➨ Works around the arch to the contralateral until all teeth secured<br>➨ Severely misaligned tooth ligated first<br>➨ Cuts excess wire length<br>➨ Looks and feel for wires that extend past the appliance |
| **7.5 Points** | ➨ Adequately ligates the wire to the brackets<br>➨ Begins from the tooth mesial to the first molar but varies slightly<br>➨ Works around the arch to the contralateral until all teeth adequately secured<br>➨ Severely misaligned tooth ligated first<br>➨ Cuts excess wire length adequately<br>➨ Looks and feel for wires that extend past the appliance |
| **5 Points** | ➨ Does not adequately ligate the wire to the brackets<br>➨ Does not begin from the tooth mesial to the first molar<br>➨ Works around the arch to the contralateral secures most teeth but does not secure all teeth<br>➨ Severely misaligned tooth is not ligated first<br>➨ Excess wire is trimmed too short<br>➨ Does not look and feel for wires that extend past the appliance |
| **3 Points** | ➨ Does not adequately ligate the wire to the brackets<br>➨ Does not begin from the tooth mesial to the first molar<br>➨ Secures some teeth but does not secure all teeth<br>➨ Severely misaligned tooth is not ligated<br>➨ Excess wire is not trimmed<br>➨ Does not look and feel for wires that extend past the appliance |

# Course Requirements

The following is an overview of the course requirements and the protocol followed for laboratory and clinical practice, the written and clinical examination.

**Minimum Number of Satisfactory Performances**

All students will perform at a minimum the following procedures in order to achieve minimum competence in the various protocols used in archwire placement and ligation.

On a typodont and patients, the student will perform the following under OSHA and DBC guidelines:

- On the typodont: placement of a preformed maxillary and mandibular archwire using elastic or metal ligatures or self-ligating brackets a minimum of four times per arch with one of each of the four times used for a practical exam according to the specified criteria.
- On the patient: Insertion of a preformed maxillary and mandibular archwire on at least two patients. Ligating both preformed maxillary and mandibular archwires using a combination of elastic and metal ligatures or self-ligating brackets on at least two patients for each according to the specified criteria with one of each of the four times used for a practical examination with 75% accuracy.

Students are required to meet the specified minimal number of satisfactory performances as indicated above. The student operator grades his/her own performance, the student assistant grades the performance of the student operator and the instructor will assess the student operator's performance and the grading method of both students.

When the student reaches the 75% minimum performance for archwire placement and ligation and 100% performance on all infection control protocol, the instructor evaluates the procedure for the minimal number of satisfactory performances. If a student does not fulfill the minimum grade for the number of satisfactory performances additional laboratory and/or clinical practice procedures will be assigned.

**Objective Evaluation Criteria**

Objective evaluation criteria shall be provided to each student prior the performance of any procedure. The student will receive information provided by the instructor prior to performing any laboratory or clinical procedures. The instructor shall supply the student with general program, individualized cognitive and psychomotor objectives and criteria for evaluation. Objective criteria will be utilized in the performance of all laboratory and clinical requirements.

***Preparation for Archwire Placement and Ligation***

1. Will review the medical/dental history, make a general assessment, and oral inspection on each patient prior to treatment, checking for information that may contraindicate the performance of the procedure
2. Will set up the required armamentaria archwire placement and ligation
3. Will use aseptic techniques according to OSHA and DBC throughout performance on all patients
4. Will place protective barriers, seat and position the patient
5. Will evaluate the maxillary and mandibular arches for archwire placement and ligation
6. Will explain to patient the treatment planned for that day
7. Will perform archwire placement and ligation
8. Will place archwires and ligate on at least two patients

***Archwire Placement Criteria***

1. Will identify the midline of the archwire
2. If a wire will be removed and replaced, will mark the midline with a wax marker for easy replacement
3. Will estimate the length of the wire prior to placement in the mouth
4. Will allow the wire to rest buccal to the terminal bracket in the arch
5. Will use distal end cutter to remove gross excess
6. Will trim the final length with the wire placed and ligated in the bracket slots
7. Will place the archwire using the utility plier place the archwire in the first molar tube, slide through to second molar tube if applicable

***Ligation Cr iteria***

1. Will confirm the midline and ligate archwire to the brackets
2. Will begin from the tooth mesial to the first molar
3. Will work around the arch to the contralateral or opposite side until all teeth are secured
4. If there is a severely misaligned tooth, will ligate this tooth first
5. Will cut excess wire length
6. Will check (look and feel) for wires that extend past the appliance

**General Criteria**

1. Will provide pertinent and individualized patient education
2. Will provide follow up appointment as identified in the treatment plan
3. Will meet ethical and legal requirements for this procedure
4. Will provide accurate chart entries for this procedure
5. Will utilize OSHA and DBC guidelines for instrument processing, removing waste and cleaning/disinfecting treatment area

The above criteria will be used to evaluate and assess appropriate archwire placement and ligation with a minimum of 75% accuracy for laboratory and clinical patients.

**General Clinical Practice Protocol**

Students will complete procedures on two clinical patients. The following general procedures will occur:

***Patient Selection Criteria***

The following criteria must apply for each patient:

1. Patient must be an active orthodontic patient
2. Patient must be in good health (medical history form will be completed prior to treatment, reviewed and approved by the instructor).
3. Each patient will have a minimum insertion of a preformed maxillary and mandibular archwire and ligation using a combination of elastic and metal ligatures or self-ligating brackets

The student will function as an operator, an assistant and a patient. Working as partners (operator and assistant) an operator will perform the procedure, the assistant will observe, and evaluate each step of the procedure. When complete each student will do the procedure, observe and evaluate.

The following general procedures will occur for each of the patients:

1. Operatory will be set up following the infection control guidelines
2. Medical history will be completed by the patient prior to seating
3. Equipment and supplies will be checked by the student
4. Patient will be seated and prepared for treatment
5. Student operator will review the medical history and perform a visual exam
6. The instructor will review the medical history and perform a visual exam
7. Instructor will accept the patient for archwire placement and ligation
8. Student operator will perform the following according to the stated criteria:
    a. Identify midline of archwire
    b. Estimate the length of the archwire
    c. Use distal end cutter to remove gross excess
    d. Final length will be trimmed after ligation
    e. Place the archwire using the utility plier placing into molar tube
    f. Confirm midline and ligate
    g. Ligate with a combination of elastic, metal or self-ligating brackets
    h. Evaluate the product
    i. Provide individualized patient education
    j. Dismiss the patient
    k. Make appropriate chart notes
    l. Perform operatory clean-up/instrument processing according to infection control guidelines

After archwire placement and ligation procedures, the student operator, student assistant and the instructor complete evaluation using the worksheet and product evaluation form.

**DURING THIS TIME PERIOD, THE FOLLOWING WILL OCCUR:**

1. Student operator will evaluate his/her own work according to stated criteria using worksheet and product evaluation forms.
2. Student assistant will assist, observe, evaluate operator's performance according to stated criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work according to stated criteria using the worksheet and product evaluation forms. Results will be discussed.

A 75% must be obtained for passage of archwire placement and ligation.

**General Examination Protocol**

***Written Examination***

A comprehensive written examination of 25 questions on the entire curriculum will be administered. The student must receive a minimum score of 75% on the examination to pass the class. One hour has been reserved for the written examination.

***Clinical Final Examination***

The clinical final examination occurs during the process of working on the two active orthodontic patients during the archwire placement and ligation, with insertion of a preformed maxillary and mandibular archwire ligating both using a combination of elastic and metal ligatures or self-ligating brackets following patient selection criteria and procedures outlined in the module's clinical practice protocol.

# Written Examination

1. Orthodontic archwires serve as the main force system and work in concert with orthodontic brackets.
    a. True
    b. False
2. The archwire discussion can be a complex issue because of:
    1. Alloy types
    2. Shapes
    3. Sizes
    4. Forces
        a. 1 and 2
        b. 2 and 3
        c. 1, 3 and 4
        d. 3 and 4
        e. 1, 2, 3 and 4
3. An ideal archwire would have:
    1. High strength
    2. Low strength
    3. Low stiffness
    4. High stiffness
    5. A long range of action
    6. High formability
    7. Low formability
        a. 2, 3, 5 and 7
        b. 1, 4, 5 and 6
        c. 1, 3, 5 and 6
        d. 2, 4, 5 and 7
4. There is no ideal archwire. For this reason, there are different sizes and wire materials that are used for different purposes.
    a. Both statements are false
    b. Both statements are true
    c. The first statement is true the second is false
    d. The first statement is false and the second is true
5. The original archwire was composed of precious metal alloys including gold until the 1960s when stainless was introduced.
    a. True
    b. False
6. Common archwires may be comprised of:
    1. Stainless steel
    2. Cobalt chromium
    3. Nickel titanium
    4. Beta titanium
        a. 1, 2, 3 and 4
        b. 1, 2 and 3
7. Introduction of newer wires has allowed significant clinical changes in orthodontic archwire progression and use. Newer wires are left in the mouth for shorter periods of time for the desired effect.
    a. Both statements are false
    b. Both statements are true
    c. The first statement is true the second is false
    d. The first statement is false and the second is true

Match the following stage of treatment with the type of archwire used during this stage:

8. Initial stages _____
9. Intermediate stages _____
10. Finishing stages _____
    a. Stainless steel, beta titanium or large dimension nickel titanium
    b. Small diameter nickel titanium, multi-strand stainless steel or multi-looped stainless steel
    c. Sectioning the stainless steel or titanium molybdenum alloys and light wires and multi-strand stainless steel

Match the following stages with desired treatment:

11. Initial stages _____
12. Intermediate stages _____
13. Finishing stages _____
    a. Inter-arch corrections while providing stability to the arch form
    b. Leveling and alignment
    c. Settling of occlusion following space closure
14. Archwires may be:
    a. Round
    b. Triangular
    c. Rectangular
    d. Square
    e. All of the above
    f. a, c and d

Match the following:

15. Stainless steel round wire _____
16. Stainless steel square wire _____
17. Stainless steel rectangular wire _____
    a. 0.016 x 0 .022ss
    b. 0.016ss
    c. 0.016 x 0.016ss
18. Armamentarium for placement of the archwire includes:
    1. Mouth mirror
    2. Weingart or utility pliers
    3. Distal end cutters
    4. Mathieu pliers or hemostat
        a. 2, 3 and 4
        b. 1, 2 and 3
        c. 1, 2, 3 and 4
19. Ligation is the process of securing the wire to the orthodontic fixed appliance. There are several systems/methods.
    a. Both statements are false
    b. Both statements are true
    c. The first statement is true the second is false
    d. The first statement is false and the second is true
20. The most common methods of ligation are:
    a. Elastic modules
    b. Steel ligatures
    c. Self-ligating bands
    d. a and b
    e. a, b and c
21. Elastic modules stretch thereby applying less force than wire ties and are less likely to debond brackets. The elastic modules do not attract more plaque and are changed less frequently than steel ligature ties.
    a. Both statements are false
    b. Both statements are true
    c. The first statement is true the second is false
    d. The first statement is false and the second is true
22. The elastic modules come in a variety of colors and appeal to the younger patients. They also deteriorate under intraoral conditions thus shorter periods of continuous force.
    a. Both statements are false
    b. Both statements are true
    c. The first statement is true the second is false
    d. The first statement is false and the second is true
23. Several types of ligature-less, self-ligation, high friction brackets have become available in recent years.
    a. True
    b. False
24. The self-ligating brackets are increasing in popularity.
    a. True
    b. False
25. Self-ligating brackets may offer advantages of:
    a. Saving time
    b. Reducing friction
    c. Increasing friction
    d. Probability of increasing patient comfort
    e. Probability of decreasing patient comfort
    f. a, b and c
    g. a, b and d

# Written Examination Answer Key

1. a
2. e
3. c
4. b
5. b
6. a
7. c
8. b
9. a
10. c
11. b
12. a
13. c
14. f
15. b
16. c
17. a
18. c
19. b
20. e
21. c
22. b
23. b
24. a
25. g

# Module 7

## Ultrasonic Scaling for Cement Removal

**PERFORMANCE OBJECTIVES**

**After completing the following areas of didactic, laboratory and clinical instruction in removal of cement around brackets and bands with an ultrasonic scaler the student will be able to:**

1. Explain the concepts of removal of cement around brackets and bands with an ultrasonic scaler
2. Describe the criteria for cement removal around orthodontic bands using the ultrasonic scaler, including indications and contraindications
3. Describe and identify characteristics, manipulation and care of ultrasonic scaler unit when removing excess cement from orthodontically banded teeth
4. Explain the steps for ultrasonic scaling procedure
5. Explain and understand tooth morphology in relationship to the removal of cement with an ultrasonic scaler
6. Describe the armamentaria/equipment/supplies needed for cement removal with an ultrasonic scaler
7. Describe the proper technique of adaptation of ultrasonic tip/insert supra-gingivally upon the tooth's surface
8. Discuss the instrumentation and steps in removal of cement
9. Maintain infection control protocol, to include operator protection, operatory, surface disinfection, or barrier placement and instrument processing, sterilization related to bracket positioning, bond curing and orthodontic bracket removal according to standards defined by OSHA and DBC
10. Identify factors that may cause a health hazard to the operator by viewing a MSDS sheet and know preventive measures that should be employed

**On typodont teeth and patients the student will be able to:**

1. Assemble appropriate armamentaria for removal of cement around orthodontic bands with an ultrasonic scaler
2. Remove cement around orthodontic band adapting tip/insert without causing damage to soft or hard tissue
3. Provide appropriate patient education
4. Maintain patient comfort by evacuation and or isolation materials
5. Maintain appropriate infection control throughout all procedures
6. Protect herself/himself and the patient from any hazardous situations as defined in the MSDS forms for any cement materials used
7. Evaluate product using ideal criteria with 75% accuracy

# Outline

Didactic and laboratory instruction will emphasize developing the student's ability to perform all the proper techniques for removal of excess cement from orthodontically banded teeth with competence. Lecture on manipulation and care of ultrasonic scaler, indications versus contraindications, effects of ultrasonic scalers on hard and soft tissue including root damage, enamel damage, thermal damage and soft tissue damage as well as safety in regards to patient with systemic medical complications and managing patients with pacemakers. In addition to ultrasonic basics criteria, use of instruments and fulcruming techniques, infection control protocols in relation to removal of excess cement using an ultrasonic scaler, use of PPE and instrument processing.

**DIDACTIC SESSION**

***2 Hours***

1. Introduction to Ultrasonic Scaling
    a. Review of OSHA Infection Control Protocol and Dental Board Regulations
    b. Review of Laboratory and Clinical Training Site Emergency Protocol
    c. Patient Requirements for Clinical Practice at Dental Facility
    d. Examination Requirements
    e. Procedures for Handling Dental Patients during Clinical Practice
    f. Supplies and Equipment Use
    g. Demonstration of Equipment
2. Proper Use and Care of Ultrasonic Cleaning Device
3. Infection Control During Ultrasonic Scaling for Cement Removal
4. Techniques and Use of Equipment
    a. Operator/patient positioning
    b. Device grasp
    c. Device types
5. Patient Health
    a. Indications and contraindications
    b. Health history
6. Procedure Outline

**LABORATORY SESSION**

***4 Hours***

During this session, students will practice ultrasonic scaler use in the removal of orthodontic cement from around bands and/or brackets on typodont teeth. Instructor will describe and demonstrate the following: criteria for ideal use of the ultrasonic scaler with appropriate selection and adaptation of tips, use of a fulcrum, operator/patient positioning, worksheet, product evaluation forms. Students will work with a partner during the process of these procedures; the assisting student will observe each state of the process for evaluation. Student, partner and instructor will evaluate all laboratory practice using stated criteria, worksheet and product evaluation sheets.

**PRECLINICAL SESSION**

***4 Hours***

During this session, students will continue practice of the use of the ultrasonic for removal of orthodontic cement on a minimum of four banded posterior first molars.

**WRITTEN FINAL EXAMINATION**

***1 hour***

A comprehensive written examination on all aspects of the course will be administered. Questions will appear on the exam in multiple choice, true/false or matching form. These questions will be chosen from a test bank. An item analysis will be conducted to determine question validity each time the examination is administered.

**CLINICAL SESSION**

***4 Hours***

Working with a partner, each student functions as operator using an ultrasonic scaler to remove orthodontic cement from four posterior first molars on a minimum of two patients. Student will function as an assistant and will observe and evaluate ultrasonic use in removal of cement with a partner.

# Didactic Material

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**ULTRASONIC SCALING FOR ORTHODONTIC CEMENT REMOVAL**
***CERTIFICATION COURSE MANUAL***

**Introduction:**

An ultrasonic scaling instrument uses an alternating magnetic field to vibrate a water-cooled, working tip at ultrasonic frequency. When contacted by this working tip, orthodontic cement is disintegrated and washed away by the water. Compared to hand scaling, the advantages which have been attributed to ultrasonic scaling for cement removal are:

- The relative simplicity of use;
- The effectiveness of use;
- The expedience of the procedure by using an ultrasonic;
- The lack of necessity to sharpen hand instruments;
- Effectiveness of a tips ability to reach difficult or tight areas; and
- The effectiveness of the water spray to debride the field quickly.

There are, however, disadvantages to using an ultrasonic tip for cement removal, to include:

- Ultrasonic vibration may remove or loosen orthodontic bands and brackets if used incorrectly;
- Ultrasonic vibration may be annoying or intolerable to the patient;
- The operator has continuous water spray to manage during the procedure;
- Cost of the equipment may be prohibitive; and
- The operator still must check for remaining cement with hand instruments following ultrasonic scaling.

It is very important to remember that this procedure, and the certification for this procedure, is currently for the Registered Dental Assistant only, and may not be performed for the purposes of calculus or subgingival removal of deposits. The RDA performing ultrasonic scaling for cement removal may not:

- Perform any subgingival procedures with the ultrasonic device;
- Perform supragingival calculus removal with the ultrasonic device;
- Perform any procedure with the ultrasonic relating to a prophy; and
- Perform this procedure without certification from a Board-approved provider and a current RDA license.

Ultrasonic scaling for cement removal is limited to orthodontic cement only and may not be used for cement removal of temporary or permanent cement relating to restorations.

**Responsibilities of the Dentist**

1. To prescribe only those scaling procedures that is necessary for treatment purposes.
2. To ensure all ultrasonic equipment is properly installed and maintained in a safe working condition.
3. To provide appropriate personal protective equipment/ attire to protect staff and patients from the splash and splatter of the ultrasonic procedure.
4. To only allow this procedure to be performed by personnel who are properly trained, credentialed, and appropriately supervised in keeping with the state regulations.

**Responsibilities of the Dental Assistant**

1. To be knowledgeable about the current licensing requirements, rules, and regulations of California pertaining to all dental assisting duties.
2. To meet the certification and licensure requirements of California prior to the performance of ultrasonic scaling for cement removal.
3. To participate in obtaining informed consent from the patient to include:
    a. explaining the purpose of the procedure to the patient
    b. helping the patient to understand the benefit of using an ultrasonic
    c. what the consequences might be should the ultrasonic loosen or free a band
    d. if the patient is a minor, the parent or guardian must give the consent

4. To review the health questionnaire; the assistant should call the dentist's attention to any information that might contradict or change the direction of the treatment by the dentist.
5. To use only those techniques that will maintain the safety and well-being of the patient at all times.

**Proper Use of Ultrasonic Equipment**

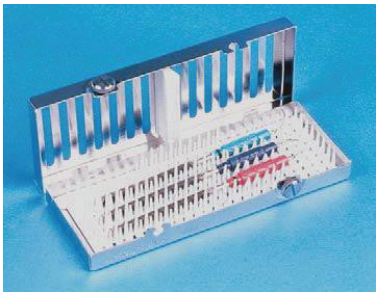
A few studies have been made available regarding the impact of improper use of an ultrasonic device against an orthodontic band. One study performed by dental faculty in Bergen, Norway, suggested that the key to successful orthodontic cement removal is the technique used in placing the ultrasonic tip next to the margins of the band rather than allow the tip to work on the band itself. The study suggested that the palatal surface of the upper incisors where it is often difficult to see the margins of the band is especially vulnerable to damage from the ultrasonic tip.

The primary negative outcome from improper operator use is the cement cracking under the band due to poor ultrasonic technique. It is likely that a rougher technique interferes with the homogeneity of the cement layer and thus causes increased risks of decalcification and loose bands.

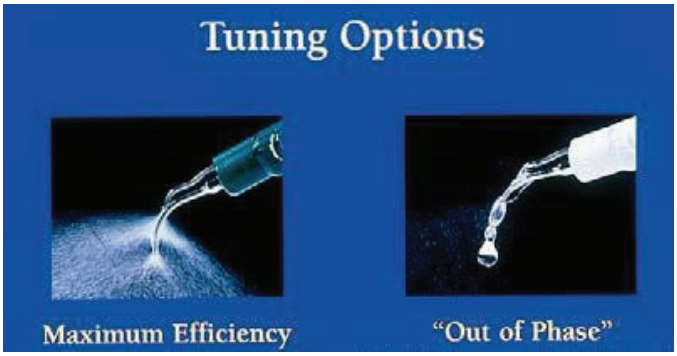
**Care of Ultrasonic Equipment**

Today's ultrasonic units are easier than ever to prepare for use, care, and disinfection. Many offices provide one at each operatory for easy access. They are light and compact, minimizing the amount of space required. Ultrasonic tips do not last forever and should periodically be evaluated for wear. As the tip of the insert wears, scaling efficiency decreases. A good rule of thumb to follow is one millimeter of tip wear results in approximately 25% loss of efficiency. Two millimeters of wear results in approximately 50% loss of efficiency, and, at this point, should be replaced.

The inserts are autoclavable for easy sterilization. The Dental Board of California Infection Control Regulations require that all handpiece and ultrasonic devices and tips be heat sterilized via the use of a FDA-cleared sterilization unit, such as a steam or heat autoclave or chemical vapor sterilization unit. Sonic inserts and ultrasonic tips can be placed inside a cassette or container system prior to sterilization to prevent damage.



It is required that all handpiece or air/water syringe lines be purges and flushed with water at the beginning of each day for at least two minutes (or the manufacturer's recommended guidelines) to clear stagnant water and reduce biofilm in the tubing (see the Dental Board of California's Infection Control Regulations). After the waterline is flushed, the selected tip can be inserted into the handpiece so the power and water can be adjusted for maximum efficiency with minimal patient discomfort. This can be achieved by adjusting the power at the lowest position possible, usually not above medium, and adjusting the water until a fine mist or a mist with water droplets is observed. Minimizing the mist from the ultrasonic tip minimizes aerosols outside the mouth.




**INFECTION CONTROL DURING ULTRSONIC SCALING FOR CEMENT REMOVAL**

Sonic and ultrasonic procedures present special infection control challenges, primarily because the operator contacts the patient's saliva and then moves about and must touch many things while performing the procedure. The mist from the ultrasonic tip can spread bacteria and microorganisms out into the operatory and onto the clothing of the operator and the patient.

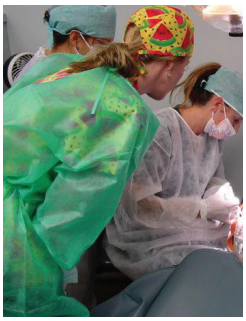
Sources of Disease Transmission and Contamination during Ultrasonic Scaling:

- Instruments laying out on countertops carts and loosely arranged in the operatory.
- Dental chair headrest and chair adjustment controls.
- Operating light handle.
- Counter tops and carts.
- Floors, doorframes, light switches, and walls.
- Patient records.
- Any object the operator touches after the procedure has begun.

**Protective Equipment**

***Personal Protective Equipment***

The operator must wear gloves, mask, labcoat and glasses while the ultrasonic procedure is performed. Gloves must be worn whenever the operator comes in contact with oral mucosa and Other Potentially Infectious Materials, commonly referred to as OPIM. The Dental Board of California's Infection Control Regulations state the following:



Healthcare workers shall wear surgical facemasks in combination with either chin length plastic face shields or protective eyewear when treating patients whenever there is potential for splashing or spattering of blood or OPIM such as saliva in dental procedures. After each patient, and during patient treatment, if applicable, masks shall be changed if moist or contaminated. After each patient, face shields and protective eyewear shall be cleaned and disinfected, if contaminated.

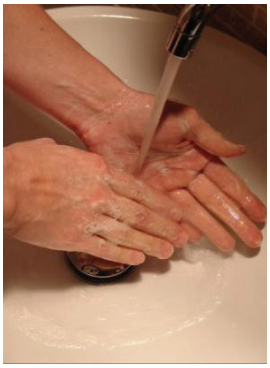
Healthcare workers shall wear reusable or disposable protective attire when their clothing or skin is likely to be soiled with blood or OPIM such as saliva in dental procedures. Gowns must be changed daily or between patients if they should become moist or visibly soiled. Protective attire must be removed when leaving laboratories or areas of patient-care activities.

Reusable gowns shall be laundered in accordance with Cal-DOSH Bloodborne Pathogen Standards and the Federal Register and must be provided and laundered or cleaned by the employer.

Medical exam gloves shall be worn whenever there is a potential for contact with mucous membranes, blood, or OPIM such as saliva in dental procedures. Gloves must be discarded upon completion of treatment and before leaving laboratories or areas of patient-care activities such as operatories and sterilization areas. Healthcare workers shall perform hand hygiene procedures after removing and discarding gloves. Gloves shall not be washed before or after use.

***Hand Hygiene***

Healthcare workers shall wash contaminated or visibly soiled hands with soap and water and put on new gloves before treating each patient or performing housekeeping, laboratory or sterilization procedures. If hands are not visibly soiled or contaminated, an alcohol-based hand rub may be used as an alternative to soap and water.



***Protective Barriers***

Any object that the operator touches while performing treatment procedures must be covered with a removable barrier or disinfected after the patient is dismissed. Barriers must be placed over the dental chair headrest, all touch surfaces, equipment that is difficult or impossible to clean, and electrical equipment that cannot tolerate cold chemical disinfectants. These items cannot be sprayed with any liquid agent due to the potential for short-circuiting or electrical shock.

No electrical items should be directly sprayed in the dental operatory. These items must be protected by the use of disposable barriers as indicated in the Dental Board of California Infection Control Regulations.

Barriers are single-use items only and must be changed after each and every patient, regardless of use. Areas of the operatory not protected by disposable barriers must be properly disinfected using the spray-wipe-spray or wipe- discard-wipe-wait technique.

Equipment such as the ultrasonic unit itself can be covered with a plastic protective barrier without causing damage to the unit. This is a very easy way to prevent cross-contamination while making adjustments to the unit during the ultrasonic procedure.

***Care of Sonic and Ultrasonic Instruments***

Ultrasonic instruments that are placed in the patient's mouth are semi-critical items as defined by the Regulations and must either be sterilized before re-use.

Today, all ultrasonic instruments are autoclavable and are clearly labeled as such. Cold chemical immersion of these devices is highly improper, not environmentally friendly, requires special handling in most local and state regulations, and requires a great deal of time to provide proper pathogenic and bacterial kill. By state regulations, ultrasonic instruments are considered semi- critical instruments and are required to be heat sterilized.

***Cleaning and Sterilization of Ultrasonic Devices***

For ultrasonic tips and sonic devices that are not harmed by the ultrasonic cleaning process, the items are placed in the ultrasonic cleaning unit following use as any other intra-oral instrument. Prior to doing so, the operator must don nitrile household gloves to disassemble the instrument tray, discard all disposable items, and gather all the contaminated instruments into the ultrasonic bath.

According to regulations:

All heat-stable critical and semi-critical instruments shall be cleaned before sterilization by use of an ultrasonic device. Instruments cleaned in an ultrasonic unit shall remain in the unit for no less than 10 minutes.

Instrument cassette systems (or containers) have become very popular in recent years. Dental washing machine units (such as Miele washers) hold cassette of instruments, including X-ray devices, and must run through an entire wash and dry cycle prior to removal of the cassettes from the washing unit and placed into a sterilization device. A  washing unit for cassettes does not eliminate the use of a sterilization unit.

Following ultrasonic cleaning, the items are rinsed, patted dry, and placed in sterilization/autoclave bags, sealed, and placed into a steam or chemical autoclave.

An autoclave is the only device available to sterilize instruments through the use of time, heat and pressure. Sterilization only occurs when the proper amount of  heat and pressure is applied for the proper amount of time for wrapped instruments. This is usually anywhere from 12 – 15 minutes, depending on the setting of the autoclave. ONLY through the use of an autoclave can complete microbial kill occur. Immersion into a liquid cold chemical will not produce total microbial kill.

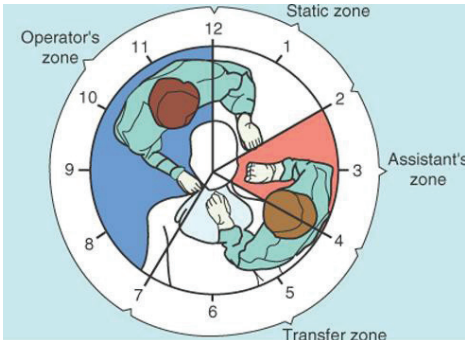
Refer to the Dental Board of California Infection Control Regulations for specific definitions of critical and semi-critical instruments, their handling, and sterilization procedures required by regulation.

## OPERATOR POSITIONING

Operator seating positions are typically the same as for hand instrumentation. The operator can be somewhat creative about seating positions, since a firm fulcrum and lateral pressure are contraindicated when using ultrasonic's. Direct vision is preferred when using an ultrasonic, since indirect vision is compromised due to the mist of the irrigant interfering with the mouth mirror. Saturating the mouth mirror with water alleviates this problem somewhat, though it has to be repeated frequently. It is also very helpful if a dry-tip or 2x2 gauze square is used to hold the upper and lower lips when working in the maxillary and mandibular anterior regions of the mouth. This makes retracting the lip easier for the practitioner, and minimizes the spray of water on the patient.

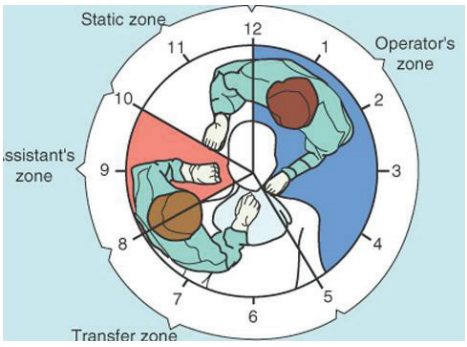
***Right-Handed Operator***

The assistant performing the ultrasonic scaling procedure will be seated in the operator chair. If right-handed, the operator's zone is between 7:00 pm and 12 midnight on the face of the clock (see illustration to indicate the correct position for the operator).




***Left-Handed Operator***

If left-handed, the operator's zone is between midnight and 5:00 am on the face of the clock as indicated in the illustration.




## ULTRASONIC SCALING TECHNIQUE

***Device Grasp***

1. Function
   a. Holding an instrument in such a manner that freedom of action, control, tactile sensitivity and maneuverability are secured.
   b. The chosen grasp should:
      1) Provide the fingertips with an increase in their tactile sensitivity.
      2) Decrease the opportunity to traumatize the tissue. Relieves fatigue of the operator's finger, hand and arm.
2. Types of instrument grasps:
   a. Pen
      1) Conventional grasp utilized for writing.
      2) Concentration of support is balanced where pads of the thumb, index and side of the third finger meet.

   b. Modified Pen:
      1) Method used to grasp the prophy handpiece
      2) Procedure
      a) Assume the pen grasp position
      b) Place the pad of the middle finger (instead of side of handpiece) close to the working end of the prophy angle.
         (a) 3rd finger is used to support handpiece.
         (b) 3rd finger is used to guide handpiece.
         (c) The handpiece may rest against the hand at any point beyond the first joint of the index finger. This depends on the area you are scaling.

It is important that you always use direct vision when scaling, keeping the margins of the band or bracket in plain sight at all times. The use of the pen grasp and a fulcrum will assist you in controlling the scaler handpiece.

***Device Types***

There are two types of scaling devices: Magnetostrictive and Piezoelectric.

The Magnetostrictive tips are composed of a stack of metal strips or rods of ferromagnetic material capable of being magnetized resulting in an elliptical or figure eight motion of the working end. This type of motion allows the use of all sides (360º) of the working tip. Heat is generated when using Magnetostrictive inserts; therefore, water is used as a cooling agent.

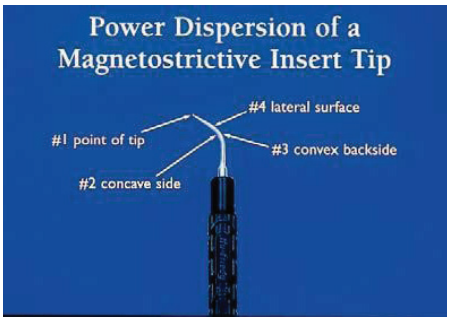



*Photo courtesy of Mosby*

Piezoelectric tips alternate electrical currents applied to reactive crystals horizontally, resulting in a linear or straight line motion. As a result, only the lateral (two) sides of the working tip are functioning. Little heat is generated when using these tips, minimizing the amount of water necessary.

When deciding whether to use the Magnetostrictive or Piezoelectric units, the advantages and disadvantages of each should be considered. Since Magnetostrictive tips operate in an elliptical motion, the tip leaves the tooth surface while it is activated, which causes a "banging" motion against the tooth structure. However, all sides of the tip can be utilized. Piezoelectric tips, with their two working sides, operate in a linear motion. This results in the tip never leaving the tooth while activated. While this makes adaptation very critical, it has been shown to result in less surface roughness. Piezoelectric tips are small and separate from the transducers (handpiece), reducing the cost of the tips and making storage easier.


*Photo courtesy of Hu-Friedly*

The Piezoelectric ultrasonic scaler is the most popular device in the dental office as it serves the hygienist very well in debridement of the gingival pocket and the assistant in the removal of orthodontic cement which can be very difficult to remove in general. The ultrasonic style and slim tip design allow for access to smaller areas in the arch.

For the purposes of cement removal, the most popular and effective ultrasonic tip to use is called the beavertail. While there are many tips to choose from, the wider the tip the more effective in handling tough zinc-phosphate orthodontic cement.


*Photo courtesy of A-dec*

***Indications and Contraindications***

Indications for using an ultrasonic scaler include:

- Positive adaptability to the surface requiring cement removal without pressure
- More timely removal of cement versus hand instrumentation
- Operating field kept clean by use of water mist

Contraindications include:

- Threat of communicable disease transmission due to contaminated aerosols
- Potential for patient concern with cardiac pacemakers; newer models of ultrasonic units contain protective measures to prevent a cardiac incident
- Demineralized areas of the teeth may lose areas of remineralization due to vibration of the ultrasonic
- Tooth sensitivity may occur in areas of exposed dentin
- Using a rougher technique may interfere with the homogeneity of the cement layer and cause increased risk of decalcification and loose bands
- The operator who uses the ultrasonic device too frequently may experience temporary or permanent tendonitis

Due to the fact that many of the patients whose teeth are being orthodontically treated are under the age of 18, it is important to work as sensitively as possible with the ultrasonic against the enamel around the bands, as young teeth and young pulps are

susceptible to over-heating and may damage newly erupted teeth as well.

The health history is always considered before utilizing an ultrasonic device. In reviewing the patient's health history, the operator and dentist should consider the following additional contraindications:

- Prosthetic joints
- Overall heart health
- Lowered immune response
- Diabetes
- Hearing aide use

***Attaching Ultrasonic Tips***

When utilizing the Magnetostrictive-type of ultrasonic device, the tips are constructed with a bundle of rods which slide into the handpiece sleeve or transducer of the unit, such as the one in this illustration. When attaching the tip into the sleeve, you should follow the following steps:

- After following all infection control and OSHA standards for PPE and tray set-up for the procedure, remove the tip from the autoclave bag;
- Make certain that water is on at the cart and at the ultrasonic unit;
- Before inserting the tip bundle into the sleeve, step on the rheostat (foot control) gently to fill the sleeve with water, then insert tip bundle into sleeve and attach.


*Photo courtesy of Biosonic*

By filling the sleeve with water at least half-way, the tip will be ready to function immediately upon activation. The rods in the bundle will overheat waiting for the sleeve to fill with water and could damage the bundle or overheat the tooth waiting for the water spray. This way, the sleeve is filled with water and the handpiece will emit a "halo" mist of water.

When utilizing the Piezoelectric-type of ultrasonic device, the tips are attached to a handpiece by simply screwing the tip onto or into the end of the handpiece. The handpiece is attached to the transducer unit, and the small tip is screwed into the working end of the handpiece, such as the one in this illustration.


*Photo courtesy of Biosonic*

***Definitions/Terms***

Transducer: A substance or device, such as a piezoelectric crystal, microphone, or photoelectric cell, which converts input energy of one form into output energy of another.

Halo: the appearance of a water halo provides the optimum cooling spray and will not create an uncontrollable amount of water into the area or the patient's mouth.

HVE: High-volume evacuator; this suction device provides the most effective suction power to handle the mist produced by ultrasonic's; is the best device to minimize the spread of contaminated particles.

***The Seated Operator and Patient***

Before beginning the procedure, the patient should be placed into the supine position, as shown in this illustration. The nose, knees and toes of the patient should be parallel with the floor. A semi-supine position, with the patient's head elevated, will cause fatigue and will not allow the operator to utilize direct vision during the procedure. The operator may not have an assistant to handle moisture control.

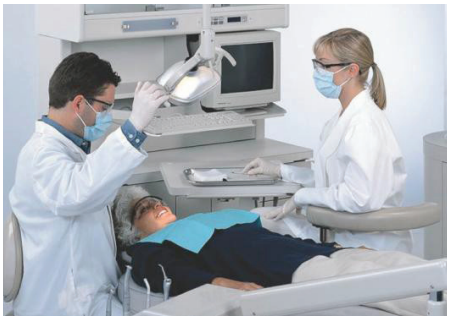


*Photo courtesy of A-dec*

During the ultrasonic procedure, the use of a saliva ejector and the HVE (high-volume evacuator) is necessary to maintain the patient's comfort as well as help reduce the amount of bacterial spray from the handpiece.

***The Banded and Bracketed Patient***

Corrective orthodontics requires the use of bands or brackets to be placed onto the middle- third of the tooth, on the facial/buccal surface, in order to hold the archwires into place. The archwire creates the forces by which the teeth are moved into another position, or stabilizes a tooth or teeth for non-movement.

***The cementation of bands or direct bonding of brackets is NOT an allowable duty for any level of dental assistant at this time.*** However, the removal of cement is allowable for a ***Registered Dental Assistant.*** Once the dentist has cemented the bands into place, the cement is allowed to harden. After the cement has reached its final stage, a scaler or hand instrument may be used to remove cement excess from around the band.

The caution: whether using a hand instrument or an ultrasonic scaler, the assistant must be cautious of the margins of the band to eliminate the possibility of loosen the band.

***Tip Movement and Operator Technique***

To minimize trauma and reduce the possibility of damaging or loosening a band or bracket, the following technique is used with ultrasonic scaling devices:

- Hold the tip at a $10^0$ - $30^0$ angle – do not use the tip of the scaling tip at any time.
- By using a flat, wide tip such as a beavertail, there are no sharp edges similar to a chisel tip or a perio tip.
- Utilize a fulcrum at all times to stabilize the hand and the handpiece. This illustration shows the third finger (ring finger) is used to establish a fulcrum. During scaling, a fulcrum should be established in the same quadrant as the area being treated.

Using rapid, light strokes in a back and forth motion, the tip is moved over the cement excess secreted from around the band. Never allow the ultrasonic tip to touch soft tissue, such as the interproximal tissues, the gingival crest, or the sulcus area.

Always use direct vision. Stay positioned in the operator's zone, preferably behind the patient's head during the procedure. To minimize trauma, the operator should always:

- Use proper technique
- Use a lower power setting on the unit
- Use a blunt-ended tip such as a beavertail
- Use a good water halo

Never do the following:

- Use a heavy hand or a heavy amount of pressure
- Use sharp tips
- Stab at to tap the tip against the cement or band
- Increase power which increases heat to save time
- Place tip onto soft tissue

Upon completion of cement removal, it is suggested that the patient brush their teeth and the operator check with floss or a floss aide to make certain that all cement in the interproximal areas has been removed.

The operator should also mouth-mirror and explorer inspection of all areas prior to asking the dentist to check the outcome of the procedure (direct supervision) and prior to dismissing the patient. The area's most likely to be missed are the distobuccal and distolingual areas of the posterior teeth.

**PROCEDURE SHEET**

Set-up:

1. Disinfection protocols are followed prior to staging the area for treatment
2. All handpiece/sleeve devices have been cleaned and prepared for receipt of a new handpiece tip
3. All protective barriers have been placed in the operatory
4. All PPE has been donned prior to handling sterilized equipment and instruments
5. All instruments and the ultrasonic tip is removed from the autoclave bag/cassette

6. The saliva ejector and the high-volume evacuator (HVE) are assembled for use during the procedure.
7. Fill sleeve with water, if using Magnetostrictive-type ultrasonic device
8. Insert tip securely or screw Piezoelectric tip to handle tightly (may require the use of an instrument wrench)
9. Check water flow; adjust as needed
10. Adjust unit settings as needed

Procedure:

1. Review health history with patient; explain procedure to patient
2. Don PPE
3. Position patient properly into the supine position; place saliva ejector and secure
4. Position self properly in the operators zone
5. Utilize a modified pen grasp to hold the ultrasonic handpiece and begin scaling
6. Utilize a fulcrum adjacent to the area being treated and within the same quadrant if possible
7. Use light strokes back and forth over cement field
8. Keep tip in motion
9. Hold tip at a $10^0$ - $30^0$ angle to the tooth
10. Keep the tip off the band or bracket
11. Keep tip from moving onto soft tissue or subgingivally
12. Use direct vision
13. Control water flow and spray field with HVE
14. Maintain patient comfort by using saliva ejector as needed
15. Remove all visible supragingival cement from around bands and/or brackets
16. Use mirror, explorer and floss to evaluate cement removal
17. Use toothbrush to brush away debris
18. Ask patient to brush teeth
19. Check for loose bands or brackets

**PROGRAM CONCLUSION**

This Ultrasonic Scaling for Orthodontic Cement Removal Certification course and the materials provided herein are intended to provide the education necessary for the user to develop strong skills as a dental healthcare worker. The producers of this material would like to thank and gratefully acknowledge the California Dental Association for its commitment to developing quality educational materials for use within the profession of dentistry.

**ACKNOWLEDGEMENTS**

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J. Productions Sacramento City College

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Thomson Learning Elsevier Saunders (Mosby) Biosonic

A-dec

Hu-Friedy

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# Laboratory, Preclinical and Clinical Instruction

**LABORATORY SESSION**

***4 Hours***

During this session, students will practice ultrasonic scaler use in the removal of orthodontic cement from around bands and or brackets on typodont teeth.

**Laboratory Instructions**

Students will work with a partner during the process of these procedures. The assisting student will observe each stage of the process for evaluation. The following is a step-by-step description of the procedures that should be followed during the laboratory practice sessions:

1. Each student will set up his/her armamentaria for ultrasonic scaler use in the removal of orthodontic cement from around bands and/or brackets on typodont teeth.
2. Student will be provided with a typodont and a bench mount and at least four posterior typodont teeth. In addition, the student will be provided with individualized packets that will include:
    a. Description of packet
    b. Assortment of typodont teeth with bands or brackets with excess cement for removal using the ultrasonic scaler
    c. All armamentarium for cement removal with an orthodontic scaler
3. Instructor will review procedures and present information on how to use the lab worksheet for ultrasonic scaler use in the removal of orthodontic cement from around bands and or brackets on typodont teeth.
4. Instructor will present criteria for ideal cement removal with an ultrasonic scaler. Instructor will demonstrate techniques and provide ideal examples that will be passed around for viewing.
5. Student will remove cement with an ultrasonic scaler from around brackets or bands on typodont teeth, partner observes, evaluates and records on worksheet.
6. Partner observes, evaluates and records on worksheet. Student will also evaluate him/herself on the procedure. Instructor evaluates the cement removal process. The entire process will continue to be evaluated on the worksheet by the student, partner/assistant and instructor.
7. Partners switch places, the operator becomes the assistant, and the assistant becomes the operator. Both students complete three typodont teeth.
8. Instructor will now present product evaluation form and how it is used to evaluate final cement removal with an ultrasonic scaler around orthodontic bands on typodont on four first molars with cemented bands.
9. Using the product evaluation form, the student operator and the student assistant and instructor grade the final cemented orthodontic bands for each other.
10. Discussion on product evaluation is conducted in small groups.

**PRECLINICAL SESSION**

***4 Hours***

During this session, students continue practice of ultrasonic scaler use in the removal of orthodontic cement from around bands and or brackets. Student partners work on each other in simulation as previously described and demonstrated by instructor. The following general procedures occur:

1. Each student will set up his/her armamentaria for ultrasonic scaler use in the removal of orthodontic cement from around bands and or brackets
2. Operatory will be set up following the infection control guidelines.
3. Medical history will be completed by student/patient prior to seating.
4. Equipment and supplies will be checked by student.
5. Student/patient will be seated and prepared for treatment.
6. Student operator will review medical history and perform a patient assessment; instructor will follow-up with same procedures.
7. Patient is given instructions/explanation of procedures.
8. Student operator will perform the following according to the stated criteria:
    a. Identify teeth with excess cement around orthodontic bands or brackets
    b. Remove cement around orthodontic bands or brackets with an ultrasonic
    c. Remove excess cement remaining supra-gingivally with no tissue damage
    d. Rinse and remove isolation products
    e. Evaluate the product
    f. Provide individualized patient education

g. Dismiss the patient

h. Make appropriate chart notes

i. Perform operatory clean-up/instrument processing according to infection control

After the student operator completes the sequence of procedures, the student operator, the assistant and the instructor will evaluate the performance of the student operator using the worksheet and product evaluation.

During this time period the following procedures will occur:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/assistant will assist, observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work/ performance using stated criteria using the worksheet and product evaluation forms. Discussion on results will be conducted.

**WRITTEN FINAL EXAMINATION**

***1 hour***

**CLINICAL INSTRUCTION**

***4 hours***

During this session, the student will practice ultrasonic scaler use in the removal of orthodontic cement from around bands on two active patients. Students will work with a partner during the process of these procedures the assisting student will observe each stage of the process for evaluation. Student operator will perform the following according to the stated criteria:

1. Each student will set up his/her armamentaria for ultrasonic scaler use in the removal of orthodontic cement from around bands and or brackets
2. Operatory will be set up following the infection control guidelines.
3. Medical history will be completed by student/patient prior to seating.
4. Equipment and supplies will be checked by student.
5. Patient will be seated and prepared for treatment.
6. Student operator will review medical history and perform a patient assessment; instructor will follow-up with same procedures.
7. Patient is given instructions/explanation of procedures.
8. Student operator will perform the following according to the stated criteria:

   a. Identify teeth with excess cement around orthodontic bands or brackets

   b. Remove cement around orthodontic bands or brackets with an ultrasonic

   c. Remove excess cement remaining supra-gingivally with no tissue damage

   d. Rinse and remove isolation products

   e. Evaluate the product

   f. Provide individualized patient education

   g. Dismiss the patient

   h. Make appropriate chart notes

   i. Perform operatory clean-up/instrument processing according to infection control guidelines

After the student operator completes the sequence of procedures, the student operator, the assistant and the instructor will evaluate the performance of the student operator using the worksheet and product evaluation.

During this time period the following procedures will occur:

1. The student/operator will evaluate his/her own work according to stated criteria using the worksheet and product evaluation forms.
2. The student/assistant will assist, observe and evaluate operator's performance according to criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work/ performance using stated criteria using the worksheet and product evaluation forms. Discussion on results will be conducted.

# Worksheets

**LABORATORY & CLINICAL PATIENT WORKSHEETS**

**General Information on Worksheets**

The student operator, student assistant, and instructor use these forms. Each of these individuals will watch the performance of the specified steps of the given procedure and then identify if any of these steps are not followed and/or inadequately performed by the student operator. During the learning process, errors can and will occur. Students and clinical instructors identify common errors encountered during each step of the entire procedure utilizing the worksheets. Worksheets are not grade sheets, but they assist the student to identify his or her own errors during performance of these steps. They are used for measuring student's progress toward attainment of clinical proficiency.

**General Procedures**

An important part of the learning experience in the process of removing cement with an orthodontic scaler is the ability to identify technique errors, understand their causes and find solutions. Equally important is to determine the degree of error and when it constitutes remedial assistance. The first step in this process is to identify the error(s). Using the Removal of Cement with an Ultrasonic Scaler Laboratory and Clinical Patient Worksheets does this. The worksheets are not grade sheets but are documents that are used to assist students in learning to identify common technique errors related to the procedures associated with removal of cement with an ultrasonic scaler. The student uses this form in the following manner:

The worksheet consists of a column titled Procedure-Laboratory and Procedure-Clinical, which is the step-by-step description of the procedures associated with removal of cement with an ultrasonic scaler. The procedures are subdivided into the following categories:

- Infection Control/Patient Safety
- Assemble Armamentaria
- Patient Considerations
- Equipment Care & Usage
- Protecting/Avoiding Damage to Components of Tooth and/or Band or Bracket
- Patient Education
- Infection Control/Patient Safety/Clean-up

**How Worksheets Are Used by Student Operator and Student Assistant**

1. When performing multiple procedures either in the laboratory or on clinical patients, all of the errors from these series are placed on one worksheet.
2. Each laboratory/clinical experience is graded in a different column.
3. When an error occurs in any of the individual steps described in the Procedure column, a check is placed in the box corresponding to the laboratory/clinical experience.

For example, on the clinical patient worksheet there would be a box for each step of the clinical practice patients. For the laboratory worksheet, there would be a box for the typodont teeth. With worksheet check-offs, the student can identify a clustering pattern of errors in any particular step. When an instructor evaluates the student's performance, he/she cannot only see how a student performs, but whether or not the student can identify errors that he/she makes.

**How the Student Identifies Cause and the Correction of Errors**

After the student identifies the error(s) performed, he/she will write the cause of the error and how it shall be rectified. The student then identifies whether the error is significant enough to require remedial assistance. During this process, the student will review the criteria for successful cement removal around orthodontic bands or brackets with an ultrasonic scaler.

**How the Instructor Uses the Worksheets**

The instructor watches the student operator during the entire process of cement removal around orthodontic bands or brackets with an ultrasonic scaler. The instructor will check the appropriate box on the same worksheet used by the student operator and the student assistant. The instructor observes both students, and then evaluates the grading completed by both students for accuracy. The instructor reviews the worksheets for information related to: cause, solution and whether any part of the procedure requires additional steps. The instructor can provide additional assistance where needed. This process of identification of errors, causes and solutions will ensure the student will progress towards clinical competence and expected course objectives will be met. This process will continue throughout all laboratory and clinical requirements. When the clinical final exam is administered the student should be clinically competent in cement removal around orthodontic bands or brackets with an ultrasonic scaler.

**Satisfactory Performances of Psychomotor Skills**

Students will practice psychomotor skills during the laboratory and preclinical sessions until they reach a competence level of 75% utilizing the documented criteria evaluated using the behaviorally anchored rating scale. Students must achieve a passing score on a minimum of two typodont teeth or natural teeth before progressing on to successive laboratory, preclinical and clinical sessions.

# Worksheet – Laboratory/Preclinical

**ULTRASONIC SCALING FOR CEMENT REMOVAL**

Date:

Student/Operator Name:

Student/Assistant Name:

Faculty Name:

Cement removal on minimum of 2 banded first molars. Record tooth number(s):

*** = Critical Error**

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, ultrasonic scaler | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| 5. Ultrasonic scaler | | | |
| 6. Ultrasonic scaler tip/insert | | | |
| 7. Isolation products-long and short cotton rolls, cheek retractors, tongue guard/ etc. | | | |
| 8. Typodont with appropriate teeth and bench mount/pole | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Verify Teeth for Cement Removal | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 9. Verify teeth for cement removal* | | | |
| 10. Use ultrasonic scaler/tip to safely remove the cement from the tooth with light sweeping movement to preserve integrity of hard and soft tissue* | | | |
| 11. Primary focus is patient safety; maintain integrity of hard and soft tissue and prevention of swallowed or aspirated cement and or water* | | | |
| 12. Teeth that have restorations takes special care when removing cement* | | | |
| ***Identify Excess Cement*** | | | |
| 13. Use an instrument to "feel" for visual inspection may not be reliable* | | | |
| 14. Use explorer to detect residual cement* | | | |
| 15. Inspect the interproximal areas where excess cement may be hiding* | | | |
| ***Remove Excess Cement*** | | | |
| 16. Use modified pen grasp to remove excess cement with a sweeping motion using an ultrasonic scaler while employing a secure fulcrum* | | | |
| 17. Suction small fragments as they are removed as well as remove water* | | | |
| 18. All excess cement is removed with out damage to hard or soft tissue around bands and brackets supra-gingivally* | | | |
| 19. Check for loose bands or brackets* | | | |
| 20. Rinse and suction remaining debris* | | | |
| 21. Remove any remaining isolation materials and rinse well* | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 22. Give post-operative instructions to the patient or parent | | | |
| 23. Document procedure in patient chart to include: date, HH review or update, teeth where cement was removed, problems encountered, operator signature, and instructor or DDS signature | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 24. Surface disinfect | | | |
| 25. Prepare and institute sterilization procedures | | | |
| 26. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 27. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Worksheet – Clinical Patient

**ULTRASONIC SCALING FOR CEMENT REMOVAL**

Date

Student/Operator Name

Student/Assistant Name

Faculty Name

Circle one: Patient #1 Patient #2

Patient Name

Cement removal on minimum of 2 banded first molars. Record tooth number(s):

Use this worksheet to identify errors in procedures. Place a check mark in the box each time a step in the procedure is incorrectly performed or omitted. After each section, the instructor will check before the student continues with the following section.

| Infection Control/Armamentarium | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| ***Infection Control/Patient Safety*** | | | |
| 1. Barriers placed on chair, unit, air-water syringe, HVE, saliva ejector, ultrasonic scaler | | | |
| 2. PPE: mask, gloves, scrubs, gown, eye wear, patient safety glasses | | | |
| ***Assemble Armamentaria*** | | | |
| 3. Basic set-up: mirror, explorer, cotton pliers | | | |
| 4. Air-water syringe, syringe tip, HVE, saliva ejector | | | |
| 5. Ultrasonic scaler | | | |
| 6. Ultrasonic scaler tip/insert | | | |
| 7. Isolation products-long and short cotton rolls, cheek retractors, tongue guard/ etc. | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Verify Teeth for Cement Removal | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 8. Verify teeth for cement removal* | | | |
| 9. Use ultrasonic scaler/tip to safely remove the cement from the tooth with light sweeping movement to preserve integrity of hard and soft tissue* | | | |
| 10. Primary focus is patient safety; maintain integrity of hard and soft tissue and prevention of swallowed or aspirated cement and or water* | | | |
| 11. Teeth that have restorations takes special care when removing cement* | | | |
| ***Identify Excess Cement*** | | | |
| 12. Use an instrument to "feel" for visual inspection may not be reliable* | | | |
| 13. Use explorer to detect residual cement* | | | |
| 14. Inspect the interproximal areas where excess cement may be hiding* | | | |
| ***Remove Excess Cement*** | | | |
| 15. Use modified pen grasp to remove excess cement with a sweeping motion using an ultrasonic scaler while employing a secure fulcrum* | | | |
| 16. Suction small fragments as they are removed as well as remove water* | | | |
| 17. All excess cement is removed with out damage to hard or soft tissue around bands and brackets supra-gingivally* | | | |
| 18. Check for loose bands or brackets* | | | |
| 19. Rinse and suction remaining debris* | | | |
| 20. Remove any remaining isolation materials and rinse well* | | | |

**STOP! REMINDER INSTRUCTOR CHECKS PRIOR TO PROCEEDING TO NEXT SECTION.**

**Comments:**

| Patient Education | Operator Evaluator | Assistant Evaluator | Faculty Evaluator |
|---|---|---|---|
| 21. Give post-operative instructions to the patient or parent | | | |
| 22. Document procedure in patient chart to include: date, HH review or update, teeth where cement was removed, problems encountered, operator signature, and instructor or DDS signature | | | |
| **Infection Control/Patient Safety/Clean-Up** | **Operator Evaluator** | **Assistant Evaluator** | **Faculty Evaluator** |
| 23. Surface disinfect | | | |
| 24. Prepare and institute sterilization procedures | | | |
| 25. Manage PPE: gloves, mask, gown, scrubs, eye wear and patient safety glasses | | | |
| 26. Unit is checked for completion | | | |

**Comments:**

**STUDENT OPERATOR EXPLANATION OF CHECKMARKS**

Procedure #s

Cause(s)

Solution(s)

Re-do? Yes No Tooth #s

# Product Evaluation Forms

**ULTRASONIC SCALING FOR CEMENT REMOVAL**

**General Procedures**

Product evaluation evaluates the end result of any performance, not the steps. This facility utilizes the behaviorally anchored rating scale (BARS) system. This 10-point system clusters the critical incidents into categories. The instructor can score objectively the end result of cement removal with an ultrasonic scaler by choosing the criteria specified in each point level. Performance is assessed according to established criteria for each of these procedures. The points are then converted to a pass or fail grade.

**How Instructor Uses Product Evaluation Form**

A product evaluation form will be used for each patient. In the "scores" area on the form you will note that an open box rather than specific grids occurs. This open box allows you to enter a score for each of the posterior first molars.

**The student must maintain a minimum point value of 7.5 on all clustered critical incidences per tooth. He/she must receive this minimum score for all four posterior first molars selected for cement removal with an ultrasonic scaler in order to pass this module. A grade of 7.5 represents a 75% passing score.**

**Product Evaluation Point Conversion**

The student will receive points for a given level of achievement from the point scale utilized for product evaluation.

**POINT SYSTEM TO A PASS/ FAIL SCORE**

***Conversion***

| Points | Grades |
|---|---|
| **10** | ➨ Pass-Excellent |
| **7.5** | ➨ Pass |
| **5** | ➨ Fail-Critical Error(s) |
| **3** | ➨ Fail-Critical Errors-no concept |

# Product Evaluation/Practical Examination – Lab Session

**ULTRASONIC SCALING FOR CEMENT REMOVAL**

Student Name:

Patient Name: Typodont

**Minimum number of satisfactory performances:**

3 banded first molars for cement removal. Record tooth number(s):

*** = Critical Error**

| VERIFY TEETH/IDENTIFY CEMENT FOR REMOVAL | | | | |
|---|---|---|---|---|
| Date: | Grade Received: | Pass | Fail | Faculty: |

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Excess cement verified*<br>B. Teeth identified* | | |

**REMOVAL OF EXCESS CEMENT**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Excess removal was accomplished*<br>B. No evidence of damage to hard or soft tissue or to band or bracket* | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Preclinical Session

**ULTRASONIC SCALING FOR CEMENT REMOVAL**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

3 banded first molars for cement removal. Record tooth number(s):

*** = Critical Error**

**VERIFY TEETH/IDENTIFY CEMENT FOR REMOVAL**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Excess cement verified*<br>B. Teeth identified* | | |

**REMOVAL OF EXCESS CEMENT**

Date: Grade Received: Pass Fail Faculty:

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Excess removal was accomplished*<br>B. No evidence of damage to hard or soft tissue or to band or bracket* | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation/Practical Examination – Clinical Session

**ULTRASONIC SCALING FOR CEMENT REMOVAL**

Student Name:

Patient Name:

**Minimum number of satisfactory performances:**

3 banded first molars for cement removal. Record tooth number(s):

*** = Critical Error**

| VERIFY TEETH/IDENTIFY CEMENT FOR REMOVAL | | | | |
|---|---|---|---|---|
| Date: | Grade Received: | Pass | Fail | Faculty: |

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Excess cement verified*<br>B. Teeth identified* | | |

| REMOVAL OF EXCESS CEMENT | | | | |
|---|---|---|---|---|
| Date: | Grade Received: | Pass | Fail | Faculty: |

***The following areas reflect the errors made that indicate a reduction in the grade.***

| Areas | Scores | Comments |
|---|---|---|
| A. Excess removal was accomplished*<br>B. No evidence of damage to hard or soft tissue or to band or bracket* | | |

**GRADING KEY: 10 = PASS-EXCELLENT | 7.5 = PASS | 5 = FAIL-CRITIAL ERRORS | 3 = FAIL-CRITIAL ERRORS NO CONCEPT**

Student Signature: Date:

Instructor Signature: Date:

# Product Evaluation Documented Criteria

| VERIFY TEETH & IDENTIFY CEMENT | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ All teeth are identified with excess cement<br>➨ All excess cement is identified<br>➨ Proper use of explorer and or floss used to identify<br>➨ Uses modified pen grasp<br>➨ Uses stable fulcrum |
| **7.5 Points** | ➨ All teeth are identified with excess cement<br>➨ Almost all excess cement is identified<br>➨ Proper use of explorer and or floss varies slightly from ideal<br>➨ Uses modified pen grasp quite well<br>➨ Uses stable fulcrum most of the time |
| **5 Points** | ➨ All teeth are not identified with excess cement<br>➨ All excess cement is not identified<br>➨ Proper use of explorer is not employed<br>➨ Uses modified pen grasp only part of the time<br>➨ Does not use stable fulcrum consistently |
| **3 Points** | ➨ All teeth are not identified with excess cement<br>➨ All excess cement is not identified<br>➨ Does not use explorer or floss for identification of cement<br>➨ Does not use modified pen grasp<br>➨ Does not use a fulcrum at any time |

# Product Evaluation Documented Criteria

| CEMENT REMOVAL | |
|---|---|
| ***Evaluation Criteria*** | |
| **Points** | **Description** |
| **10 Points** | ➨ Uses a modified pen grasp in the use of the ultrasonic tip<br>➨ Uses a light sweeping motion while using the ultrasonic tip<br>➨ Remains supra-gingivally while using the ultrasonic tip<br>➨ Uses fulcrum<br>➨ Manages water flow<br>➨ Uses HVE to control debris and water in oral cavity<br>➨ No loose bands detected at the end of cement removal |
| **7.5 Points** | ➨ Uses a modified pen grasp adequately while using ultrasonic<br>➨ Uses a light sweeping motion but varies slightly<br>➨ Remains supra-gingivally while using the ultrasonic tip<br>➨ Uses fulcrum adequately<br>➨ Manages water flow adequately<br>➨ Uses HVE to adequately control debris and water<br>➨ No loose bands detected at the end of cement removal |
| **5 Points** | ➨ Does not use a modified pen grasp while using ultrasonic<br>➨ Does not use a light sweeping motion while using the ultrasonic<br>➨ Does not remain supra-gingivally while using the ultrasonic<br>➨ Does not use a fulcrum<br>➨ Does not manage water flow, too much water<br>➨ Does not use HVE well to control debris and water<br>➨ A few loose bands are detected |
| **3 Points** | ➨ Does not use a modified pen grasp while using ultrasonic<br>➨ Does not use a light sweeping motion while using the ultrasonic Does not remain supra-gingivally while using the ultrasonic<br>➨ Does not use a fulcrum<br>➨ Does not manage water flow, too much water<br>➨ Does not use HVE well to control debris and water<br>➨ Loose bands are detected |

# Course Requirements

The following is an overview of the course requirements and the protocol followed for laboratory and clinical practice, the written and clinical examination.

**Minimum Number of Satisfactory Performances**

All students will perform at a minimum the following procedures in order to achieve minimum competence in the various protocols used in the removal of cement with an ultrasonic scaler:

On a typodont and patients, the student will perform the following under OSHA and DBC guidelines:

- On the typodont: Complete cement removal at the very least on four posterior first molars a minimum of two times, with one used for a practical exam according to the specified criteria.
- On the patient: identify teeth with excess cement that will be removed with an ultrasonic scaler using proper technique with the focus on safety and comfort of the patient, as well as staying supra-gingivally with no damage to hard or soft tissue. Removing excess cement on four posterior first molars on at least two patients according to the specified criteria with one of each of the four times used for a practical examination with 75% accuracy.

Students are required to meet the specified minimal number of satisfactory performances as indicated above. The student operator grades his/her own performance, the student assistant grades the performance of the student operator and the instructor will assess the student operator's performance and the grading method of both students.

When the student reaches the 75% minimum performance for cement removal with an ultrasonic scaler and 100% performance on all infection control protocol, the instructor evaluates the procedure for the minimal number of satisfactory performances. If a student does not fulfill the minimum grade for the number of satisfactory performances additional laboratory and/or clinical practice procedures will be assigned.

**Objective Evaluation Criteria**

Objective evaluation criteria shall be provided to each student prior the performance of any procedure. The student will receive information provided by the instructor prior to performing any laboratory or clinical procedures. The instructor shall supply the student with general program, individualized cognitive and psychomotor objectives and criteria for evaluation. Objective criteria will be utilized in the performance of all laboratory and clinical requirements.

***Preparation Prior to Cement Removal with an Ultrasonic Scaler***

1. Will review the medical/dental history, make a general assessment, and oral inspection on each patient prior to treatment, checking for information that may contraindicate the performance of the procedure
2. Will set up the required armamentaria for removal of excess cement around bands or brackets with an ultrasonic scaler
3. Will use aseptic techniques according to OSHA and DBC throughout performance on all patients
4. Will place protective barriers, seat and position the patient
5. Will evaluate the teeth for cement removal with an ultrasonic scaler
6. Will explain to patient the treatment planned for that day
7. Will perform cement removal with an ultrasonic scaler
8. Will isolate four posterior first molars in preparation for cement removal with an ultrasonic scaler on two patients

***Verify Teeth with Excess Cement and Identify Cement Criteria***

1. Verify teeth with excess cement and identify cement.
2. Will remove excess cement using appropriate armamentarium (ultrasonic scaler).
3. Will proceed safely and with the patient's comfort as a primary focus as well as preventing damage to hard and soft tissues while staying supra-gingivally.
4. Will identify special circumstances that require adaptation to treatment to ensure no damage results to tissues or restorations.

***Removal of Cement with Ultrasonic Scaler Criteria***

1. Will remove excess cement with an ultrasonic scaler around bands and brackets
2. Will explore areas where excess cement will be found
3. Will remove excess cement supra-gingivally with an ultrasonic scaler
4. Care will be taken to use a stable fulcrum
5. Care will be taken while using a light sweeping motion with the ultrasonic scaler when removing excess cement
6. Will be meticulous in monitoring debris to prevent swallowing or aspirating residual cement
7. Will take care not to injure soft or hard tissues

**General Criteria**

1. Will provide pertinent and individualized patient education
2. Will provide follow up appointment as identified in the treatment plan
3. Will meet ethical and legal requirements for this procedure
4. Will provide accurate chart entries for this procedure
5. Will utilize OSHA and DBC guidelines for instrument processing, removing waste and cleaning/disinfecting treatment area

The above criteria will be used to evaluate and assess appropriate removal of cement around orthodontic bands and brackets while using the ultrasonic scaler

with a minimum of 75% accuracy for laboratory and clinical patients.

**General Clinical Practice Protocol**

Students will complete procedures on two clinical patients. The following general procedures will occur:

***Patient Selection Criteria***

The following criteria must apply for each patient:

1. Patient must be an active orthodontic patient
2. Patient must be in good health (medical history form will be completed prior to treatment, reviewed and approved by the instructor)
3. Each patient will have a minimum of four posterior first molars with bands

The student will function as an operator, an assistant and a patient. Working as partners (operator and assistant) an operator will perform the procedure, the assistant will observe, and evaluate each step of the procedure. When complete each student will do the procedure, observe and evaluate.

The following general procedures will occur for each of the patients:

1. Operatory will be set up following the infection control guidelines
2. Medical history will be completed by the patient prior to seating
3. Equipment and supplies will be checked by the student
4. Patient will be seated and prepared for treatment
5. Student operator will review the medical history and perform a visual exam
6. The instructor will review the medical history and perform a visual exam
7. Instructor will accept the patient for cement removal with an ultrasonic scaler
8. Student operator will perform the following according to the stated criteria:
    a. Identify teeth with excess cement around orthodontic bands or brackets
    b. Remove cement around orthodontic bands or brackets with an ultrasonic
    c. Remove excess cement remaining supra-gingivally with no tissue damage
    d. Rinse and remove isolation products
    e. Evaluate the product
    f. Provide individualized patient education
    g. Dismiss the patient
    h. Make appropriate chart notes
    i. Perform operatory clean-up/instrument processing according to infection control guidelines

After removing excess cement with an ultrasonic scaler procedures, the student operator, student assistant and the instructor complete evaluation using the worksheet and product evaluation form.

During this time period, the following will occur:

1. Student operator will evaluate his/her own work according to stated criteria using worksheet and product evaluation forms.
2. Student assistant will assist, observe, evaluate operator's performance according to stated criteria using the worksheet and product evaluation forms.
3. The instructor will evaluate both students' work according to stated criteria using the worksheet and product evaluation forms. Results will be discussed.

A 75% must be obtained for passage of removal of cement around orthodontic bands or brackets with an ultrasonic scaler on a practice patient and a minimum of two clinical patients.

**General Examination Protocol**

***Written Examination***

A comprehensive written examination of 20 questions on the entire curriculum will be administered. The student must receive a minimum score of 75% on the examination to pass the class. One hour has been reserved for the written examination.

***Clinical Final Examination***

The clinical final examination occurs during the process of working on the two active orthodontic patients during the removal of excess cement with an ultrasonic scaler on four posterior first molars following patient selection criteria and procedures outlined in the module's clinical practice protocol.

# Written Examination

1. Which of the following would be considered a contraindication of using an ultrasonic scaler?
   a. Pregnancy
   b. Vitamin deficiency
   c. Headache
   d. Pacemaker
2. Which of the following would be considered the best position of utilizing a fulcrum during ultrasonic scaling?
   a. The tongue
   b. The lip
   c. The vestibule
   d. The adjacent tooth
3. Which is the most commonly used and preferred ultrasonic tip to use for orthodontic cement removal?
   a. Chisel
   b. Perio
   c. Beavertail
   d. None of the above
4. At what angle range should the operator use for tip placement in scaling off cement?
   a. 18 - 25 degrees
   b. 20 - 30 degrees
   c. 10 - 30 degrees
   d. 15 - 30 degrees
5. Which stroke pattern is to be used with the ultrasonic tip in removing cement?
   a. Up and down
   b. Side to side
6. Which term best describes the amount of water to be used as a coolant for the ultrasonic handpiece?
   a. Stream
   b. Halo
   c. Flood
   d. Maximum
7. When removing orthodontic cement, the ultrasonic tip should be placed where?
   a. On the enamel of the tooth
   b. On the band
   c. On the bracket
   d. On the cement
8. The tip of the ultrasonic scaler is always to reach under the sulcus.
   a. True
   b. False
9. The area most missed by the use of an ultrasonic scaler for cement removal is where?
   a. The distobuccal and distolingual surfaces of posterior teeth
   b. The distobuccal and distolingual surfaces of anterior teeth
   c. The mesiobuccal and mesiolingual surfaces of posterior teeth
   d. None of the above
10. What device will provide the maximum control/prevention measure during the spread of contaminated mist when using the ultrasonic handpiece?
    a. Saliva ejector
    b. Rubber dam
    c. HVE
    d. Patient bib
11. Using correct water flow and speed settings will _____ the potential for trauma during ultrasonic cement removal.
    a. Increase
    b. Decrease
    c. Not change
12. The use of _____ during scaling procedures will help reduce the level of bacterial contamination in the operatory?
    a. Surface barriers
    b. Alcohol
    c. Piezoelectric scalers
    d. None of the above

13. Which scaling device is made up of rods of ferromagnetic material which when magnetized create an elliptical motion of the tip?
    a. Magnetostrictive
    b. Piezoelectric
14. Which scaling device alternates electrical currents resulting in a linear or straight-line motion of the tip?
    a. Magnetostrictive
    b. Piezoelectric
15. Demineralized areas of the teeth may lose areas of remineralization due to_____ of the ultrasonic?
    a. Vibration
    b. Water
    c. Pressure
    d. Air
16. Under what level of supervision may a dental assistant perform ultrasonic scaling for cement removal?
    a. Direct
    b. General
    c. None of the above
17. Which edge of the ultrasonic tip should the operator use?
    a. Dull or flat
    b. Sharp or point
    c. None of the above
18. The correct operator zone for a right-handed operator would be:
    a. 6:00 - 10:00
    b. 7:00 - 12:00
    c. 12:00 - 5:00
    d. 12:00 - 4:00
19. The operator should always use _____ vision when using an ultrasonic scaler.
    a. Indirect
    b. Direct
20. Placing the patient in the _____ position will increase operator fatigue.
    a. Supine
    b. Sub-supine
    c. Semi- supine

# Written Examination Answer Key

1. d
2. d
3. c
4. c
5. b
6. b
7. d
8. b
9. a
10. c
11. b
12. a
13. a
14. b
15. a
16. c
17. a
18. b
19. b
20. c

# Module 8

## Updates in Orthodontics

The following sections on CBCT, Clear Aligners, Intraoral Scanning and Lasers may be helpful as supplemental material to that which is covered in the Orthodontic Assistant Permit program. While it has not historically been content that is tested over, you may find it helpful for assistants in your office to have this knowledge base and understanding of newer concepts and technology now routinely used in the orthodontic office.

# The use of CBCT (Cone Beam Computerized Tomography) in the Orthodontic Office

*By: Melanie Parker, DDS, MS*
*Edited by: Sunil Kapila, BDS, MS, PhD*

**Background and Technology**

Cone beam computerized tomography (CBCT) is by definition a form of computerized tomography. In a single rotation the region of interest is scanned by a cone-shaped x-ray beam around the vertical axis of the patient's head. Developed primarily for use in dentistry, CBCT is a less sophisticated and lower radiation form of 3-dimensional radiography, i.e. CAT scan. First developed in Europe in 1998, it was approved for use in the US in 2001. It is increasingly being used for diagnosing, treatment planning and research.

2D images are comprised of subunits called Pixels (picture elements); 3D images are comprised of Voxels (volume elements). Voxels posses the attributes of size-.1-.4mm, location-x, y, and z, and a grayscale value between 12 bits (4,096 shades of gray) and 14 bits (16,384 shades of gray. The monitor is a 2D 8-bit display (256 shades) so the data must be viewed using a software technique called "windowing" to allow the image to be visualized in full, 8 bits at a time. Software allows the entire volume to be analyzed, rotated, viewed from any orientation or cut into meaningful slices or densities.

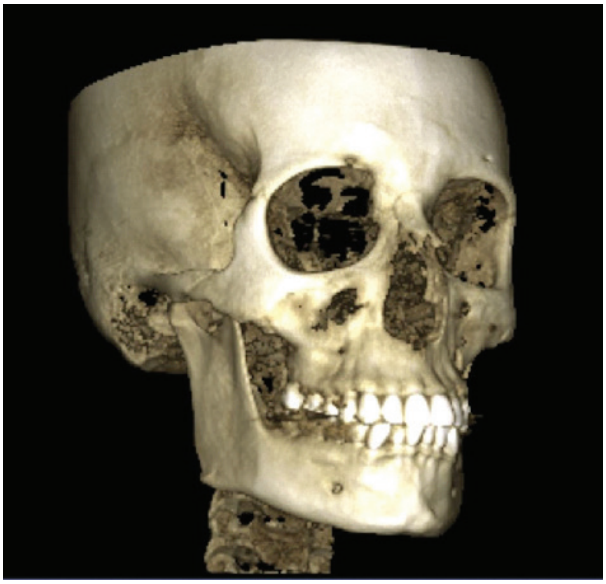


*Figure 1: A 3-D rendering of a skull.*

*Figure 2: A 3-D unit in use.*

**Radiation Exposure**

A discussion of dose outside the context of biological harm has little relevance to patient care; therefore we focus on effective dose, a quantity with direct correlation to biological risk. Different tissues absorb radiation differently. The thyroid gland is particularly susceptible to the effects of ionizing radiation.

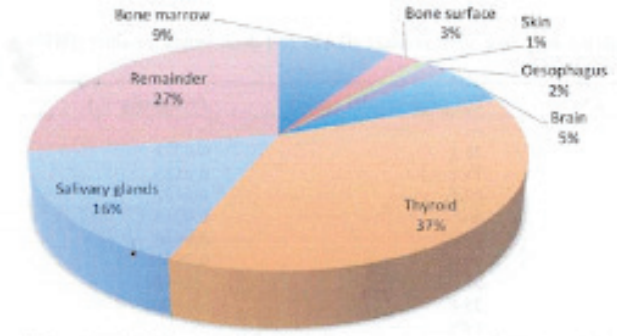



Figure 1 Distribution of effective dose components in an adult phantom for large field of view dental CBCT.

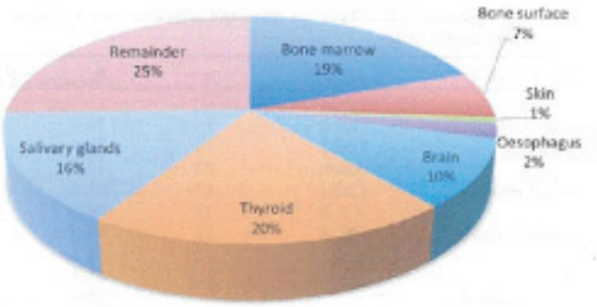



Figure 2 Distribution of effective dose components from large or medium field of view CBCT imaging of a child phantom

Equivalent dose is absorbed dose adjusted for the attenuating quality of the radiation that is involved. It is expressed in international units, Sieverts, or for diagnostic imaging, more commonly, microsieverts (μSv).

**Exposure in μSv**

| | |
|---|---|
| Intraoral radiograph PA (per exposure) | up to 8.3 μSv |
| Dental panoramic radiograph | 9-26 |
| Full mouth series | 35-388 |
| Cone beam (dentoalveolar) | 5-38 |
| Cone beam (craniofacial) | 68-599 |
| Medical fan beam CT scan (max and Mand) | 2000 |
| US trans-continental flight | 2.19 |
| Annual background radiation from natural sources | 3.1 |

2/3 from inhaled radon and thoron gasses, 1/3 from cosmic, terrestrial and internal sources

****Field of View (FOV)

How much is too much? Children are at greater risk from ionizing radiation than adults. Sensitive tissues such as thyroid, eyes and brain are closer to dental exposure than they are in adults, growing tissue is more radiosensitive and there is greater risk for accumulated lifetime dose because of increased lifespans. There is substantial evidence for a dose related response to ionizing radiation in the form of cancer developing years after initial exposure leading to the linear-non-threshold model. This means that the more exposure you have, the greater the risk of developing cancer, however there is no measurable threshold that leads to cancer equally. It may be different between different people, tissue types, ages, and times. It has been suggested that as many as 1.5-2% of cancers in the US may be related to x-ray exposure from CT imaging.

The ICRP (International Commission on Radiological Protection) recommends a limit of a total effective dose equivalent of .05 Sv per year for the whole body, which equals 50,000 μSv.

It is important to be conservative when considering which images to take. ALARA (As Low as Reasonably Achievable) Principals should be followed to minimize the "attributable lifetime radialtion risk". The use of the x-ray should be justifyable, the image should be optimized so that you learn as much as you can from the image, and the dose should be limited so that you are giving the lowest dose in order to collect the information you need.

**2D vs. 3D Radiography**

The limits of 2-dimensional radiography include magnification, geometric distortion, superimposed structures and inconsistent head position. Additionally, a great deal of area that may contain significant information is left uncaptured. The types of cases that CBCT could be the greatest advantage include ectopic teeth, impacted teeth, supernumerary teeth, bony defects, volumetric analyses including the airway, pathology including conditions outside of the dental field of view, TMD and the diagnosis and placement of implants. It is not uncommon to see findings on a 3-D image that was undetected on a 2-D image, and some doctors find it helpful to have a radiologist review the scan.

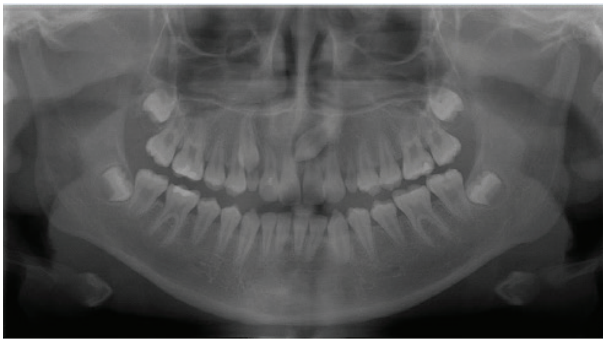


*Figure 4: A panoramic of an ectopic cuspid.*

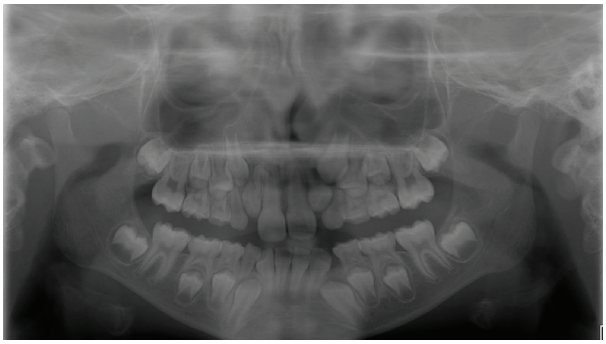


*Figure 6: A panoramic image of a patient with a supernumerary tooth.*

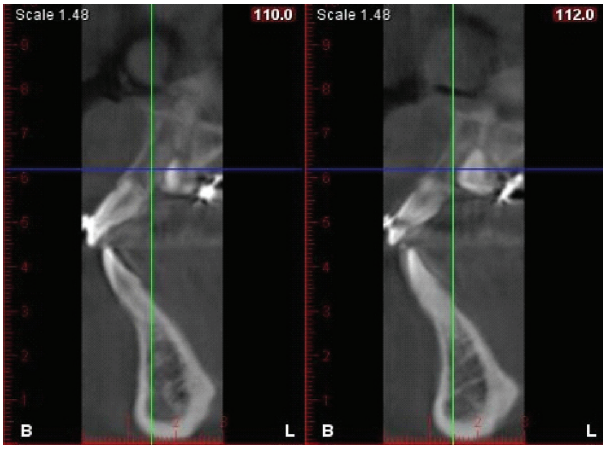



*Figure 5: A cross-section of the same patient showing the damage to the root of the central incisor using CBCT.*

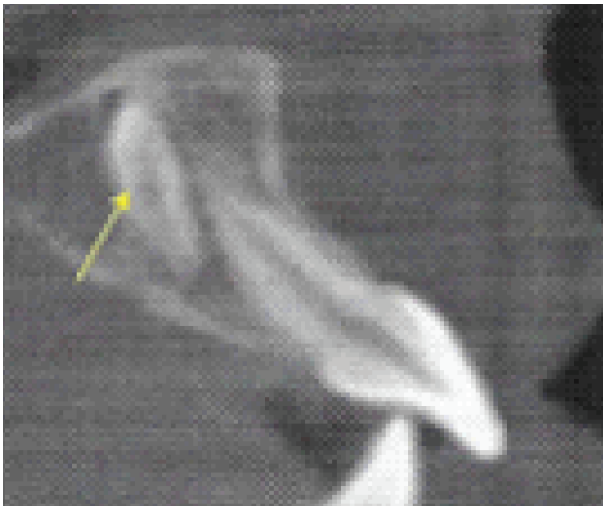


*Figure 7: A cross-section from a 3-D image of the same tooth showing it's location relative to the root of the central incisor.*

*Figure 8: A panoramic of a patient with an impacted 3rd molar.*

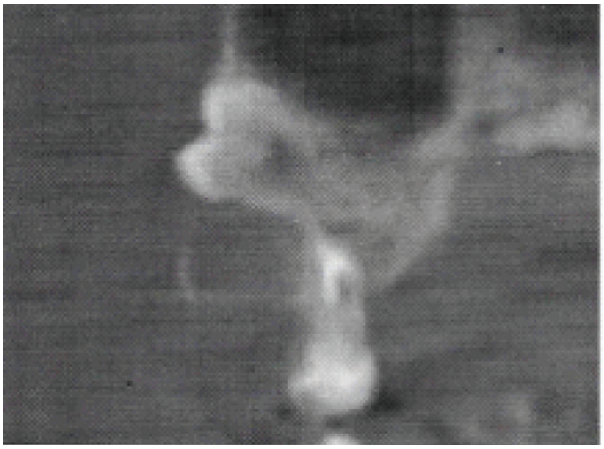
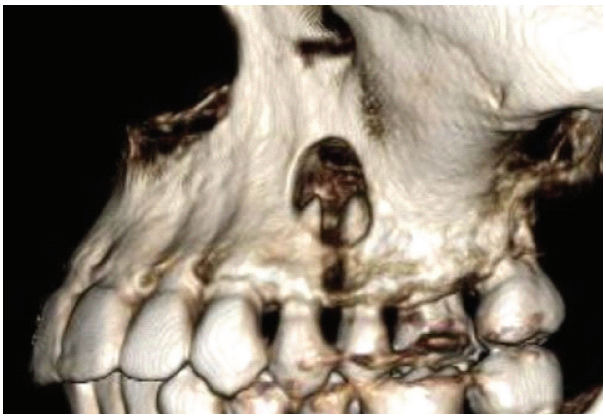


*Figure 9: A cross-section of the impacted molar.*



*Figures 10 & 11: 3-D renderings showing the shape of bony defects. The image on the left is the result of periodontal disease. The image on the right is a lesion of endodontic origin.*

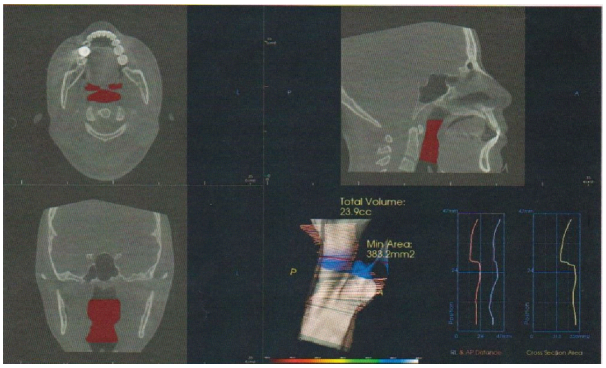



*Figure 12: A 3-D volumetric analysis of a normal airway.*

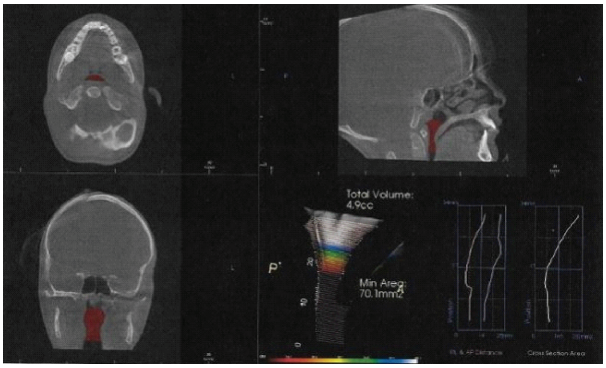



*Figure 13: A volumetric analysis of a narrow airway. This patient could be at risk of having sleep apnea.*

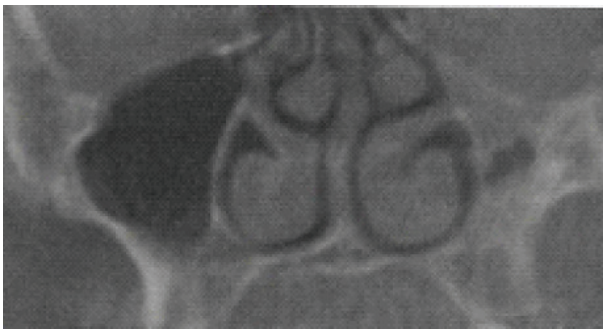


*Figure 14: This patient has abnormal sinus morphology on their left side.*

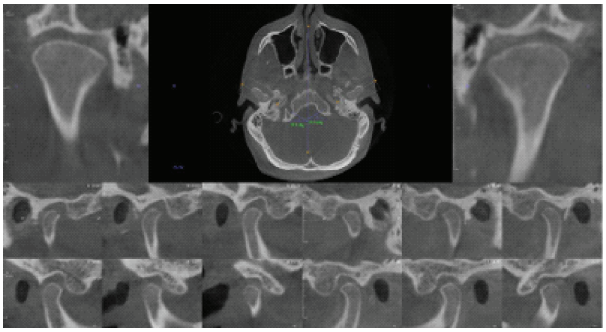


*Figure 15: Normal Temporomandibular joints*

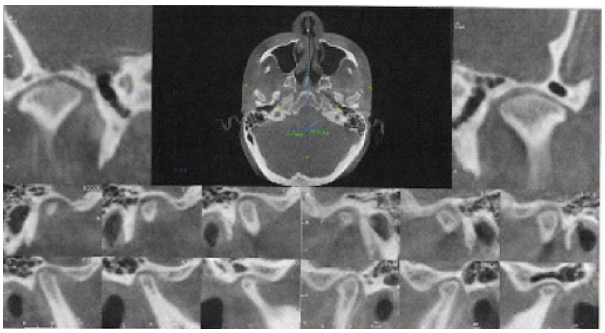


*Figure 16: Degenerated joints associated with Temporomandibular Joint Disease (TMD).*

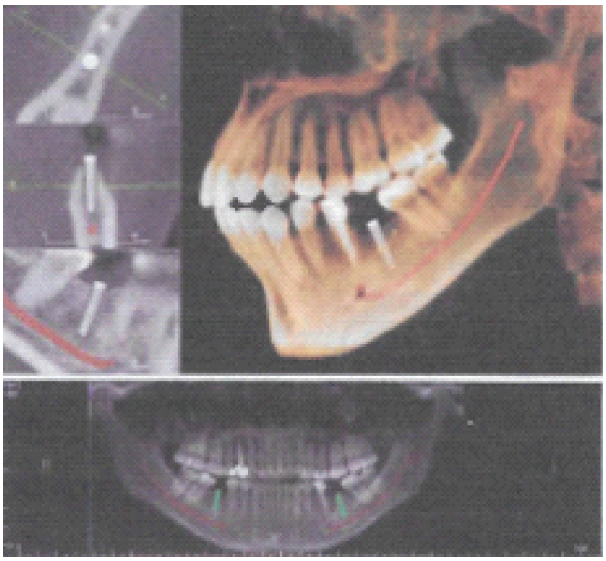


*Figure 17: 3-D CT used in preparation for implant placement.*

**Qualifications:**

In California you must have achieved your Radiation Certificate in order to take any x-ray, including CBCT images. It is also necessary to be adequately trained on the specific machine you will be using.

# Intraoral Scanning in Orthodontics

*By: Rita Chuang, DDS, MS*

- The accuracy of digital models made from intraoral scans has been shown to be as accurate as plaster models made with traditional impression techniques; thus, digital models are acceptable for orthodontic diagnostic procedures.
- A key advantage of digital technology is that it eliminates or minimizes the need to send impressions or poured models to the laboratory via mail or courier. Once the digital file is uploaded, it can be transferred to the lab with a click for model or appliance fabrication.
- Intraoral scans can be used for fabrication of orthodontic study models, aligners and other appliances, as well as indirect bonding trays.

**Background**

In 2001, technology became available for the production of 3D digital models, indirect bonding trays and virtual occlusal setups. Initially, either stone models or polyvinyl siloxane (PVS) impressions were sent to the scanning center, where the model or impression was scanned. The data was processed into a digital file that was downloaded into the practitioner's office network. In 2008, the first in-office digital impression system capable of full-arch intraoral scanning became available. By 2011, clinicians could submit 3D scans in lieu of PVS impressions for fabrication of aligners.

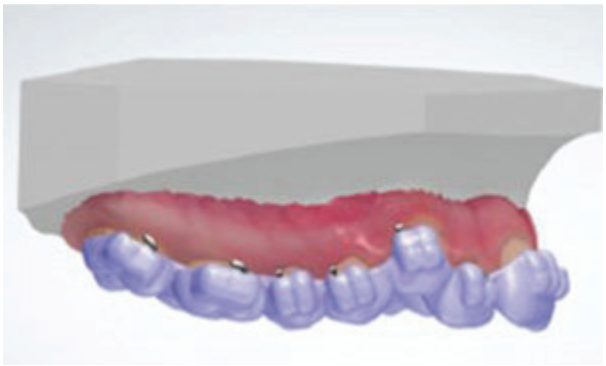


*Figure 18: This rendering of an indirect bonding tray for a lingual appliance using Trios 3 Shape software demonstrates one of the uses of three-dimensional (3D) imaging in orthodontic treatment. The appliance can be fabricated via 3D printing technology.*

**Intraoral Scanning Overview**

One of the initial drawbacks of 3D intraoral scanning was the need to apply a titanium dioxide powder to the dentition prior to scanning to ensure that light from the scanner was reflected back to the scanner wand in a uniform and predictable manner. The powder was considered objectionable by some patients. As long as the structures to be scanned are relatively clean and dry, many of the current intraoral scanners no longer require the application of powder.

Here is a brief description of dental scanning technologies:

- **Triangulation:** Optical triangulation measures distances to objects without physically touching them. It is useful in acquiring data within a few microns from delicate, wet or soft materials, as are found in the oral cavity. Laser technology is used to calculate distances from the scanner wand sensor to the object using Pythagorean geometric principles.
- **Active Wavefront Sampling:** This system utilizes a 3D-in-motion technique. It captures the 3D data in a video sequence and models the data in real time. Because it does not rely on a laser and triangulation techniques, it is thus faster and eliminates the downsides of distortion and optical illusion. It can create an onscreen virtual model almost instantaneously.

- **Parallel Confocal Imaging:** Using a system of "point and stitch" reconstruction, laser light bounced off the target surface is reflected back to the sensor. The resulting data is used to construct thousands of tomographic slices that are assembled into a picture of the target object.
- **Accordion Fringe Interferometry:** This system utilizes two beams of laser light that create three projected patterns—called fringe patterns—that strike the target surface and take on new fringe patterns. The distortion in the original pattern is detected by a high-definition video camera, which forms the 3D image.

*Figure 19: Diagnostic procedures and measurements once done by hand can now be processed digitally using three-dimensional (3D) imaging. This is an example of linear measurements taken with a 3D OrthoAnalyzer program (3Shape, Warren, New Jersey).*

All of the current dental scanners offer acceptable accuracy for orthodontic utilization, most record their data in stereolithography (STL) files.

**Scanning in Orthodontics**

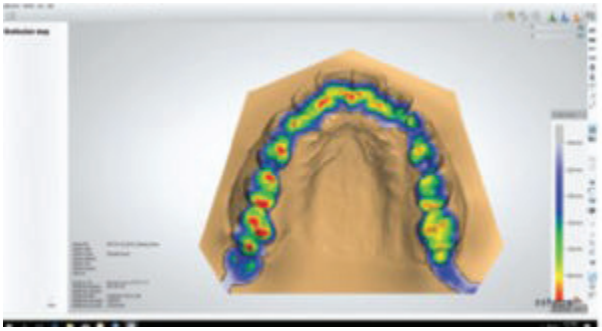


*Figure 20: An example of an occlusal contact representation form created with specialized orthodontic software.*

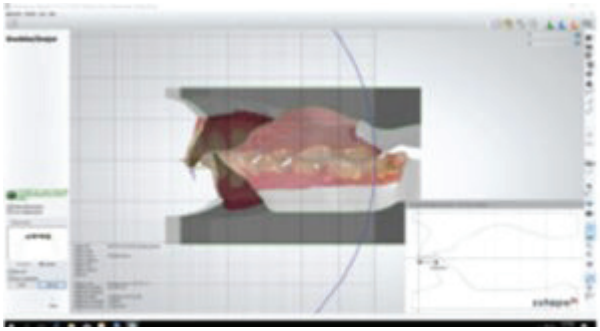


*Figure 21: Overjet determination, as shown in an orthodontic analysis program.*

An important consideration before adopting a new technique or technology is whether the end results are as accurate, or more accurate, with the new technique. This issue has been resolved in a number of studies in the orthodontic realm, as well as prosthodontics and oral surgery. It is well documented that 3D-printed models from impressions are as accurate as plaster models generated from the same impressions. The accuracy of digital models made from intraoral scans is no longer in question, as they have been shown to be as accurate as plaster models made from traditional impression techniques—thus, such models are acceptable for orthodontic diagnostic purposes. As indicated by a systematic review of the literature, some authors have even suggested that digital models from intraoral scans are the new gold standard in orthodontics due to their accuracy and other perceived benefits—such as cost, time and storage considerations.

**Treatment Planning**

Another major consideration when adopting new technology is whether it will impact treatment-planning decisions. Providers must consider possible bias that might be influenced by use of handheld plaster models, handheld 3D-printed models or virtual 3D models. At present, it is unclear if this is a significant factor. A systematic review of decision-making found that treatment planning for orthognathic/orthodontic care changed in 13% to 22% of cases based on whether records were presented in a digital or plaster format. In orthodontic-only care, treatment planning changed in 6% of the cases reviewed, depending on the dental model type used (digital versus plaster).

There are certainly other considerations when deciding between a digital and traditional impression format. A cost analysis should include the initial purchase of a scanner, software licensing, personnel time and training, data storage, and maintenance of the equipment. Costs for today's intraoral scanners range from approximately $16,500 to $49,000. Licensing fees also have to be taken into account. Some firms provide free service initially, some charge per click, and others have a set monthly fee for software ranging from $1200 per year for the first two years to $3600 per year after two years.

A key advantage of digital technology is that it eliminates or minimizes the need to send impressions or poured models to the laboratory via mail or courier. Once the STL file is uploaded, it can be transferred to the lab with a click for model or appliance fabrication. Replacement of a retainer is an easy task (provided there has not been significant tooth movement), as the digital file is stored either locally, in the cloud, or at the lab for simple retrieval.

Two factors have made digital scanning an easy choice for large orthodontic practices. One deals with possible contamination, and the other involves costs. The use of physical models raises questions about asepsis, both in the clinic with trays, mixing bowls and wrapping, as well as the laboratory. Clinicians may experience uncertainty over potential contamination of model trimmers or appliances, or the possibility of models being made from nondisinfected impressions if there is a breakdown in the disinfection/sterilization cycle.

Another issue facing large practices is the question of how much lab expense and/or personnel time and effort should be directed toward the fabrication of models. Now that there is no longer going to be a required presentation of treated cases for the American Board of Orthodontics Examination Part III Clinical Exam, the pressure for clinicians to produce beautiful, highly polished orthodontic models is diminished. Prior to the change in the examination process, digitally produced models had become acceptable for submission—provided they met certain requirements in regard to detail, color, composition and basing.

**Drawbacks for Intraoral Scanning and Digital Models**

*Figure 22: These traditional stone casts represent a typical pour-up of working models. The possibility of contamination within the laboratory setting is also evident.*

As was pointed out by Grunheid et al, 3D scanning is neither universally welcomed by patients, nor does it always present significant savings in time or expenses. If physical models are required (for whatever reason) as opposed to virtual models, the cost from the laboratory is about the same for presentation-quality models. Depending on the number of scans required for any given clinic period, there can be significant delays in patient chair time while waiting for a scanner to become available and undergo asepsis procedures between patients. It is much easier to have an adequate number of impression trays and impression materials than it is to have a significant number of scanners.

With the use of 3D scanning for diagnostic models and progress models (especially for patients undergoing orthognathic surgery), there is difficulty in reconciliation of the bite from centric occlusion to centric relation. Models mounted in centric relation on semi-adjustable or fully adjustable articulators using a centric relation bite and facebow transfer have long been the workhorse of orthodontists with patients for whom centric relation and centric occlusion are not coincident. With virtual models, the ability to fabricate splints in-office for diagnostic or treatment modalities is lost without 3D-printing capabilities. In this case, STL files must be sent out for fabrication of the prostheses, without plaster model and articulators in the laboratory. Often, intermediate splints for orthognathic surgery are constructed at a site distant from the oral surgeon. A different system of planning for these limitations of 3D imaging has to be in place in order for the clinical team to function in a timely fashion.

It has been demonstrated that tooth excursions replicated on a virtual articulator are similar and as accurate as those done on a physical articulator. Delong et al noted that occlusal contacts derived from stone models on an articulator were faithfully reproduced on virtually mounted 3D models. The same conclusion was reached by Maestre-Ferrin et al in a study that suggested, "The virtual articulator is a precise tool for the full analysis of occlusion in a real patient." These same findings with regard to accuracy of articulated virtual versus stone models for orthognathic surgery planning have been verified by Caloss et al, as well as the previously mentioned study by Delong et al.

From a clinician's perspective, unless in-office fabrication is available or a lab facility is on site that can print models, turnaround time for appliances must be considered in treatment planning. While 3D-printed appliances are as accurate as handcrafted appliances, often, they cannot be produced as quickly when employing a local laboratory. In such cases, scheduling for appliance delivery becomes difficult when it is not planned well in advance.

**Summary**

Once chiefly thought of in terms of restorative procedures, intraoral scanning has become an integral part of orthodontics. In today's practice, 3D intraoral scans are used for fabrication of fixed appliances and orthodontic study models, as well as indirect bonding trays. This technology is also useful in diagnostic setups, fabrication of aligners and removable orthodontic appliances, and diagnostic procedures. While clinicians should be well versed in traditional impression techniques, the need for digital skills is likely to assume an increasingly important role in evidence-based orthodontic care.

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# Lasers

*By: Doug Jaul, DDS*

**Definition**

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Essentially, a laser beam is a concentrated source of light energy composed of one wavelength, which travels in a specific direction. These properties differ from ordinary light, which are diffused and non-coherent, in that laser light energy is accurately targeted with high intensity. The first laser was built in 1960.

Lasers are composed of three basic parts:

1. An active medium or sometimes referred to as gain medium
2. An energy source or pump source
3. A set of mirrors that form an optical cavity or optical resonator

***Laser Medium***

The laser medium is the 'active element' which produces the laser beam. Most elements in the periodic table can be used as media to develop a laser beam. A laser medium can be a gas, dye (in liquid), solid-state element (distributed in a solid crystal or glass matrix), or semiconductor (diode). The medium will determine the wavelength output, which primarily influences the efficacy of the laser at the target site.

***Pump Source***

The pump source 'stimulates' the lasing medium until light-energy is emitted. Examples of pump sources include electrical discharges, flash-lamps, arc-lamps, or chemical reactions. The type of pump source used depends on the type of laser medium.

***Optical Cavity or Resonator***

The laser optical cavity or resonator amplifies the light energy. The optical cavity is a compartment of mirrors that contains the laser medium. Light-energy released from the laser medium is reflected by the mirrors back on to itself (referred to as feedback), where it may be amplified by stimulated emission before exciting the cavity. The alignment of the mirrors with respect to the laser medium will determine the exact operating wavelength of the laser system. In summary, a laser is a special form of artificial light with specific properties. A laser beam is produced within a laser machine when the pump source stimulates the laser media, releasing light energy which amplifies as it travels through the optical cavity. The amplified light energy released from the machine is what we refer to as the laser beam. When light energy enters the target tissue, it transforms into heat – a process known as the photothermal effect– resulting in the vaporization of the target tissue cells

A laser beam has several physical characteristics that distinguishes it from typical white light: light source, including collimation, coherence (phase correlation) and monochromaticity (single wavelength).

Dental lasers are further defined in terms of the following characteristics:

- Emission type: spontaneous or stimulated
- Output Power: high powered, medium powered, low powered
- Active medium: liquid, gas, solid state
- Target Tissue: hard or soft tissues
- Potential biological damage:
  - Class I: low powered and safe to view
  - Class II: low powered visible laser, dangerous to view along the beam

- Class IIIa: medium powered laser, not dangerous if seen less than 0.25s
- Class IIIb: medium powered laser, dangerous when viewed directly along the beam for any length of time
- Class IV: Dangerous high powered laser can cause damage to skin and eyes. The biggest risk is to the eyes. Protective glasses must be worn by the patient and the practitioner and anyone else in the operatory during laser therapy.

**Thermal Ablation**

Unlike a scalpel which slices, a laser separates tissue by thermal ablation. Thermal ablation is an instantaneous process of absorption, melting, and then vaporization, resulting in decomposition of the tissue. As the target cells absorb the concentrated light-energy of the laser beam, the tissue rapidly rises in temperature. The target cells instantly undergo stages of warming, welding, coagulation, protein denaturization, drying, and vaporization via a microexplosion known as spallation. Thermal ablation is dependent on the amount of light energy absorbed, which is determined primarily by the wavelength of the laser. The degree of tissue absorption is influenced by:

- Laser wavelength (measured in nanometers) – a component of the laser media
- Electrical power of the surgical unit (measured in watts)
- Exposure time
- Composition and thickness of the tissues.

In summary, lasers separate tissue by thermal ablation. The type of laser media produces a specific wavelength, which among other factors, influences the degree of tissue absorption and thus the 'cutting' power of the laser.

**Laser versus Scalpel**

A laser works similarly to electrocautery and possesses advantages compared with conventional scalpel surgery. The most significant advantage is that a laser coagulates capillaries, seals lymphatics, and sterilizes the surgical field during ablation. Separation of tissue is more precise with a laser than a scalpel. Additionally, minor aphthous and herpetic ulcerations—which commonly occur during the early stages of treatment as the patients get accustomed to their orthodontic appliances—can be vaporized. Laser surgery is routinely performed using only light local anesthetic or compound topical anesthetic. Furthermore, there is markedly less bleeding with laser surgery, particularly for frenal surgery, as well as minimal edema, and no need for sutures or unsightly periodontal dressings. A report suggested that laser excisions produce less scar tissue than conventional scalpel surgery, although contrary evidence also exists; Soft tissue applications include gingival recontouring, exposure of unerupted and partially erupted teeth, removal of hypertrophic and inflamed tissues, frenectomies, treatment of aphthous lesions, esthetic recontouring of gingiva, establish tooth proportionality, crown lengthening and crown height asymmetries and interdental margins and bone regeneration.

Post-surgically, patients report less discomfort, fewer complications related to speaking and chewing, and require less pain medication than do patients treated with conventional scalpel surgery. The benefits of laser surgery can be summarized: '[soft tissue lasers] result in shorter operative time and faster post-operative recuperation.'

The primary disadvantage of laser surgery is the operatory and upkeep expense. Furthermore, laser surgery is primarily excisional and performed without a flap, often resulting in less change in alveolar crest height. As such, there is a tendency for significant tissue rebounding or regrowth after laser surgery, particularly if the patient does follow optimal oral hygiene practices.

**Diode versus Solid-state Lasers**

The two most popular lasers used in dentistry are the diode and the solid-state lasers. Diode lasers are almost exclusively used for soft tissue surgery. Solid-state lasers, on the other hand, can be used for both soft and hard tissue surgery, such as tooth preparation, root canal debridement, and crown lengthening. The fundamental difference between a diode and a solid-state laser is the laser medium, which generates laser beams of different wavelengths. The laser medium determines the wavelength output, which ultimately influences the efficacy of thermal ablation at the target site.

***Diode Lasers***

Diode (semiconductor) lasers convert electrical energy into light energy. Diode lasers are known as semiconductors, as they use a media of gallium and arsenide, and occasionally indium and aluminum, whose ability to conduct electricity is between that of conductors and insulators. By doping the laser medium with impurities (dopants), stimulated emission occurs. The wavelengths produced by diode lasers range between 810nm and 980nm. Light energy at these wavelengths is easily absorbed by melanin (soft tissue pigmentation) and hemoglobin, and poorly absorbed by enamel. Therefore, diode lasers are highly effective in soft tissue ablation, hemostasis, and sealing lymphatics, with low risk of damaging teeth and bone, making them ideal for soft tissue laser surgery. Compared with other laser types, diode lasers are compact, reliable, and have a long operatory lifetime, and are packaged in portable units. Connecting to the main unit is a thin, pencil-sized hand-piece containing a 200–400µm fiberoptic tip. Newer models have handpieces that receive single-use, twist-on laser fiberoptic tips, providing a higher potential standard of cleanliness and eliminating time-consuming stripping and cleaving of the fiberoptic tip.

***Priming***

Before surgery with a diode laser, the fiberoptic tip must be conditioned or primed. All diode lasers need to have some type of pigment applied to the fiber tip in order to create a sufficient amount of energy for ablation. Priming is the process of concentrating heat energy at the fiberoptic tip. Priming is performed by tapping an initiated-fiberoptic tip on thick blue articulating paper, a felt tip marker, a solid color in a magazine page, or a cork. Essentially, the laser tries to ablate the pigmented region, creating a super focus of light energy. Failure to properly prime the diode laser may result in less effective tissue ablation. During laser surgery with a diode, the fiberoptic tip should be held in light-contact with the tissue. For the majority of surgeries, soft tissue ablation is performed at1.0–1.5W, with gentle, sweeping brush strokes. All lasers are collimated; as such, the 'cutting' end is at the tip. Therefore, dragging the laser sideways tends to collect soft tissue buildup and may even damage the fiberoptic tip. During surgery with a diode laser, tissue margins may appear dark and charred. High-speed suction is critical to remove laser plume and burnt tissue smell, as well as to maintain a clear field of vision.

***Solid-state Lasers***

Solid-state lasers use a gain medium that is a solid, rather than a liquid or gas. It should be noted that semiconductor lasers are also in the solid state but are considered in a separate class from solid-state lasers. The active laser medium in a solid-state laser consists of a glass or crystalline matrix. Two common matrices are the yttrium aluminum garnet (YAG) and the yttrium scandium gadolinium garnet (YSGG). Comparative studies have shown little difference in efficacy between the two. Atoms in the crystal are excited to produce light energy when dopants, such as erbium, chromium, and neodymium, are added to the medium (i.e. Nd:YAG, Er:YAG, or ErCr:YSGG).

Erbium-doped solid-state lasers are most commonly used in dentistry. The wavelengths produced by erbium-doped solid-state lasers range between 2780nm and 2940nm. Unlike diode lasers, light energy at this wavelength is easily absorbed by hydroxyapatite and surface tissue water, and therefore can ablate both hard and soft tissues. Erbium-doped solid-state lasers are routinely used by pediatric dentists and general dentists for caries excavation, and less frequently for endodontic and periodontal procedures. When performing soft tissue laser surgery with an erbium-doped solid-state laser, the laser machine is operated at low electrical power to reduce the depth of tissue penetration. For most gingival surgeries, soft tissue excision may require 1.5–2.5W depending on the tissue thickness. Coagulation with a solid-state laser requires a different setting, generally less than 1.0W often without water spray. It should be noted that a solid-state laser will begin to ablate hard tissue at approximately 4.0–5.0W.

Solid-state lasers are packaged in larger, more complex rolling units (weighing up to 40 kg or 90 lb). The laser handpiece resembles a high-speed handpiece with removable fiberoptic tips ranging from 400µm to 750µm. During surgery with an erbium-doped solid-state laser, the fiberoptic tip should be held 1mm away from the tissue (Hadley et al., 2000). Priming is not required as the solid-state lasing medium does not absorb pigmentation. Excision is performed with slow, short back-and-forth strokes. Coagulation is achieved under a different operatory setting, with low wattage and often no water. Tissues appear slightly reddish during excision and chalky white after coagulation. Although, a solid-state laser can effectively control hemorrhaging, hemostasis may be easier with a diode, particularly during more invasive soft tissue surgeries such as frenectomies.

Other dental lasers are the gas lasers such as the Argon laser and CO2 laser.

**Laser Machine Set-up**

All soft tissue lasers have similar machine components and set-up steps. The main components of a dental laser machine include:

- A touch-screen control system, which incorporates factory loaded pre-sets and customizable settings such as watts, joules, and pulse repetition rates
- A handpiece with a fiberoptic tip
- Foot pedal or footswitch to initiate laser firing
- Protective goggles for the patient, the doctor, and the assistant, which blocks a range of wavelengths specific to the laser

First, connect the power cable and footswitch, and then place a sterilized fiberoptic tip on the handpiece. Second, turn on the machine and use the touch-screen window to control the appropriate settings. Ablation of thicker tissue may require increased wattage, whereas surgeries with a likelihood of bleeding such as frenal surgery or inflamed tissue may respond better to continuous-mode laser firing rather than pulsed-mode. Erbium-doped solid-state lasers typically connect to the air-pressure valves in the chairside delivery unit and may require distilled water. Third, prepare to initiate laser firing by switching the laser from 'standby' to 'ready' mode. Finally, initiate laser firing by pressing on the footswitch. If needed, prime the laser tip at this point prior to entering the mouth. Remove foot from the pedal to cease laser initiation and move the handpiece to the mouth before initiating laser firing.

**Additional Uses of Lasers in Orthodontics**

There have been studies applying lasers in orthodontics to also include accelerating tooth movement, bone remodeling, enamel etching, debonding of ceramic brackets, pain reduction, prevention of enamel demineralization. These uses are not well established and typically not found in orthodontic practices.

**Conclusion**

The use of soft tissue lasers offers many advantages such as improved oral hygiene, practice efficiencies and esthetic finishing. Currently, dental personnel other than the dentist are not allowed to use lasers in the treatment of patients. Clinicians and all adjunctive personnel interested in incorporating soft tissue lasers into their practice should obtain proficiency certification, attend continuing education courses and recognize the inherent risks associated with laser surgery. As an orthodontist committed to providing the best possible service, adjunctive procedures such as soft tissue surgery can dramatically enhance the overall treatment experience in an orthodontic office.

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# Thermoplastic Aligner Therapy

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**Background**

Clear aligners, or clear thermoformed plastic aligners, is the common name for many appliances that may cover one tooth or multiple to all dentitions. These systems have variety of applications and, depending on the system used, will render different ability in treating a wide range of orthodontic problems.

It was understood as early as 1944 that utilization of Tooth Positioner (TP) Orthodontics could treat malalignments of mild to moderate severity with success. Dr. Harold Kesling was a pioneer in utilizing the tooth positioner, dating back to 1946. This modality of orthodontic treatment was accelerated in 1998 by Align Technology with the introduction of Invisalign® appliances. Today, the market of clear aligner is more saturated and there are many more companies providing similar products.

**Introduction**

Along with the current trend of increasing adult orthodontic patients, the demand for clear aligners has increased due to its present esthetic and comfort compared to traditional braces. While effective, metal braces are also associated with issues that can cause people to shy away from them, including:

- Limitations on what you can eat or drink
- Potential for tooth decay with improper maintenance
- Irritation and pain

Most clear aligner systems are made up of strong, polyurethane, with a mix of different compositions which may allow exclusivity to a given company providing that aligner. These aligners are designed using 3D modeling technology to align teeth in increments. Currently, there are some clear aligner therapy systems that have gone above treating only mild orthodontic cases. Some systems use bonded resin attachments on certain teeth in order to achieve movements otherwise deemed difficult to impossible. There remains a significant lack of scientific evidence to support the claims by some of the systems in their ability to tackle complex orthodontic cases.

**Technology**

The evolution from tooth positioner to spring aligners over the past several decades and, furthermore, in combination with advancement of transparent thermoplastic materials and computer technology has revolutionized the ease of use of this modality of treatment. The technologies such as, digital scanning, CAD-CAM, and treatment simulation software have made the incorporation of these system into everyday clinical orthodontic easier than ever before.

In the past, an impression of the teeth with alginate or polyvinyl siloxane (PVS) was used for fabrication of the dental model in order to form the clear aligners. But today, with the advent of new technologies, the material sciences and fabrication methodologies in these systems have allowed the process to become more precise. This precision comes from the culmination of digital scanning accuracy, doctor control (utilizing software 3D models for detail adjustment of tooth/teeth), pressure-formed aligners or 3D printing, variety of resin attachments and incorporation of bite ramps/power ridges/pressure points, all helping to achieve a more predictable outcome.

**Different Types**

The majority of differences between systems are related to the type of clear aligner materials used in a given system. Other differences, such as plastic overlapping the gingiva or cut short of the gingival margin have been used by different companies as pros and cons depending on their particular line of product. For example, it has been claimed by some systems that with gingival coverage more predictable tooth movement can be expected; while other systems claim that staying short of the gingival margin will lead to less gingival irritation. The same can be said about the utilization of resin attachments. Other differences include but are not limited to: vacuum-formed vs.

pressure-formed vs. 3D printed appliances. As the debate about which clear aligner therapy is more precise continues, further scientific research is needed to answer many of these questions instead of relying on the claims and reports of the manufacturer.

**Risks & Limitations**

Clear aligner therapy has multiple pros and cons when compared to the traditional straight wire appliances (braces). The advantages of this system include, but are not limited to:

- Easier to maintain good oral hygiene leading to better health of periodontium
- Esthetics
- Comfort
- Fewer clinical emergencies

Clear aligner therapy in more complex cases requires extended treatment time and the use of auxiliaries (i.e. elastics, attachments, bite ramps, TADs, etc.). It is important to note that the success of the clear aligner therapy heavily depends on the level of the patient's compliance to wear the aligners as recommended by the treating doctor. This is in contrast to traditional braces where the compliance is out of the hand of the patient since the braces are fixed on the teeth. Other risks and limitations include, but not limited to:

- Allergies – Although rare, some patients may find themselves allergic to the clear aligners
- Speech Impediment – It is normal for a patient to temporarily struggle with a speech impediment, like a lisp, initially. This will almost always go away, but it is something to remember as a consideration for this type of treatment.

**Protocol for Case Submission**

- 3D Images – Records [PVS impression or digital scan of the teeth, photo collage, and panoramic X-ray and bite registration may be requested as well) are sent to the creators of the clear aligner for digital imaging. All impressions are put through a computed tomography scanner, and a 3D model of your lower and upper teeth is created from the data.
- 3D Treatment Visualization – The model is then used to create an animation of your teeth using computer software (i.e. ClinCheck). This will be used by the treating doctor to be detailed and customized.
- Molds – Once the treating doctor approves the treatment plan, the aligner company will create the appropriate number of see-through dental casts, or one model in which individual teeth can be moved and/or manipulated. In the case of the cast, each cast is designed to move your teeth a small amount. The exact number of casts created reflects the degree of complexities to fully align teeth.
- Delivery of aligners – Instruct patient for full-time aligner wear (20-22 hours per day). However, in certain cases the doctor may change the wear time depending on the treatment and patient needs. Discuss food list (ie. avoid drinking hot or colorful drinks as they may damage the aligner etc.). Use tell-show-do approach on instructing patient how to put on and remove the aligners optimally to prevent unwanted side effects.
- Bonding attachments and Interproximal reduction (IPR) – The procedure for bonding resin attachments or IPR can take place at any stage of clear aligner therapy, and is devised by the treating doctor.

**Other Modality of Treatment with Clear Aligner Therapy**

The history of utilizing clear aligners in conjunction with springs to help with a given tooth's movement goes back several decades. However, currently there are claims of clear aligner therapy systems that can help address present jaw discrepancies (transverse and anterior-posterior). These manufacturer claims need to be evaluated by researchers in the field to be validated.

# Certification of Course Completion

This is to certify that

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has fulfilled the Orthodontic Assistant Permit (OAP) Staff Training Course program requirements as established by the Dental Board of California.

This includes the instruction of Ultrasonic Scaler: *Yes* ☐ *No* ☐

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*Authorized OAP Provider* *Authorization #*

_____

*Date of Course Completion* *Hours of Training Completed*

*"For the things we have to learn before we can do them, we learn by doing them."*

*– Aristotle –*