

RADIOGRAPHIC IMAGING

Radiographic imaging (x-rays and other types) is an essential component of the evaluation and diagnosis that must occur prior to beginning orthodontic treatment.



For some companies offering orthodontic treatment “direct-to-consumer,” or through clear aligners mailed directly to the patient, x-rays or other radiographic images of the patient’s teeth are not taken by the company or the dentist/orthodontist providing treatment.

A 3D digital scan of the patient’s teeth does not provide the same information as radiographic images, because digital scanners cannot view below the surface of the gums.

Radiographic images provide crucial information for the safety and success of the patient’s treatment, and includes essential components that simply cannot be replicated by reviewing only digital scans or other photographs. Moreover, the minimal risks of taking x-rays are far outweighed by their clear value for orthodontic treatment.



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In order to best protect patients, laws should require radiographic imaging (x-rays) before orthodontic treatment begins.



Moving teeth is a complex biological process. Teeth are moved by the pressure exerted by an orthodontic appliance, like clear aligners or braces.¹ This pressure causes necrosis (death) of the vascular tissue around the tooth, allowing the tooth to move within its alveolus (bone socket); and bone then reforms around the tooth.^{2,3}



Moving teeth is not just a cosmetic procedure. The pressure from clear aligners or other orthodontic appliances causes “minor reversible injury” to the tooth-supporting structures.⁴ Moving teeth must take into consideration not just the final appearance of the teeth, but also impact on tooth and jaw function.⁵



The complexity of the process of moving teeth **requires that a trained expert (dentist or orthodontist) have all necessary information** at their disposal (which can only be gained through an in-person examination) before starting treatment.

Radiographic images are an essential component of the evaluation and diagnosis that must occur prior to the start of orthodontic treatment.

It is “widely considered beneath the standard of care to initiate orthodontic care without first acquiring proper diagnostic information. A clinician who begins orthodontic treatment without appropriate radiographs necessary for creating an adequate and appropriate diagnosis and treatment plan **may be breaching the standard of care.**”⁶

“Diagnosis and treatment planning for the correction of misaligned teeth **should not be performed without a thorough review of baseline radiographs** by a skilled orthodontist or radiologist.”⁷

Radiographic images are “**an important part of the clinical examination**” and a **require[d], ... integral part of treatment planning.**”⁸

Radiographic images are “**an essential part of the diagnostic process in orthodontics**” and “**a crucial step in the initial diagnostic process.**”⁹



[1] Wise, G.E. and King, G.J. (2008) Mechanisms of tooth eruption and orthodontic tooth movement. *J Dent Res*, 87, 414-434 at 414.

[2] Wise & King (2008) at 415.

[3] Antoun, J.S., Mei, L., Gibbs, K. and Farella, M. (2017) Effect of orthodontic treatment on the periodontal tissues. *Periodontol* 2000 74, 140-157 at 141.

[4] Wise & King (2008) at 414.

[5] Gkantidis, N., Christou, P. and Topouzelis, N. (2010) The orthodontic-periodontic interrelationship in integrated treatment challenges: a systematic review. *J Oral Rehabil*, 37, 377-390 at 377.

[6] Abdelkarim, A.I. and Jerrold, L. (2018) Clinical considerations and potential liability associated with use of ionizing radiation in orthodontics. *Am J Orthod Dentofacial Orthop*, 154, 15-25 at 16 (emphasis added).

[7] Park, J.H. (2020) A licensed orthodontist versus do-it-yourself orthodontics. *Am J Orthod Dentofacial Orthop*, 157, 591-92 at 591 (emphasis added).

[8] Taylor, N.G. and Jones, A.G. (1995) Are anterior occlusal radiographs indicated to supplement panoramic radiography during an orthodontic assessment? *British Dental Journal* 179 at 10 (emphasis added).

[9] Sameshima, G.T. and Asgarifar, K.O. (2001) Assessment of root resorption and root shape: periapical vs. panoramic films. *Angle Orthodontist* 71, 185-89 at 185 (emphasis added).

[10] Witcher, P.T., Brand, S., Gwilliam, J.R., and McDonald, F. (2010) Assessment of the anterior maxilla in orthodontic patients using upper anterior occlusal radiographs and dental panoramic tomography: a comparison. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 109:765-74 at 765; Michelogiannakis, D., Vastardis, H., Malkopoulos, I., Papathanasopoulou, C., and Tassios, K.I. (2018) The challenge of managing patients with generalized short root anomaly: A case report. *Quintessence Int*, 49, 673-79 at 677.

[11] Witcher et al. (2010) at 770-71.

[12] Park (2020) at 592.

[13] McCollough, C.H., Bushberg, J.T., Fletcher, J.G., and Eckel, L.J. (2015) Answers to common questions about the use and safety of CT scans. *Mayo Clin Proc*, 90, 1380-92 at 1380 (emphasis added).

[14] Abdelkarim and Jerrold (2018) at 17-18.

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Radiographic imaging (x-rays and other types) is an essential component of the evaluation and diagnosis that must occur prior to beginning orthodontic treatment.



Radiographic images are indispensable for evaluation of the patient's oral health prior to beginning orthodontic treatment.

Digital scanning (such as the iTero® scanners) create a 3D image that can be used in place of traditional alginate impressions. *They are not a substitute for radiographic imaging because they cannot view below the surface of the gums—that is, they do not show the tooth roots, or anything else that cannot be seen with the naked eye.*

Radiographs are required to assess short root anomaly (abnormally short tooth roots), which is a *significant risk factor for root resorption (the loss of tooth roots)* during orthodontic treatment.¹⁰

"Intraoral radiographs are likely to be needed if a full and reliable assessment is to be made, especially to assess root morphology."¹¹

One researcher sums up the risks of failing to perform radiographic imaging succinctly in stating,

"What if there is a supernumerary tooth in the path of the tooth movement that might result in root resorption? What if there are other pathologic lesions or findings that need attention before the initiation of tooth movement such as dentigerous cysts, periapical disease, periodontal bone loss, interproximal or secondary caries [decay], or bony lesions such as ameloblastoma? Consider if the patient has an undiagnosed temporomandibular disorder, devitalization of teeth, or current crown or bridgework."¹²

There are countless conditions that can profoundly affect orthodontic treatment and can only be diagnosed through the use of radiographic images.

In nearly all orthodontic cases, the minimal risk associated with radiographic images is far outweighed by their clear value for orthodontic diagnosis and treatment.

Radiographic images used in the orthodontic context pose a minimal, nearly statistically insignificant risk to the patient, with technology continuously evolving to reduce the risk even further.

"Although there is a perception among some physicians and patients that the dose of ionizing radiation from medical imaging examinations, particularly CT, poses a substantial cancer risk to patients, **this perception is not consistent** with data from high-quality studies, nor with current consensus opinions of radiation protection organizations."¹³

The effective doses for some commonly-utilized orthodontic radiographic images (measured in microsieverts (μSv)) are as follows:

RADIOGRAPHIC IMAGING TECHNIQUE	EFFECTIVE DOSE OF RADIATION
• Digital panoramic radiography	• 6-38 μSv
• Digital cephalometric radiography	• 2-10 μSv
• CBCT	• 20-1025 μSv

For reference, the average effective dose of radiation in the United States from naturally occurring, ubiquitous background radiation (that is, unavoidable radiation exposures from sources such as radon gas and cosmic rays) is approximately 3000 μSv per year.¹⁴

In other words, the typical effective dose from the most common orthodontic radiographs (digital panoramic and cephalometric) is but a very small fraction of the dose of radiation most individuals are exposed to environmentally each year in the United States.

Statutes and regulations governing teledentistry should include that radiographic images (x-rays) be taken before any orthodontic treatment that will lead to irreversible changes to the dentition, in order to best protect the patient's health and well-being.

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