ACTA SCIENTIFIC DENTAL SCIENCES (ISSN: 2581-4893)

Volume 4 Issue 9 September 2020

Case Report

Endodontic Management of Trauma-induced External Root Resorption Following Orthodontic Treatment by Placement of Biodentine: A Case Report

Reza Sayyad Soufdoost[1]*, Ali Jamali Ghomi[2], Hossein Labbaf[1] and Homeira Ansari Lari[3]

[1]Endodontics Department, Faculty of Dentistry, Shahed University, Tehran, Iran

[2]Prosthodontics Department, Faculty of Dentistry, Shahed University, Tehran, Iran

[3]Prosthodontics Department, Faculty of Dentistry, Islamic Azad University of Medical Science, Tehran, Iran

***Corresponding Author:** Reza Sayyad Soufdoost, Endodontics Department, Faculty of Dentistry, School of Dentistry, Shahed University, Tehran, Iran.

Received: July 15, 2020

Published: August 25, 2020

Abstract

External root resorption is considered as a frequent complication of orthodontic tooth movement, particularly, in a tooth with the history of trauma and resorption. Advances in dental material science not only have increased demand from the patients for saving their teeth, also have enabled clinicians to treat the complicated cases. Previously most of the teeth with severe external root resorption were scheduled to extraction due to poor prognosis of conventional endodontic treatment. This case report presents successful nonsurgical endodontic management of a trauma-induced perforating external root resorption with Biodentine which had been progressing rapidly after applying orthodontic forces. 24 months follow-up revealed arrest of root resorption, and advanced healing of the lesion.

Keywords: Biodentine; External Root Resorption; Orthodontic; Trauma; Endodontic

Introduction

External root resorption (ERR) is considered as one of most important sequelae observed after common dental trauma [1]. External surface of root is protected by pre-cementum, cementoblast and epithelial rest of malases [2]. Following traumatic injuries, a chemotactic process is triggered after damage or interruption of these tissues, which attract the activated clasts, colonize the affected surface of root and initiate the resorption process [3]. Necrotic pulp is considered as the main factor accounting for maintenance of ERR. Both presence of necrotic pulp rests or bacteria within dentinal tubules attract large number of osteoclasts to the area of resorption [3,4]. The pulp canal is ultimately exposed if resorption progression continues up to root canal [4]. Tooth mobility, pain, sinus tract and crown discoloration may be presented in a tooth with the history of trauma [4,5].

Orthodontic treatment can consider as a predisposing factor for ERR. In a tooth with the history of trauma, orthodontic pressure can cause collapse and thus localized loss of the blood supply within periodontium [6]. Degradation of the protective outer layers of the tooth, which caused by the ischemic necrosis in the periodontal ligament, results in root resorption [7]. So, follow-up radiographs and clinical examination of traumatized teeth plays an important role in early diagnosis of these defects [5]. Early diagnosis and appropriate treatment of a tooth with ERR can prevent its serious complications [1].

Cone beam computed tomography (CBCT) is a diagnostic imaging modality which affords clinicians the ability to accurate diagnosis, treatment planning and follow-up [8]. CBCT provides a detailed three-dimensional evaluation of teeth, maxillofacial skeletal district and relation among anatomical structures comparing the two-dimensional images, which provided by conventional intraoral periapical radiographs [5,8]. Particularly, in the case of ERR, it is important to understand whether there is a communicating lesion or it is limited in the external surface without involvement of root canal space [4,5].

The survival possibility of traumatized teeth encourages clinicians to attempt endodontic treatment of the tooth to fulfill functional, psychological and esthetical needs of the patient [5]. Various materials have been recommended to restore the resorption area of the root canal [9]. Biodentine is a bioactive calcium silicate-based cement which has been recently introduced in the market as a dentine substitute [10]. Some characteristics of Biodentine such as faster setting time and easy manipulation compared to Mineral Trioxide Aggregate (MTA), has made Biodentine as first choice material to treat complicated endodontic cases [11]. Also, some studies have proved that compressive strength, flexural strength and biocompatibility of Biodentine are superior to that of MTA [10,11].

This case report describes the endodontic management of severe ERR potentiated after applying orthodontic forces in maxillary central incisor.

Case Report

A 16-year-old female patient referred to Endodontic Department of Shahed University, Tehran, Iran, with the chief complaint of pain on tooth 21. Clinical and radiographic examinations were performed. Intra oral examination showed a weak discoloration, mobility grade 2, tenderness to vertical percussion, 2mm extrusion and multiple sinus tracts in association with tooth 21.

Medical history was noncontributory, but dental history revealed a trauma to her anterior teeth 2 years before starting the orthodontic treatment, as she met with a car accident and for that she did not receive any dental treatment. OPG (Figure 2A), intraoral periapical (Figure 2B) and CBCT (Figure 3 and 4) were taken.

Figure 1: Photograph of patient before treatment.

Figure 2A and 2B: Preoperative OPG (A) and periapical radiograph (B).

Figure 3: CBCT Sagittal section showing the extent and location of the resorption defect in sagittal plane.

Figure 4: CBCT Axial section showing the extent and location of the resorption defect in axial plane.

Radiographic examinations revealed areas of radiolucency along the coronal and middle third of root and surrounding bone (moth eaten appearance) with loss of lamina dura which suggested sever ERR in relation to tooth 21, however the apical third of tooth was intact. On the other hands, the CBCT confirmed a communicating ERR through the coronal and middle third of the root. Evaluation of older Orthopantomogram (OPG) which had been taken before starting the orthodontic treatment (Figure 5) showed the presence of resorption, however the area of ERR was smaller significantly compared to the new OPG taken.

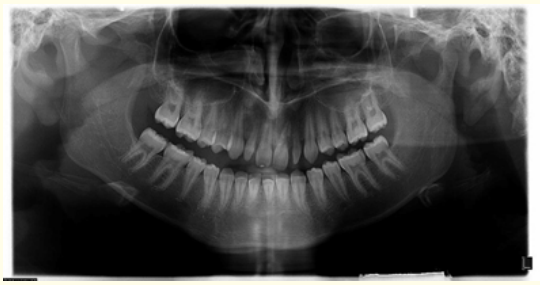

Figure 5: OPG before starting the orthodontic treatment.

On the basis of history, clinical examination and radiographic findings a diagnosis of sever ERR in tooth 21 was made. Since the extension of root resorption was massive, the conventional endodontic treatment was controversial. The questionable prognosis of treatment was explained for the patient and her guardian, and the other choices of treatments were introduced. Patient was willing to take a chance for saving her tooth despite of uncertain prognosis and outcome. After the consent form was signed by the patient and her guardian, the conventional endodontic treatment followed by obturation of apical third and areas of resorption by Biodentin was planned.

Access cavity was made under local anesthesia with Lidocaine with 1:100000 epinephrine (Daroupaksh, Tehram, Iran). All infected and necrotic dentin were removed by round bur and gingival tissue was cauterized on the palatal aspect of root. Afterwards, the tooth was isolated by rubber dam. The root canal was instrumented with K-files up to 60# (Mani, Tochigi, Japan) and was frequently irrigated with copious 2.5% NAOCL. Then, the root canal was dried and calcium hydroxide was placed as intracanal medicament. A wet cotton pellet was placed in the access cavity and restored with temporary restorative material. Analgesic on demand was prescribed. The next appointment was scheduled for 2 weeks later. However, in case of pain/swelling, the patient was advised to report immediately. Also, patient was instructed to avoid holding food only with this tooth, and to take care of even minor trauma to the tooth.

On the subsequent visit, the patient revealed no history of pain over the past 14 days and there was no sign of sinus tract in associated with tooth 21 (Figure 6).

Figure 6: Photograph of patient after treatment.

After anesthesia and applying rubber dam, all temporary filling material was removed and initial working length was determined by using electronic apex locator (Raypex 5, VDW GmbH, Munich, Germany). Working length was confirmed radiographically with a K file #60 (Figure 7A). Root canal was rinsed several times by 2.5% NAOCL followed by a final rinse with 5 ml 17% EDTA and was dried by sterile paper points (Aria Dent, Tehran, Iran). Afterwards, Biodentine (Septodont, St. Maurdes Fossés, France) was mixed according to the manufacturer's instructions and under dental operating microscope (OPMI pico, Carl Zeiss, Jena, Germany) was condensed gently with finger plugger in the full length of root canal and the areas of resorption as well.

After completion of root canal therapy, patient was referred to restorative department to restore the crown of the tooth (Figure 8).

The patient was scheduled for appointments at 3, 6, 12, 24 months after treatment (Figure 9A-9D respectively).

Figure 7A and 7B: Working length radiograph (A) and Final radiograph (B).

Figure 8: PA after restoration of crown.

Figure 9A-9D: Follow-up radiographs 3 (A), 6 (B), 12(C) and 24 (D) Months.

At the recall visits, the patient was asymptomatic and the result of treatment was satisfactory. The healing of resorbed areas was remarkable after 24-month follow-up. Also, there was no sign of replacement resorption and crown discoloration.

Discussion

ERR is a serious dental complication, which can lead to extraction of a tooth in early age. ERR is a possible late complication of trauma in anterior teeth. Early diagnosis of ERR generally increases the chances for successful treatment. CBCT is a new diagnostic technology that provides clinicians very precious information about anatomic complications, extension and exact location of lesions which cannot be obtained by conventional intraoral radiographs [8]. Also, by using CBCT, the problems of anatomical superimposition seen with conventional intraoral radiographs can be eliminated [12]. In the present case, by using CBCT, the comprehensive information was achieved about the extension of root resorption and precise location of trauma-induced perforating ERR through the coronal and middle third of root.

Various factors may influence the progression pace of ERR including orthodontic treatment, age of patient, trauma and systemic condition [13,14]. ERR may be potentiated after applying orthodontic forces, and it may progress rapidly [7]. In the present case, patient had the history of trauma to anterior region of her face before orthodontic treatment. Also, according to her initial OPG, which had been taken before starting the orthodontic treatment, the area of ERR was completely diagnosable. Definitely, it was missed by her orthodontist, otherwise, if it had been diagnosed before applying the orthodontic forces, the prognosis and outcome of endodontic treatment might have been more hopeful. Time is the most important factor which can affect tremendously on the future outcome and long-term prognosis of the endodontic treatment in the traumatized teeth [13]. According to some articles, root resorption before orthodontic treatment have been shown linked with greater risk for severe root resorption [7,15]. Also, it has been proven that the longer duration of active treatment and force application could be highly associated with ERR [16]. So, it is important that orthodontists being aware about the consequences of application of orthodontic forces to the teeth with the history of trauma. On the other hands, orthodontists should take a history of trauma before starting the orthodontic treatments of their patients, and

evaluate the radiographic images precisely to find the possible areas of resorption existing around the roots, and if necessary, to consult with an endodontist [16]. Besides, follow-up radiographs should be taken regularly during orthodontic procedure, specially, in the cases with the history of dental trauma [6].

Young adults are seeking orthodontic treatments, and traumatic injuries are prevalent among young adults aged 6 - 12 years old [15]. Also, external inflammatory root resorption may progress rapidly in young teeth as dentinal tubules are wide and irritant easily can reach to the external surface of the root [13]. Accordingly, in the present case, age was another contributing factor along with orthodontic treatment which might have influenced on the rapid progression of ERR.

Biodentin is a bioactive and biocompatible calcium silicate-based material which makes it a favorable perforation repair material [10]. Biodentin has some advantages over MTA including easy handling, less setting time and no discoloration [11]. Also, Biodentin has a better consistency after mixing compared to MTA which makes it possible to place in areas of resorption defects with the higher adaptation [10]. Biodentine does not require a two steps obturation as in the case of MTA because of its faster setting time [11]. In the present case, the area of root resorption and perforation were extensive and therefore Biodentine was preferred over MTA so as to prevent the subsequent leakage between sessions of root canal and crown restoration in the case of MTA. On the other hands, Biodentine shows apatite formation after immersion in phosphate solution indicating its bioactivity and ability to enhance the marginal sealing due to deposition of apatite structures. Besides, Biodentine has been introduced as a dentine substitute material which made it the treatment of choice in the cases of root resorption along with the massive loss of root structure in order to reconstruct the damaged tissue.

Therapeutic methods used to treat a tooth with severe external root resorption remain a unique challenge in the clinical practice. There are some alternative treatment modalities to treat cases like the present case described, such as surgical procedure, replantation, and extraction followed by implant replacement [5]. In practice, a tooth with only one third of the cervical root may remain in the mouth and preserve its function in mastication, phonation and esthetics without any increased mobility or gingival changes [17]. Also regarding to age and acceptance of risk of treatment by the patient and her guardian, extraction followed by implantation was ruled out from treatment plan options. Surgical endodontic treatment and replantation are considered as a last resort and should be attempted only when the other treatments are not possible due to the chance of root fracture, replacement resorption and ankylosis [18]. Pruthi., *et al*. [5] treated successfully a case of ERR with extraction of involved tooth with a communicating root resorption after root obturation followed by debridement and obturation of defect, and replantation of tooth. This treatment modality carries some risks including root fracture through the extraction due to excessive loss of root structure, chance of replacement resorption and ankylosis [18]. So, in the present case, it was decided to endodontically treat the tooth with Biodentine without surgical procedure. Also, in the present case, the entrance of perforating area of resorption was as extensive as that made it possible to access the defect from the inside of root space completely, however, in cases with a small perforating EIR, accessing to the defect might not be possible from the root canal space [13]. In the present case, it has been shown that with the noninvasive conventional endodontic treatment and precise placement of Biodentine could reach to the optimal and favorable outcomes expected.

Noninvasive approach is a first choice for treatment of any disease [19]. According to 24 months follow-up radiographs, conventional endodontic treatment along with applying Biodentin in management of ERR resulted in healing of the resorptive areas of root and bone as well as apical lesion.

Conclusion

Biodentine can be considered as a favorable filling material in the case of severe external root resorption which can help not only to arrest the progression of resorption, also can promote healing of the apical lesion and bone defect adjacent to area of resorption. Also, orthodontists should evaluate the anterior teeth radiographically and clinically before and during orthodontic treatment, to prevent possible external root resorption.

Conflict of Interest

None.

Bibliography

1. Aidos H., *et al*. “Resorption Classifications: A Narrative Review and a Clinical Aid Proposal for Routine Assessment”. *European Endodontic Journal* 3.13 (2018): 134-145.

2. Santos BO., *et al.* "Root resorption after dental traumas: Classification and clinical, radiographic and histologic aspects". *Revista Brasileira De Odontologia* 8 (2011): 439-445.

3. Finucane D., *et al*. "External inflammatory and replacement resorption of luxated, and avulsed replanted permanent incisors: a review and case presentation". *Dental Traumatology* 19.3 (2003): 170-174.

4. Heithersay GS. "Management of tooth resorption". *Australian Dental Journal* 52 (2007): S105-S121.

5. Pruthi PJ., *et al*. "Management of external perforating root resorption by intentional replantation followed by Biodentine restoration". *Dental Research Journal (Isfahan)* 12.5 (2015): 488-493.

6. Alberto C. "Extreme root resorption in orthodontic practice: teeth do not have to be replaced with implants". *Dental Press Journal of Orthodontics* 24.5 (2019): 20-28.

7. Fang X., *et al*. "Root resorption in orthodontic treatment with clear aligners: A systematic review and meta-analysis". *Orthodontics and Craniofacial Research* 22.4 (2019): 259-269.

8. Durack C., *et al*. "Cone beam computed tomography in endodontics". *Brazilian Dental Journal* 23 (2012): 179-191.

9. Kaur M., *et al.* "MTA versus biodentine: Review of literature with a comparative analysis". *Journal of Clinical and Diagnostic Research* 11 (2017): ZG01-ZG05.

10. Camilleri J., *et al.* "Investigation of the hydration and bioactivity of radiopacified tricalcium silicate cement, Biodentine and MTA Angelus". *Dental Materials* 29.5 (2013): 580-593.

11. Bortoluzzi EA., *et al.* "Marginal gingiva discoloration by gray MTA: A case report". *Journal of Endodontics* 33 (2007): 325-327.

12. Al-Alawi H., *et al.* "The prevalence of radix molaris in the mandibular first molars of a Saudi subpopulation based on cone-beam computed tomography". *Restorative Dentistry and Endodontics* 45.1 (2019): e1.

13. Shemesh A., *et al.* "External invasive resorption: Case report of a rapidly progressive process in an impacted maxillary canine during orthodontic treatment". *Australian Endodontic Journal* 45.2 (2019): 259-264.

14. Soares AJ., *et al.* "Frequency of root resorption following trauma to permanent teeth". *Journal of Oral Science* 57.2 (2015): 73-78.

15. Hartsfield J. "Genetic factors in external apical root resorption and orthodontic treatment". *Critical Reviews in Oral Biology and Medicine* 15 (2004): 115-122.

16. Alhadainy HA., *et al.* "Orthodontic-induced External Root Resorption of Endodontically Treated Teeth: A Meta-analysis". *Journal of Endodontics* 45.5 (2019): 483-489.

17. Consolaro A., *et al.* "Extreme root resorption associated with induced tooth movement: A protocol for clinical management". *Dental Press Journal of Orthodontics* 19.5 (2014): 19-26.

18. Nayak G., *et al.* "Biodentine-a novel dentinal substitute for single visit apexification". *Restorative Dentistry and Endodontics* 39.2 (2014): 120-125.

19. Peer M. "Intentional replantation: A 'last resort' treatment or a conventional treatment procedure? Nine case reports". *Dental Traumatology* 20 (2004): 48-55.