Effective Endodontically Treated Incisors with External Root Resorption during Orthodontic Movement: A Case Report

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Abstract

This case report describes a 21-year-old orthodontic patient experienced the external apical root resorption of maxillary central incisors with pulpitis during the orthodontic movement. The active cooperation of orthodontists and endodontists demonstrated the satisfactory treatment outcome and prevention of further apical root resorption.

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Abstract

This case report describes a 21-year-old orthodontic patient experienced the external apical root resorption of maxillary central incisors with pulpitis during the orthodontic movement. The active cooperation of orthodontists and endodontists demonstrated the satisfactory treatment outcome and prevention of further apical root resorption. The etiology of external apical root resorption is comprehensive, orthodontists should be armed with an adequate training and scientific knowledge, and keep the treatment mechanism simple and precise to guard against it. Besides, we should know the right timing of endodontic treatment and applying orthodontic force when external apical root resorption occurs.

1 Introduction

External apical root resorption(EARR) is one of the most undesirable sequel of orthodontic treatment, which was first reported by Ottolengui in 1914.[1] EARR may occur in as many as 90% of orthodontically treated patients[2] ,and it is most commonly seen in the maxillary incisors.[3][4] EARR associated with orthodontic forces is typically root surface resorption and causing the apical region of the roots to become shorter, even cause an imbalanced ratio of crown and root in the affected teeth.

While, orthodontically induced EARR can be considered as a frequent and acceptable complication. Orthodontic treatment itself does not induce the pulp necrosis nor calcific metamorphosis of the pulp. Moreover, the pulp is vital in teeth with EARR induced by orthodontic treatment. Endodontic treatment is not required unless pulp symptoms involved.[5] Root canal treatment can be considered for preventing EARR for severe externa root apical resorption.[2] Endodontically treated teeth may have a lower level of EARR even the difference might not be clinically significant (up to 1mm).[6]

This case report describes a 21-year-old girl undergoing orthodontic treatment encountered pulpitis and external apical root resorption of maxillary central incisors. When pulp symptoms appear, orthodontists consulted with the endodontist in time to complete endodontic treatment. Timely and effective endodontic treatment not only controlled the external apical root resorption, but also ensured orthodontic treatment proceeded smoothly.

2 Diagnosis and etiology

A girl aged 21 years old asked for orthodontic treatment with the chief complaints of irregularly located teeth and protrusion. Facial photographs showed mild asymmetry, with the left side larger than the right. The lateral view showed a slight convex facial profile with upper and lower lips to the E-line measurements of 0.9mm and 0.7mm, respectively. Intraorally, deep bite with excessive eruption of mandibular incisors, the maxillary dental midline was shifted to the right by 1mm, and the mandibular dental midline was shifted to the left by 1mm. The maxillary right canine buccally erupted, the mandibular second premolar inclined buccally and crossbite. An Angle Class I molar relationships were seen on both sides. Mild gingivitis and Teeth #11, #36, #46, #47 were caries (Fig1).Cast analysis showed severe crowding in both maxillary and mandibular arch(Fig2). The panoramic radiograph showed four wisdom teeth and asymmetric morphology of bilateral condyles. No TMJ symptoms and signs were noted. Cephalometric radiograph revealed a skeletal Class I relationship (ANB, 1.59) and low Mandibular plane angle (SN-MP, 24.26)(Fig 3; Table1). The diagnosis of this present patient was skeletal Class I malocclusion, low mandibular plane angle, and Class I dental relationships.

3 Treatment objectives

Caries were asked to go for dental treatment. Better oral hygiene was required. Because of the severe crowding and convex facial profile, the patient's 4 first premolars were planned for extraction to relieve the crowding and improve the profile. 4 third molars were also planned for removal. Align maxillary canine and mandibular premolar, correct their inclination, correct anterior deep bite by controlling lower incisor eruption to establish normal bite. Moderate anchorage was planned to achieve ideal occlusal relationship with coinciding upper and lower midline. Improve facial and dental appearance by orthodontic treatment.

4 Treatment progress

Completing resin fillings of teeth#11, #36, #46, #47 and removal of the 4 first premolars, the maxillary and mandible arch were bonded with 0.022-inpassive self-ligation system(Damon Q; Ormco, Glendora, Calif). The following sequence of arch wires was used for leveling and alignment:(1) 0.014 NiTi (Both arches), (2) 0.016 NiTi (Both arches), (3) 16 x 22 NiTi (Both arches),(4) 18 x 25 NiTi (Both arches), (5) 19 x 25 NiTi (Both arches), (6) 19 x 25 SS (Both arches), and (7) 0.014 SS (Both arches) with settling elastics.

However, the patient complained of maxillary right incisor pain and swelling one year after the start of orthodontic treatment. We paused the orthodontic process and referred to the endodontist for further examination. Clinical dental examination revealed the apical sinus tract of tooth #11, electronic pulp vitality test respond negative with grade-one mobility based on Millers Mobility Index. Periapical radiographs showed decreased apical density of two maxillary central incisors. The ratio of root and crown length decreased to 1.29(tooth #11) and 1.12(tooth#21) from the initial 1.47 respectively(Fig4A). Crown and root lengths were measured using the method of Linge.[7] Repeated electronic pulp test of #21 showed vital. Based on the above examination results and analysis, #11was diagnosed with periapical periodontitis, and undergone root canal treatment immediately. Due to the pulp is vital and no clinical symptoms, tooth #21 was not endodontically treated for the time.(Fig4B)

Unfortunately, tooth #21 occurred apical sinus tract and no vitality of electronic pulp test 2-month later. Periapical radiographs displayed decreased apical density and further EARR of tooth #21, the ratio of root and crown length decreased to1.10(Fig4C). Diagnosis of tooth #21 was chronic periapical periodontitis, and underwent root canal treatment. A three-month follow-up showed the reducing density-decreasing area, and no progress of EARR(Fig4D). The sinus tract has completely healed and no clinical symptoms.

Orthodontic treatment was continued 6 months after root canal treatment. During the latter orthodontic treatment, maxillary central incisors had no progress of EARR. The total treatment duration was 33 months, including a 8-month interval for dental treatment.

5 Treatment results

Post-treatment exhibited acceptable and appreciable outcome with improved profile. The Class I molar relationship on both sides was maintained throughout the treatment. The canine relationships were corrected to Class I, and the upper, lower, and facial midlines were coincident(Fig5,Fig6). A functional occlusion was established with stable posterior support and proper anterior guidance. The superimposition of the cephalometric tracings before and after treatment showed the treatment goals were achieved(Fig7). 3 year post-treatment revealed proper retention and stability(Fig8). There was no complaint of discomfort in the affected teeth, the clinical examination was normal, the dental function was good, and the occlusal relationships and function remained stable. Radiographs showed continuous intact periodical membrane, no change in alveolar bone height, no further root resorption, no change in root length(Fig4E). Two third molars will be extracted.

6 Discussion

The etiology of EARR is comprehensive, including individual biological characteristics, genetic predisposition and the effect of orthodontic forces. Risk factors can be divided into patient-related and treatment-related factors.[8] The orthodontic treatment duration, magnitude of applied force, direction of tooth movement, amount of apical displacement, and method of force application are all belong to the latter.[9] Levander et al and Kjaer reported a higher prevalence of EARR in females than males.[10][11] The prolonged treatment duration and treatment with extraction are the highly related risk factors.[6] Besides, the use of class II elastics could aggravated root resorption of incisors.[7]

In this case, we used the conventional light force for leveling and alignment, applied short-time class II elastics for later occlusal adjustment. The cause of necrotic pulp may be attributed to patient-related factors. It probably due to the dental caries secondary to periodontal inflammation for tooth #11.The cause of tooth#21 EARR was not very clear, and it might owe to periapical inflammation or patient's tolerance. During orthodontic treatment, the incidence rate of external apical root resorption is up to 90%. Pulp infections and periapical inflammation can increase the incidence of external apical root resorption. Kaku[12]proved that orthodontic treatment may promote the expression of inflammatory factors in the pulp tissue. During orthodontic movement, an aseptic inflammatory process which consisting of excessive force, inflammatory cells, the surrounding matrix, bones, and biological messengers will occur.[13][14]Therefore, the status of the pulp should be determined before orthodontic treatment.

In this case, tooth #11 had caries and tooth# 21 had no caries before orthodontic treatment. Undergoing 1 year of orthodontic treatment, tooth#11occured necrotic earlier than tooth# 21, and X-ray examination showed the tooth #11 had EARR and periapical lesions. It was proved that the pulp inflammation aggravated the degree of EARR. Root canal treatment can remove the infected pulp tissue and stop the periapical inflammation during the force application. In our case, no further development of EARR was found in the follow-up after treatment of tooth#11 and tooth#21.

When it comes to the timing of RCT, both of the pulp status and the severity of EARR should be considered together. Ballal's [15]case published in 2008 suggested that loss of pulp vitality does not always occurred with the external apical root resorption. Endodontic treatment is recommended only when pulp necrosis with periapical inflammation or severe apical root resorption. Root length reduction is more than 4mm or 1/3 of original root length is considered the severe apical root resorption. We should distinguish the etiology of the moderate and severe root resorption according to Proffit[16]. In the case of extreme resorption, endodontic treatment should be taken even the pulp is vital. Severe root resorption, such as the root length less than 9mm, will affect the prognosis of the teeth[17].

In this case, one year after the start of orthodontic treatment, tooth#11 showed no vitality while 21 showed vitality. When both tooth showed obvious external apical root resorption on X-ray examination, endodontists did RCT only for tooth#11. RCT for tooth #21 was performed 2 months later when pulp showed no vital. Therefore, RCT is not recommended for teeth without pulp symptoms. We did RCT for the affected incisors to remove the infective agents, and stopped applying the orthodontic force. Armans[17] proposed a same point in the case published in 2008.

Since the orthodontic treatment will not affect the outcome of RCT, it can only delay the healing process. When to start applying orthodontic force should be considered. De Souza[18]established a model of periapical periodontitis in dog's teeth, and suggested 3 weeks after RCT. For teeth with large periapical lesions, the orthodontic treatment should be initiated at least 3months later. Still, it is recommended to take X-ray examination every 3 months during orthodontic treatment to follow up the healing process. We reapplied orthodontic force 6 months later in our case.

Satisfactory endodontically treated teeth had more resistance to the applied orthodontic forces than pulp vitality, and consequently being moved safely with less resorption. [13][14] [19][20]The endodontic treatment in our case could be called successful for strongly tolerating the orthodontic forces along with the physiologic masticatory forces. Furthermore, EARR never aggravated during following treatment and retention period.

Since EARR is a multifactorial phenomenon, care should be taken to prevent it by keeping the orthodontic treatment mechanism simple and precise. For patients who have notable root resorption, follow-up radiographic examinations are recommended until root resorption is no longer evident.

7 Conclusion

Orthodontists should be mindful that multiple factors lead to EARR, and have an adequate training and scientific knowledge to adopt preventive and predictive approaches to EARR in orthodontic practice. Effective endodontic treatment makes EARR teeth safer for orthodontic movement.

8 Conflict statement

All authors have no conflict of interest.

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