Orthodontic Movement after Regenerative Endodontic Procedure: Case Report and Long-term Observations

Antonis Chaniotis, DDS, MD

Abstract

Introduction: Although regenerative treatment approaches in teeth with incomplete root formation and pulp necrosis have become part of the suggested therapeutic endodontic spectrum, little is known about the effect of orthodontic movement in the tissue that has been regenerated. Furthermore, as the number of adults undergoing orthodontic treatment increases, there is an increasing need to investigate the changes that these tissues may undergo during orthodontic movement. Here we describe the alterations observed after the application of orthodontic forces in a case of an apically root-fractured necrotic immature root that had been managed with regenerative endodontic procedures in the past. **Methods:** A 9-year-old male patient was referred after suffering the third incidence of trauma in the anterior maxilla. Radiographic evaluation revealed a periapical rarefaction associated with an apically root-fractured immature central incisor. Clinical evaluation revealed a buccal abscess and grade 3 tooth mobility. Periodontal probing was within normal limits. The tooth was accessed and disinfected by using apical negative pressure irrigation of 6% NaOCl. Intracanal dentin conditioning was achieved by using 17% EDTA for 5 minutes. A blood clot was induced from the periapical area, and calcium silicate–based cement was placed in direct contact with the blood clot at the same visit. The composite resin restoration was accomplished in the same appointment. **Results and Conclusions:** Recall radiographic examination after 24 months revealed healing of the periapical lesion and signs of continuous root development despite the apical root fracture. Clinical evaluation revealed normal tooth development, normal mobility, and a resolving buccal infection. The tooth was subjected to orthodontic treatment because of Class II division 1 malocclusion with an overjet of 11 mm. After completion of the orthodontic treatment, 5.5 years after the initial intervention, the radiographic image revealed marked remodeling of the periapical tissues and repair of the apical fractures, and the buccal infection had resolved completely. *(J Endod 2017;■:1–6)*

Key Words

Apical fracture, Biodentine, negative pressure irrigation, orthodontic movement, regenerative procedures

Significance

The effect of orthodontic tooth movement after regenerative endodontic repair procedures is largely unknown. Under certain circumstances, orthodontic tooth movement might improve the periapical repair of necrotic immature teeth that had been subjected to regenerative endodontic procedures.

Surprisingly, detailed information on the overall relationships between endodontics and orthodontics during treatment planning decisions is sparse and insufficient (1). There is a general belief that orthodontic tooth movement can cause degenerative and/or inflammatory responses in the dental pulp of teeth with completed apical formation. Although teeth with incomplete apical foramen are not immune to adverse sequelae during tooth movement, a reduced risk for these responses is expected (1). The impact of the tooth movement on the pulp is focused primarily on the neurovascular system, in which the release of specific neurotransmitters (neuropeptides) could influence both blood flow and cellular metabolism. The responses induced in these pulps are suggested to impact on the initiation and perpetuation of apical root remodeling or resorption during tooth movement (2). The incidence and severity of these changes might be influenced by the width of the apical opening and the previous or ongoing insults to the dental pulp such as trauma or caries. Moreover, for teeth with previous root canal treatments, fewer propensities for apical root resorption during orthodontic tooth movement are expected (1). Minimal resorptive/remodeling changes can occur apically in well-cleaned, shaped, and three-dimensionally obturated teeth that are being moved orthodontically, and the outcome would depend on the absence of coronal leakage or other avenues for bacterial ingress.

It is believed that traumatized teeth can also 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 disease, appropriate endodontic management is necessary before 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.

Recently, regenerative endodontic procedures were introduced for the induction of continued root development and dentin wall thickening in necrotic immature traumatized teeth. Although early case reports suggested regeneration, histologic studies in

From the Endodontics, Warwick Dentistry/Athens Dental School, Kalithea, Atiki, Greece.

Address requests for reprints to Dr Antonis Chaniotis, Warwick Dentistry/Athens Dental School, Endodontics, 17676 Kalithea, Atiki, Greece. E-mail address: antch8@me.com

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animals and extracted teeth from patients, which had received regenerative endodontic procedures, suggest that what takes place in some cases may not be regeneration. It might be healing or repair, which is defined as tissue formation with a (partial) loss of function of the original tissue (3). When it comes to such teeth, very little is known about our ability to move them. Likewise, little is known about the potential risks or sequelae involved in moving immature teeth that have had repair tissue ingrowth after previous regenerative intervention. Especially absent is the long-term prognosis of this type of treatment in such teeth.

The aim of this article was to describe the long-term alterations observed after the application of orthodontic forces in a case of an apically root-fractured necrotic immature root that had been managed with regenerative endodontic procedures in the past. The regenerative endodontic procedure followed is also discussed in detail.

Case Report

A 9-year-old male patient was referred for the evaluation and possible treatment of his right maxillary central incisor after suffering the third incidence of trauma. His medical history was noncontributory. In his dental history, he reported 2 previous impact injuries during soccer training. The first injury was described as a concussion injury 8 months before attending our office. The second injury (3 months later) was described as enamel dentin fracture that had been managed by composite resin restoration. The third injury was suffered 1 month before the initial visit and was described as an intrusion injury with minimal displacement.

Clinical evaluation at the time of the initial visit revealed grade 3 mobility of the tooth combined with a buccal abscess (Fig. 1*A*). The tooth was percussion painful. Periodontal probing was less than 3 mm all around the tooth. Thermal and electrical vitality tests were negative only for the right maxillary central incisor. The incisal edge of the right maxillary central incisor seemed 0.5 mm lower than its contralateral central incisor, suggesting an intrusion luxation injury with minimal displacement (Fig. 1*A*).

The radiographic evaluation of the right maxillary central incisor revealed an immature root with an associated periapical lesion around the wide-open apex (Fig. 2*A*). Detailed examination of the periapical radiograph revealed 2 apically located fracture lines, suggesting that the weak root had been fractured in the vertical and horizontal planes during the intrusion injury. A pulpal diagnosis of pulp necrosis was made. The periapical diagnosis was acute apical abscess associated with an apically fractured immature tooth. Tooth retention at that time seemed extremely challenging because spontaneous repositioning and normal tooth development were halted. A decision was made to try and save this tooth by applying regenerative endodontic therapy.

Regenerative Endodontic Therapy

After delivering non–vasoconstrictor-containing infiltration anesthesia (Mepivastesin; 3M ESPE, Seefeld, Germany), the rubber dam was placed and secured with wedges and liquid dam material (Dam Cool; Danville Materials Inc, San Ramon, CA). Initial access to the wide canal was achieved by using the Endoguide burs (S S White Burs Inc, Lakewood, NJ) and by using a 25-mm-long Endo Z bur (Dentsply Maillefer, Ballaigues, Switzerland). On entering the wide canal, purulent exudate was noticed. After the purulent drainage ceased, the wide canal was rinsed with sterile water.

By using an electronic root canal length measurement device (Root ZX; J Morita Mfg Corp, Kyoto, Japan) and an ISO 100 Hedstrom file, the level of the apical fractures was assessed and verified with a radiograph (Fig. 2*B*). Disinfection was achieved by using negative pressure irrigation. An Endo Vac macro cannula (Endo Vac; Axis/Sybron Endo, Coppell, TX) was inserted into the wide canal, and 6% NaOCl solution (CanalPro plus; Coltene/Whaledent, Langenau, Germany) was delivered in the coronal part of the root. Approximately 45 mL freshly introduced 6% NaOCl was delivered, followed by 10 mL 17% EDTA solution (Canal Pro; Coltene/Whaledent). The macro cannula was withdrawn from the canal in the presence of sufficient EDTA solution in the pulp chamber to ensure that the canal remained totally filled with EDTA, and no air was drawn into the canal space.

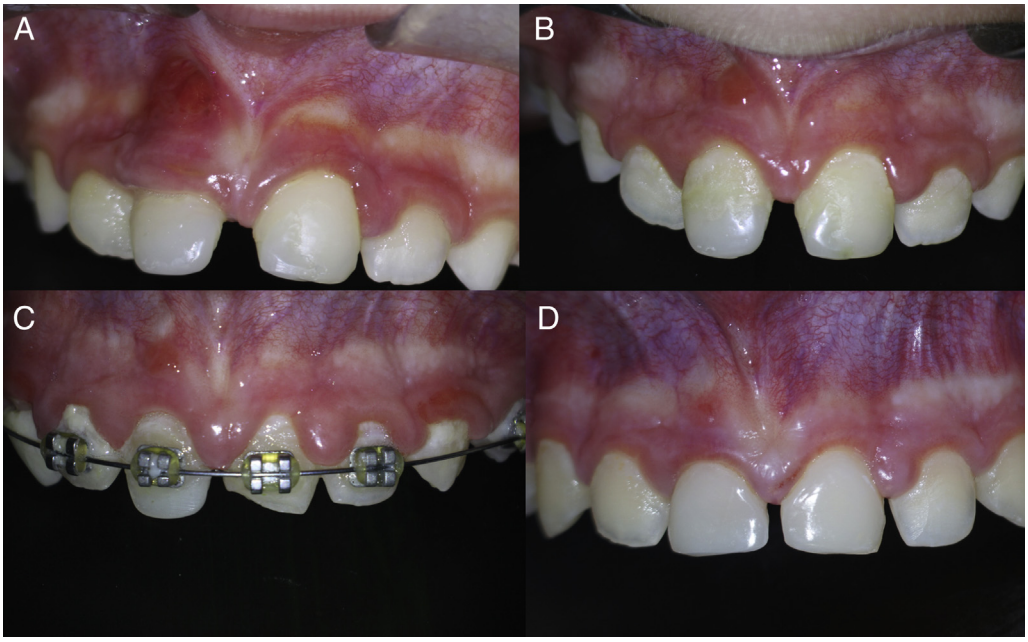

Figure 1. (*A*) Preoperative labial view of maxillary anterior teeth after intrusion injury; (*B*) 2-year follow-up labial view showing persistence of buccal abscess; (*C*) 42-month follow-up labial clinical view showing reduced size of persistent buccal abscess; (*D*) 5.5-year follow-up clinical view showing healthy tissues.