

Orthodontic Endodontic Relationship : A Clinicians Perspective

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Introduction

Inter-relationship between different aspects of teeth and related structures has always been a perplexing phenomenon when diagnosis and treatment planning involves restoring both health and aesthetics of the teeth. It may be of concern when the treatment planning includes tooth movement in teeth which are endodontically involved or undergoing some kind of orthodontic tooth treatment.

There are two major areas where Endodontics and Orthodontics share a common ground. One is etiologic because orthodontic movement affects the tooth being moved, and some response may be noted in the pulp tissue. The other, involves combined therapy, where orthodontic therapy is required to achieve the desired endodontic result.

This relationship ranges from effects on the pulp from orthodontic treatment and the potential for resorption during tooth movement, to the clinical management of teeth requiring integrated endodontic and orthodontic treatment. Literature data bases were accessed with a focus on orthodontic tooth movement and its impact on the viability of the dental pulp; its impact on root resorption in teeth with vital pulps and teeth with previous root canal treatment; the ability to move orthodontically teeth that were endodontically treated versus non endodontically treated; the role of previous tooth trauma; the ability to move teeth orthodontically that have been subjected to endodontic surgery; the role of orthodontic treatment in the provision for and prognosis of endodontic treatment; and, the integrated role of orthodontics and Endodontics in treatment planning tooth retention.

The Endodontic Orthodontics Continuum

Orthodontic tooth movement can cause degenerative and/or inflammatory responses in the dental pulp of teeth with completed apical formation. The impact of the tooth movement on the pulp is focused primarily on the neurovascular system, in which the release of specific neurotransmitters (neuropeptides) can influence both blood flow and cellular metabolism. The responses induced in these pulps may impact on the initiation and perpetuation of apical root remodelling or resorption during tooth movement. The incidence and severity of these changes may be influenced by previous or on-going insults to the dental pulp, such as trauma or caries. Pulps in teeth with incomplete apical foramen, whilst not immune to adverse sequelae during tooth movement, have a reduced risk for these responses. Teeth with previous root canal treatment exhibit fewer chances for apical root resorption during orthodontic tooth movement. Minimal resorptive/remodelling changes occur apically in teeth that are being moved orthodontically and that are well cleaned, shaped, and three-dimensionally obturated. This outcome would depend on the absence of coronal and apical leakage or other avenues for bacterial ingress. A traumatized tooth can be moved orthodontically with minimal risk of resorption, provided the pulp has not been severely compromised (infected or necrotic). If there is evidence of pulpal demise, appropriate endodontic management is necessary prior to orthodontic treatment. If a previously traumatized tooth exhibits resorption, there is a greater chance that orthodontic tooth movement will enhance the resorptive process. If a tooth has been severely traumatized (intrusive luxation/

avulsion) there may be a greater incidence of resorption with tooth movement. This can occur with or without previous endodontic treatment. Very little is known about the ability to move successfully teeth that have undergone peri-radicular surgical procedures. Likewise, little is known about the potential risks or sequelae involved in moving teeth that have had previous surgical intervention. Especially absent is the long-term prognosis of this type of treatment. During orthodontic tooth movement, the provision of endodontic treatment may be influenced by a number of factors, including but not limited to radiographic interpretation, accuracy of pulp testing, patient signs and symptoms, tooth isolation, access to the root canal, working length determination, and apical position of the canal obturation. Adjunctive orthodontic root extrusion and root separation are essential clinical procedures that will enhance the integrated treatment planning process of tooth retention in endodontic-orthodontic related cases.

Studies have determined that the risk of pulp damage in the average orthodontic patient is minor. There are conditions, however, that predispose a patient to an increased likelihood of pulpal damage during orthodontic treatment.

Orthodontic tooth movement will usually induce some degree of reversible or transient pulpal inflammation. 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.

Effect of Orthodontics on the Tooth Being Moved

Orthodontic treatment is used to gain aesthetic appearances and also helps settle occlusion. To achieve such results, the teeth being moved sometimes develop some side effects like blunting of the root of the tooth being moved, due to apical and sometimes lateral root resorption.

Orthodontics as an etiologic agent for Endodontics

- Blunting of root apex in the area where apical blood and nerve vessels emerge. It can be a susceptible site of injury and could affect pulp vitality.
- Movement of crowded teeth hiding periapical lesions due to inadequate radiographic view. This is many times seen after alignment.
- Tooth movement may cause some pulpal changes due to deposition of reparative dentin secondary to root resorption. Resorption can also occur from pulpal injury that might have been initiated by orthodontic movement.
- Rapid tooth movement using heavy forces may cause damage to the apical and periapical neurovasculature.

Endodontic Considerations Prior to Orthodontic Tooth Movement

There is no relevant contraindication to orthodontic movement of previously endodontically treated teeth with proper obturations.

Endodontically treated teeth may withstand root resorption during orthodontic movement better than vital teeth assuming good RCT is done and the tooth has a good coronal seal. This could be attributed to the lack of vital tissue at the tooth apex.

Teeth with immature apices also seem to better withstand resorption during orthodontic forces compared to mature teeth. This could probably be attributed to the lack of a closed apical area. They may show apical closure with vital neural tissue after assuming the final tooth position.

In teeth with irreversible pulpitis or necrotic pulps which are undergoing orthodontic treatment, root canal therapy should be started immediately to prevent periodontal breakdown. Some authors suggest continuous Ca(OH)₂ placement with coronal seal until completion of orthodontic treatment to prevent apical root resorption. Others recommend immediate Obturation.

Little is known about orthodontic movement of teeth that have undergone

apicoectomy exposed dentin may be a concern. But Proper retro-preparation and a 3mm apical seal may prevent any problems from occurring.

Orthodontic tooth movement should be restricted in cases under going endodontic treatment or on a recall which have periapical radiolucency. One should wait till signs of healing or complete resolution are observed. 6 month recall should be observed before initiating orthodontic treatment.

Orthodontic forces should not be placed on severely traumatized teeth for at least one year when possible.

Teeth with healed fractures (i.e. horizontal fracture in the middle third) may be moved orthodontically if the tooth is clinically and radiographically asymptomatic for two years post trauma.

Traumatized permanent teeth in preadolescents which undergo ankylosis have special considerations:

- Maintain the tooth in the mouth until the beginning of the adolescent growth spurt if possible
- Good space maintainer, maximized alveolar bone height, best option esthetically
- Extract the tooth at the beginning of the adolescent growth spurt
- Prevent s severe alveolar bone defect since the majority of facial growth occurs during this period
- In patients with tooth ankylosis during late adolecent period may have very little alveolar defect and normal restorative procedures may be sufficient to align teeth esthetically.

Care of Teeth Pre & Post Orthodontic Treatment Requiring Endodontic Therapy

- Monitoring tooth vitality during and after orthodontic treatment is absolutely necessary to check for changes if any.
- There is a high percentage of overfills as tooth movement may affect apical dentin matrix formation in maturing teeth.
- Blunting of root apex pre and post endodontic treatment in orthodontically treated teeth may also affect the apical limit of instrumentation and apical seal, considering that both cannot be accurately seen through a radiograph.
- Due to bands and arch wires, pulp vitality testing with neural stimulants id difficult orthodontic treatment. In such conditions, test cavity may be a choice of testing.
- Orthodontic tooth movement also helps improve periodontal health in teeth which may be periodontally not very appropriate to save otherwise, like teeth with sub-gingival defects managed by forced orthodontic tooth eruption.
- Forced orthodontic extrusion also helps restore teeth with infrabony defects and teeth fractured at or below gingival level. Care has to be taken that sufficient tooth structure should be present for post and core and and biologic width should not be invaded. A circumferential supracrestal fibrotomy should be performed before any restorative

treatment is initiated.

- Any form of infection and inflammation should be controlled before tooth movement.
- Adequate anchorage must be available to produce only the movement specifically required.
- Care should be taken during applying intrusive and extrusive forces as improper intrusive forces may cause compression of the apical neurovascular apparatus and improper extrusive forces may cause excessive stretch to the neurovascular apparatus at the tooth apex.
- Heavy and rapid continuous forces may be avoided to cause neural decompression or stretching at the root apex.
- All types of carious lesions should be restored optimally prior to the beginning of Orthodontic treatment.

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