Australian Society of Orthodontists

University of Sydney

Orthodontic - Endodontic Considerations

PART 1

Creating Brighter Futures

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In this and the following issue of Brighter Futures we will examine the relationship between orthodontics and endodontics. Endodontic treatment of teeth is now a common procedure across all age groups, either as a result of caries or trauma. Furthermore, as the number of adults undergoing orthodontic treatment increases, the number of orthodontic patients presenting with root filled teeth is on the rise. For children, trauma is the most common cause of pulp necrosis and loss of vitality.

This article will provide information for guiding patients to an informed decision about their orthodontic treatment and possible endodontic implications. It will also provide the clinician with the latest information on possible orthodontic/endodontic interactions, aiding in treatment planning and prognosis.

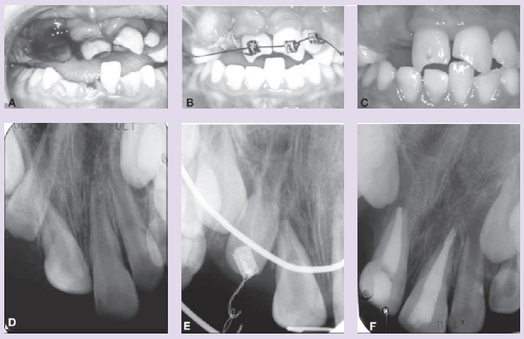
Orthodontic tooth movement and pulp vitality

Orthodontic tooth movement will usually induce some degree of reversible or transient pulpal inflammation. As early as 1936, Oppenheim demonstrated signs of pulpal degeneration in human teeth undergoing movement with fixed orthodontic appliances. He concluded that the lack of a collateral circulation for the pulp was the main etiologic factor behind this occurrence. The use of light intermittent forces to reduce the risk of damage to the dental tissues and to allow time for repair was recommended.

Seltzer and Bender in 1984 explained that rapid orthodontic tooth movement increased the risk of pulpal injury, primarily due to alterations in the blood vessels in the apical periodontium and those entering the pulp. McDonald and Pitt Ford in 1994, using Laser Doppler flowmetry, assessed pulpal blood flow in permanent maxillary canines before, during and after application of a 50 gram force. They found that changes in blood flow were dynamic in response to potentially poor perfusion of the tissues. During the period of tooth movement there was a phase of pulpal reactive hyperemia where tissue perfusion improved then returned to normal within 72 hrs. This time frame was considered insignificant with regard to long-term pulpal damage, hence rare permanent loss of vitality.

More at risk are teeth with mature apices and those with a history of trauma or significant caries. Pulpal respiratory rate was found to correspond to the degree of dentinogenic activity and pulpal metabolism. Unterseher et al (1987) assessed pulpal respiratory response after a 7-day rest period following orthodontic force application. Mean respiratory rates stayed 32.2% depressed. However, two subgroups were identified; one that had returned to a normal respiratory rate and one that did not. Age and apical opening size were the determining factors, with wide-open apices and young age correlating with a return to normal respiration.

Teeth that have a history of trauma, especially an intrusive type of trauma, have a 50% chance of suffering moderate to severe resorption during orthodontic treatment (Chaushu et al., 2004). One should also bear in mind that certain anatomical root shapes such as fine conical roots and dilacerated or excessively curved roots may be predisposed to greater resorption (Sameshima and Sinclair, 2001, Linge and Linge, 1991, Levander and Malmgren, 1988)



Images from Chaushu et al (2004). (a) Immediately post-trauma. (b) Orthodontic extrusion and alignment. (c) Seven months post-trauma. (d) Immediately post-trauma. (e) One month post-trauma, showing inflammatory resorption of the right lateral incisor root, and (f) Seven months post-trauma with central incisors root filled and the resorbing left lateral incisor removed.

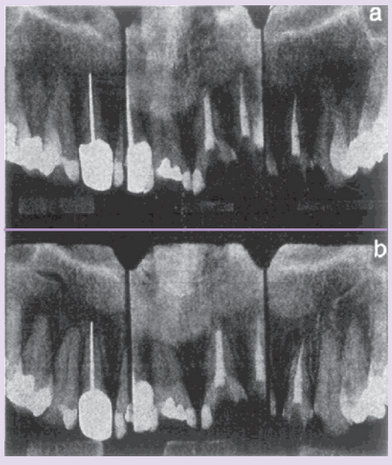
A special group of patients are those that have undergone segmental maxillary osteotomies. In these cases the teeth can maintain a normal blood supply but are denervated although in some cases these teeth may regain some sensation. However, loss of sensation is not an indication for endodontic treatment. As these teeth will respond negatively to pulp testing, laser Doppler Flowmetry may be the only way to examine vitality and determine the need for endodontic therapy (Proffit and Fields, 2000).

Will endodontically treated teeth move and are they at greater risk of root resorption?

There has always been a concern with regard to orthodontic movement of endodontically treated teeth and a supposition that these teeth might not respond as readily to orthodontic force or that they might be more susceptible to root resorption. However, since it is the response of the periodontal ligament, not the pulp, that is fundamental to orthodontic tooth movement, moving endodontically treated teeth should be perfectly feasible.

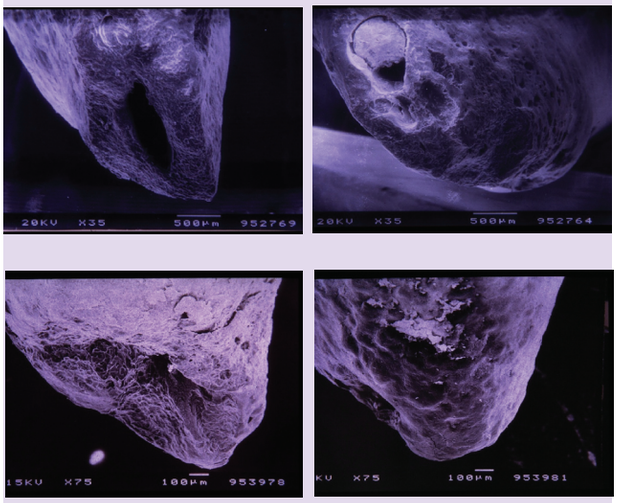
Both animal (Mah et al., 1996) and human studies (Wickwire et al; 1974) show that endodontically treated teeth can be moved orthodontically as readily as vital teeth. In adults who are receiving adjunctive orthodontic therapy it may be necessary for some teeth to be treated endodontically and repositioned orthodontically. There is no contraindication to this practice.

Studies have unanimously shown that endodontically treated teeth can be moved just as readily as vital teeth. Although early studies (Wickwire et al; 1974) suggested they might show more root resorption, more recent studies have shown the opposite. Spurrier et al (1990) studied 45 orthodontic patients with one or more endodontically treated teeth before orthodontic treatment and who exhibited signs of apical root resorption after treatment. They found that the vital contralateral teeth, that served as controls, exhibited a statistically, though not clinically significant, greater amount of root resorption (0.77mm) than those that had been treated endodontically. A Study by Mirabella and colleagues in 1995, on their sample of adult orthodontic patients, confirmed this. A recent study (Esteves et al., 2007) indicated no difference in the amount of apical resorption between the two groups.



Images of a case from Mirabella et al., (1995) showing radiographs before (a) and after (b) orthodontic treatment with one central incisor endodontically treated and the other vital. Note the vital central incisor showing more resorption.

In a study currently being carried out at the University of Sydney (Tarraf NE, Jones A, Erverdi N and Darendeliler M A), scanning electron microscopy images of endodontically treated versus vital controls subjected to orthodontic intrusion appear to show that endodontically treated teeth do not exhibit more resorption than vital teeth. However this study is not yet finalised. In the SEM images below the endodontically treated teeth on the right show no apparent difference in resorptive activity than the vital teeth on the left.



If root filled teeth resorb – what happens to the root canal filling?

Unfortunately the literature is lacking in this area with little reported about this particular issue and its consequences. According to Hamilton and Gutmann (1999) there are several possibilities:

1. The tooth itself may resorb to the extent that it exfoliates or needs to be removed, either removing the filling material with it, or the filling material may be left behind. If left behind, a fibrous capsule may form around it and it may remain asymptomatic. It is also possible that a sinus tract may form, indicating removal of the material. Alternatively, the filling material may resorb or even exfoliate.

2. In some cases root resorption may take place, without the loss of the tooth, exposing protruded root filling material. In this case, the periodontal ligament can adapt to the presence of the filling material, develop a new periodontal space and lamina dura in close proximity to the filling material, remaining symptom free with normal function (RoEnnermann, 1973). It is also possible that as soon as resorption takes place, a radiolucency may develop at the apex and around the filling material, either remaining symptom free or resulting in a sinus tract or swelling that requires treatment.

If resorption occurs will the apical seal in the root canal system be altered, resulting in failure of the endodontics?

Again this is an area that has not been addressed very well in the literature. Hamilton and Gutmann (1999) have proposed that if a root filled tooth has been well cleaned, shaped and three dimensionally obturated the apical seal would be maintained regardless of the amount of resorption. However resorption may lead to exposure of dentinal tubules that may

Australian Society of Orthodontists

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harbour bacterial toxins and necrotic material that may provide sufficient irritation to induce an inflammatory response or increased inflammatory root resorption (Peters et al., 1995, Nissan et al., 1995).

Summary

Some degree of usually reversible pulpal inflammation occurs following orthodontic movement. Poorly controlled forces can cause loss of tooth vitality, mainly due to severing of the blood supply at the apical foramen as the tooth is rapidly moved. Teeth in young patients with open apices are at minimal risk while teeth with a history of trauma or with an ongoing insult such as caries may be at risk similar to or greater than teeth with closed apices.

Endodontically treated teeth can be moved orthodontically just as readily as vital teeth. Generally, they are at no greater risk of root resorption. However, for those teeth that have suffered intrusive trauma, there is a greater risk of moderate to severe root resorption. Endodontically treated teeth that have been well cleaned with three dimensional obturation are less likely to initiate periapical pathology if root resorption occurs.

The next issue of Brighter Futures will review issues concerning the timing of orthodontic treatment following endodontics, movement of teeth that have undergone periradicular surgery, the effect of ongoing orthodontic treatment on the provision and outcome of endodontic treatment and overall orthodontic/endodontic treatment planning.

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