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Bracket Placement and Removal Module

Performance Objectives for placing and removing brackets on teeth:

- Understand the concepts of bracket design
- Describe the key concepts of bracket placement on teeth
- Know the different materials used for bonding brackets to teeth
- Describe the steps for placing and curing brackets on teeth
- Describe the proper technique for placing bonding material on a bracket base
- Describe the armamentarium and steps involved in bracket placement
- Describe direct bonding and indirect bonding and their differences
- Know the instrumentation and steps in removing brackets from teeth

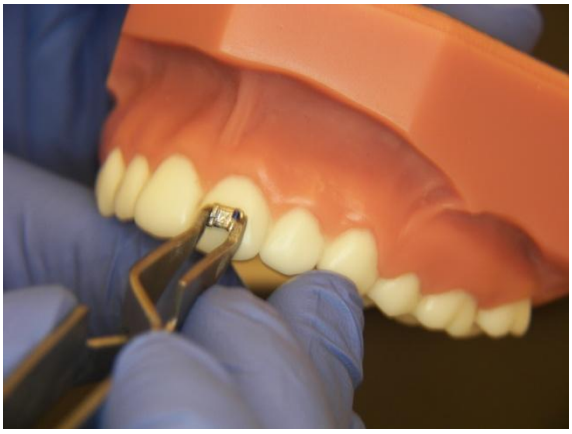

Figure 1.

This module will educate you on the concepts of placing orthodontic brackets on teeth (Figure 1), curing them and removing them from the teeth. You will understand and effectively demonstrate the sequence of steps, patient management, and the different materials used to effectively accomplish these tasks.

Syllabus Content

I. Bracket Design and Bracket-Archwire Interaction
II. Bracket Placement criteria
III. Bonding material characteristics, application techniques, and curing time factors.
IV. Armamentaria for bracket placement
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XI. Procedures for bracket or tube removal.

Successful bracket placement and removal techniques are essential in orthodontics and a very important skill 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.

I. 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.

Typical Metal Bracket Designs and features

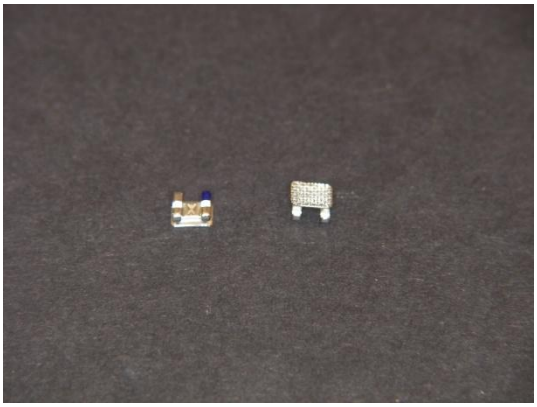

Figure 2

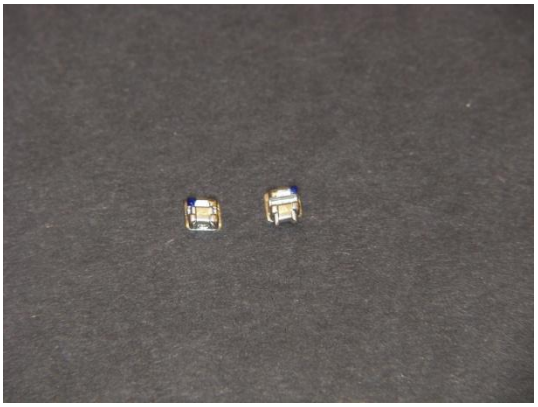

Figure 3

A typical bracket (Figure 2) has as its base a pad, which aides 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 1), 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.

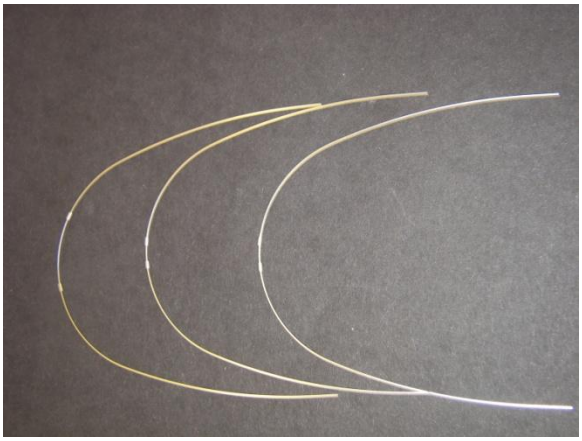

Figure 4

Archwires

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 (Figure 4) 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.

II. Bracket Placement

Figure 5

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:

1. Reposition the bracket to a more ideal position or
2. 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.

Every bracket must be properly oriented to the tooth in four different dimensions.

1. Vertical: the occlusal/gingival position
2. Horizontal: the mesial/distal position
3. Tip: the mesial/distal tilt of the bracket
4. 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 aide 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.

III. Bonding material characteristics, application techniques, and 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 (Figure 6 below)

Figure 6

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 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.

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 (Figure 7 below)

Figure 7

Figure 8

Light-cured composites 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.

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.

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 (Figure 9 below)

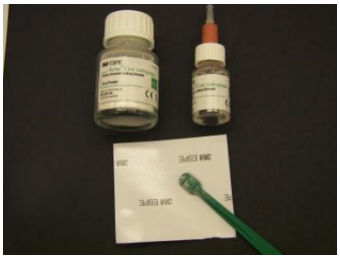
Figure 9

Glass ionomer cements 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.

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 section on Bonding for more information about this topic.

IV. Armamentarium for Direct Bracket Placement

A list of typical materials and instruments is included. Different offices will vary their procedures and subtract or add additional 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 section.***

Bonding Set-up: See Armamentaria for Bonding section

Bracket Set-up: (see Figure 10 below)

(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


Figure 10

V. 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 in the Bonding section.
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 section 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 4-7 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 - 2 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.
5. 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.

VI. Rationale for Indirect Bonding


Figure 11


Figure 12

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.

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.

VII. Armamentaria for Indirect Bonding

Figure 13

Figure 14

Indirect Bonding Set-up: (see Figures 13, 14 above)

(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.

VIII. 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.

IX. Bracket Removal Considerations (Figure 15)

Figure 15

When treatment is complete, the brackets must be removed from the teeth. 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.

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.

X. Armamentaria for Bracket Removal


Figure 16

A list of typical materials and instruments is included. Different offices will vary their procedures and subtract or add additional 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

XI. 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 intra- and extraoral photos, panoramic x-ray and cephalometric x-ray, if indicated. Take impressions for final study models.

<u>Laboratory instruction</u> 2 hours

1. Instructor demonstration on staff member (no tooth preparation prior to this exercise, which will prevent brackets from adhering to the participants teeth)
2. Patient assessment
3. Patient instruction
4. Isolation
5. Composite added to bracket base
6. Bracket placement on anterior and posterior teeth

7. Light curing of brackets
8. Bracket removal
9. Clean and polish teeth after bracket removal

Typodont Exercise for Bracket Placement (and review for tooth preparation)

1. Set up appropriate armamentaria for bonding and bracket placement procedures
2. Select from inventory the correct brackets for the upper and lower left lateral and canine teeth, and the upper and lower right first molars and 2nd bicuspid teeth
3. Place typodont with plastic teeth in the mannequin head
4. Recline the position to simulate patient position
5. Use a slow speed handpiece with a diamond coated bur or green stone to roughen the surface of the teeth to be bonded, enhancing the bond strength.
6. Place cheek retractors to isolate the teeth.
Go through the complete bonding procedure for bonding to a plastic restoration: prophy, rinse, dry, etch, dry, plastic conditioner, sealant.
7. Pick up the appropriate molar bracket with the posterior bracket holder. (When placing anterior brackets use the anterior bracket holding instrument.)
8. Apply light-cured bonding material to the bracket base.
9. Place the bracket on the tooth, position it ideally.
10. Light cure the bracket.
11. Repeat steps for the other three brackets utilizing proper instruments and technique.

Typodont Exercise for Bracket Removal

1. Set up appropriate armamentaria for debonding procedure
2. Using appropriate technique, remove brackets from teeth starting with the posterior brackets and moving forward.
3. Using composite removing plier, remove adhesive from the teeth
4. Prophy and finish.

Repeat bracket placement and bracket removal exercise two times.

The fourth time through the procedure will serve as the exam.

Passing criteria

a) Proper instruments selected, patient instructions given, and teeth isolated
b) Bracket placement steps completed in proper sequence
c) Correct times for each step observed
d) Proper bracket identification observed
e) Proper adhesive placement on bracket base
f) Proper instrumentation demonstrated
g) Proper bracket placement on each of the four teeth
h) Proper curing of bonding material on tooth
i) Proper removal of brackets and bracket adhesive

j) Proper finishing steps to clean and restore tooth surface

Clinical instruction 2 hours

Goal: selecting, adding bonding material, prepositioning, curing and removal of anterior and posterior brackets on at least two patients.

Clinical instruction- 2 hours
1). Instructor demonstration of sequence for tooth bracket placement on a dental assisting student ("patient")
2). Tooth preparation: No tooth preparation will be performed during this procedure, which will prevent the brackets from adhering to the tooth and prevent any harm to the teeth of the "patient".
3). Set up armamentaria for both the bonding procedure and debonding procedure.
4). Isolate the teeth with cheek retractors
5). Place two anterior and two posterior brackets following the steps in the lab procedure
6).Remove two anterior and two posterior brackets following the steps in the lab procedure.

Student experience on "patient" (other dental assisting student)
1). Set up armamentaria and isolate teeth,
2). Place two anterior and two posterior brackets and cure them.
3). Have instructor check bracket placement.
4). Remove brackets from teeth.
5). Clean teeth and remove any bonding materials. Have instructor check again. 6). Repeat this procedure at least four times with one of the times serving as the exam.

Passing Criteria

a) Proper instruments selected, patient instructions given, and teeth isolated
b) Bracket placement steps completed in proper sequence
c) Correct times for each step observed
d) Proper bracket identification observed
e) Proper adhesive placement on bracket base
f) Proper instrumentation demonstrated
g) Proper bracket placement on each of the four teeth
h) Proper curing of bonding material on tooth
i) Proper removal of brackets and bracket adhesive
j) Proper finishing steps to clean and restore tooth surface

Key words and concepts

Archwire- 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