

**INTENTIONAL REPLANTATION OF TWO CENTRAL INCISORS WITH  
HORIZONTAL ROOT FRACTURES APPLYING APICAL MTA PLUGS AND  
EMDOGAIN: A CASE REPORT**

**HORİZONTAL KÖK KIRIKLI İKİ ORTA KESER DIŞIN APİKAL MTA TIKACI  
VE EMDOGAIN UYGULAMASIYLA BİLİNÇLİ REPLANTASYONU: VAKA  
RAPORU**

**Doç.Dr. Özgül BAYGIN\***  
**Prof.Dr. Esra BALTACIOĞLU\*\***

**Doç.Dr. Tamer TUZUNER\***  
**Yrd. Doç. Dr. Mehmet TANRIVER\*\*\***

**Makale Kodu/Article code:** 2403

**Makale Gönderilme tarihi:** 30.09.2015

**Kabul Tarihi:** 14.01.2016

**ÖZ**

Horizontal root fractures are complex traumatic injuries that require multidisciplinary management. A 48-month clinical-radiographical follow-up of delayed intentional replantation in a patient with horizontal root fractures was presented. A 10-year-old male patient was referred to the Pediatric Dentistry department 10 days after the initial intervention due to severe trauma in the maxillary central incisor region. Severe gingival inflammation together with mobility was observed in the intraoral examination of patient, who attended to our clinic in a late period. Horizontal root fractures were detected in the apical region of the teeth with radiographic examination. Intentional replantation was planned to remove the fractured apical segments and to regenerate the damaged periodontal tissues. The teeth in the trauma region were gently extracted, granulation tissues were debrided after removal of the fractured segments in the alveolar socket, and the teeth were soaked in doxycycline solution. Subsequently, the apical parts of the teeth were plugged with mineral trioxide aggregate (MTA), the tooth surface was coated with Emdogain gel and the teeth were placed in the sockets after completing the endodontic treatments. The teeth were splinted for 2 weeks in a semi-rigid fashion. No pathologies were detected, while marked healing in the periodontal tissues and ankylosis were observed in the teeth at the 48-month clinical-radiographical follow-up. Though the follow-up in our case is 48 months, delayed intentional replantation in hopeless trauma cases with Emdogain and MTA can be discussed as an acceptable way for managing dental trauma in a growing child.

**Key Words:** Horizontal-root fractures, Intentional Replantation, Emdogain, MTA

**ABSTRACT**

Horizontal kök kırıkları multidisipliner tedavi gerektiren kompleks travmatik yaralanmalardır. Bu vaka raporunda horizontal kök kırıklı bir hastanın gecikmiş bilinçli replantasyonunun 48 aylık klinik-radyografik takibi sunulmuştur. On yaşında erkek bir hasta üst orta keser diş bölgesindeki şiddetli travma nedeniyle gerçekleştirilen ilk müdahaleden 10 gün sonra çocuk diş hekimliği bölümüne sevk edilmiştir. Kliniğimize geç başvuran hastamızın ağız içi muayenesinde mobiliteyle birlikte şiddetli dişeti iltihabı gözlenmiştir. Radyografik muayene sonucunda dişlerin apikal bölgelerinde horizontal kök kırıkları tespit edilmiştir. Kırık apikal parçaları uzaklaştırmak ve hasar görmüş periodontal dokuların rejenerasyonu amacıyla bilinçli replantasyon planlanmıştır. Travma bölgesindeki dişler dikkatlice çekilmiş, alveoler soketteki kırık segmentler uzaklaştırılmasından sonra granülasyon dokuları temizlenmiş ve dişler doksisisiklin çözeltisinde bekletilmiştir. Takiben, dişlerin apikal kısımları mineral trioksit agregat (MTA) ile tıkaçlanmış, diş yüzeyi Emdogain jelle kaplanmış ve endodontik tedavileri tamamlandıktan sonra dişler sokete yerleştirilmiştir. Dişler 2 hafta boyunca yarı sabit şekilde splintlenmiştir. Kırık sekiz aylık klinik-radyografik takipte periodontal dokularda belirgin iyileşme ve ankiloz gözlenirken, herhangi bir patoloji de gözlenmemiştir. Bu vaka raporunda takip süresi 48 ay olsa da, ümitsiz travma vakalarında Emdogain ve MTA ile bilinçli replantasyon, büyüme sürecindeki çocukta dental travmanın tedavisinde kabul edilen bir metod olabilir.

**Anahtar Kelimeler:** Horizontal kök kırıkları, Bilinçli replantasyon, Emdogain, MTA

\* Karadeniz Teknik Üniversitesi Diş Hekimliği Fakültesi Pedodonti AD

\*\*Karadeniz Teknik Üniversitesi Diş Hekimliği Fakültesi Periodontoloji AD

\*\*\*İzmir Şifa Üniversitesi Diş Hekimliği Fakültesi Pedodonti AD



## INTRODUCTION

Root fractures, defined as fractures including the dentin, cementum, and pulp, are not common injuries among dental traumas with an observation ratio of 0.5 to 7% in permanent dentition.<sup>1,2</sup> A fracture line perpendicular to the long axis of the root of a tooth is identified as a horizontal root fracture. Horizontal root fractures (HRF) generally are observed in the anterior teeth of young adults following traumatic injuries.<sup>2</sup> Almost 75% of HRFs affect the maxillary central incisors of male patients resulting from trauma associated with automobile accidents, sports injuries, fights, etc.<sup>3</sup>

The most frequently affected region of this type of trauma was reported as the middle third of the root compared to the coronal and apical thirds.<sup>4</sup> A slightly extruded and often lingually displaced tooth is observed in root fractures in the clinical scenario. The tooth is often mobile, but the degree of mobility depends on the fracture location. Increased mobility of the tooth accompanied with bleeding from the periodontal ligament and damage to other tissues is also observed. Pain during occlusion is also reported.<sup>1,5,6</sup> Radiographically, the most frequent oblique fracture line and separation of the displaced coronal fragment from the apical one is revealed during radiographic examination.<sup>1</sup>

Several factors, such as degree of dislocation, stage of root formation, fracture location, time between trauma and treatment, and type of dental trauma affect treatment outcome.<sup>3,7-9</sup> Since damage to the pulp, dentin, cementum, bone, and periodontium is combined, the consequences can be complex, horizontal root fractures require multidisciplinary management.<sup>3</sup> The common treatment method to overcome this type of trauma was reported as a reduction of displaced coronal fragments and immobilization by using semi-rigid fixation for about 4 weeks.<sup>1,4,7,10</sup> The observed healing process also includes the interposition of calcified, connective, and bone tissue.<sup>3</sup>

Intentional replantation is defined as the replantation of teeth extracted due to trauma or infection following pre/post-endodontic treatment, extraction, and replantation in the socket.<sup>11-14</sup> The main causes of failure in intentional replantation procedures have been identified as external root

resorption and ankylosis. Investigators have reported that the use of Emdogain in bone defects could be an acceptable way to obtain a better prognosis for intrabony periodontal defects.<sup>15-18</sup> It also prevents and delays the ankylosis of the replanted teeth.<sup>17</sup>

MTA, a successful pulp-capping and pulpotomy agent, has been shown to induce root-end closure in immature teeth.<sup>3,14,19</sup> Nowadays, synthetic apical plug materials have been proposed as an alternative to the apexification treatment method with calcium hydroxide. Mineral trioxide aggregate is the most frequently selected material for this purpose. MTA has been suggested to create an apical plug at the root end and helps to prevent the extrusion of the filling materials. There are fewer reported clinical studies and few case reports suggesting the use of MTA in the treatment of teeth with horizontal root fractures.<sup>3,4,14,19</sup>

This case report describes the treatment and 48-month clinical and radiographical follow-up of delayed intentional replantation in a patient with horizontal root fractures using Emdogain and MTA.

## Case Report

A 10-year-old male patient was referred to the Pediatric Dentistry department 10 days after the initial intervention due to severe trauma in the maxillary central incisor region. Severe gingival inflammation accompanied with mobility was observed in the intraoral examination of the patient with delayed referral. The patient explained that he had been referred by a physician who prescribed NSAIDs and advised him to have a dental check-up when he felt better. The patient reported constant pain, and occlusion was impossible because of the severely altered position of the upper front teeth. Clinical examination revealed swelling and erosions in the soft tissues. No signs of alveolar bone fracture were observed. Grade 3 mobility was shown in tooth 2.1 and 1.1 Grade 2 mobility was shown in tooth 2.2 (Fig 1.). Teeth 2.1, 1.1, and 2.2 were not sensitive to thermal stimulation. Horizontal root fractures were detected in the apical third region of the teeth with radiographic examination (Fig 2).

Intentional replantation was planned to remove the fractured apical segments and to regenerate the damaged periodontal tissues. The teeth in the trauma



Figure 1. Clinical view of the gingival inflammation after 10 days having treated in another dental health care center.



Figure 2. Periapical radiograph showing horizontal root fractures.

region were gently extracted, granulation tissues were debrided after removal of the fractured segments in the alveolar socket, and the teeth were soaked in doxycycline solution (Fig 3). Tooth 2.1 and 1.1 were instrumented with ProTaper Universal<sup>®</sup> rotary instruments (Dentsply Maillefer) up to SX/F5 at the root portion. The instruments were used with a high torque endodontic electric motor (VDW.GOLD<sup>®</sup> RECIPROC<sup>®</sup>, Pistoia, Italy) at maximum torque and 300 rpm. The canal was irrigated with 2 ml of 4% sodiumhypochlorite between each instrument. After completing instrumentation, the canal was irrigated with 2 ml of 10% citric acid. After drying of the canal with paper points, the apices of the teeth were plugged with MTA (Pro Root; Dentsply Maillefer), and the root canal treatment was completed with gutta percha. The root surfaces were coated with Emdogain gel (Biora AB, Malmo, Sweden), and the teeth were replanted in the sockets. The teeth were splinted for 2 weeks in a semi-rigid fashion (Fig 4).



Figure 3. Extraction of upper anterior incisors with horizontal root fractures from the traumatic region.



Figure 4. Replantation and splinting of teeth following periodontal and endodontic treatment.

Two weeks after the first visit, the patient returned to the office with swelling and pain in tooth 2.2. Tooth 2.2 was instrumented with ProTaper Universal<sup>®</sup> rotary instruments up to SX/F5 at working length. The instruments were used with a high torque endodontic electric motor at maximum torque and 300 rpm. The working length was controlled using VDW.GOLD<sup>®</sup> RECIPROC<sup>®</sup>. Between each instrument usage, the canal was irrigated with 2ml of 4% sodiumhypochlorite. After the completion of instrumentation, the canal was irrigated with 2ml of 10% citric acid, which was left in the canal for 1 min. After drying of the canal with paper points, a size F5 obturator (ProTaper Universal<sup>®</sup>, Dentsply Maillefer) was used to fill the root canal with AH Plus (Dentsply DeTrey, Konstanz, Germany) as a root canal sealer.

The 18-month follow-up period revealed beneficial periodontal healing and no resorption pattern for all teeth (2.1, 1.1, 2.2) (Fig 5,6). Replacement resorption was also not detected, while marked healing in the periodontal tissues and ankylosis were observed in tooth 2.1 and 1.1 at the 48-month clinical and radiographical follow-up (Fig 7,8).



Figure 5. Clinical view 18-month after the operation.



Figure 6. Radiographical view 18-month after the operation.



Figure 7. Clinical view 48-month after the operation.

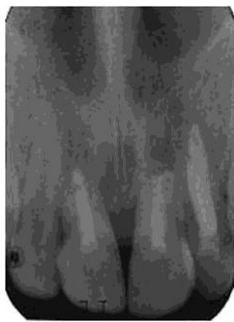


Figure 8. Radiographical view 48-month after the operation.

## DISCUSSION

Horizontal root fractures in the middle third and apical region may heal spontaneously,<sup>19,20</sup> particularly with immediate referral to the dental clinic.<sup>3,4,19</sup> Immobilization of root fractures is achieved with semi-rigid fixation, e.g., an acid etch/resin splint.<sup>1,4,6-10</sup> However, the coronal fragment can remain necrotized and managed with endodontic treatment.<sup>3,4,19</sup> If the immediate treatment is utilized, the repositioning of the tooth can be achieved easily.<sup>1,4,19</sup> In this case report, a child was referred to our clinic with the severely extruded and mobile upper central incisors and soft tissue swelling and erosion 10 days after the trauma. Radiographic evaluation also revealed root fracture in the apical third of the teeth. Because of the fracture factors, including degree of dislocation and particularly the delayed clinic visit,<sup>3,6-8</sup>

resistance was obtained upon repositioning. Thus, to overcome this seemingly hopeless situation, intentional replantation was decided upon.

In cases where it is not possible to treat the fractured tooth conservatively and tooth extraction is decided upon, it should be taken into account that careless extraction procedures will result in serious damage to the alveolar process and subsequent severe atrophy, especially in the labio-lingual direction, ultimately resulting in a compromised esthetic restorative treatment.<sup>1</sup>

By the way, to gain the acceptable future alveolar ridge thickness and height, the care must be taken into account in a growing patient.<sup>21</sup> In this case report, to minimize damage to the alveolar process, the extraction of both the coronal and apical fragments were completed carefully and gently via socket.

Since intentional replantation with the application of Emdogain has been found to be a promising approach to preserve teeth with limited ankylosis after dental trauma,<sup>15-17</sup> we used this concept to increase healing success. Also, the major disadvantage of the intentional replantation technique has been reported as postoperative root resorption.<sup>15,22</sup> Moreover, no postoperative resorption areas were observed around teeth 2.1 and 1.1 after a 48-month follow-up period. However, ankylosis was found in teeth 2.1 and 1.1 with a lesser infraocclusion pattern. This problem was solved temporarily by using a composite in the incisor regions of related teeth. Nevertheless, it should be remembered that the ankylosis of teeth replanted after dental trauma in children and adolescents may cause localized disturbances in jaw growth and, subsequently, in tooth loss.<sup>15,16,23,24</sup> Thus, when intentional replantation procedures are using in a growing child, careful follow-up procedures must be strictly considered, and if serious extended bone defects, particularly in the vertical direction, are found that require an augmentation procedure, the affected teeth must be extracted while the jaw is still growing.<sup>15,23</sup> It is also important to manage the development in a downward and forward direction of maxilla in children who have suffered from dental trauma.<sup>15</sup> Considering the aforementioned factors, the alveolar process, which was preserved for 48 months without observing any root resorption and infection problems, might provide functional considerations

upon completion of jaw growth in this case report.

Thus, the MTA is a biocompatible material that has demonstrated beneficial healing patterns in teeth with necrotic pulp and open apices<sup>3,19,25,26</sup> in root fractures; the apical portion of the coronal fragment was healed with MTA in this case report. No apical resorption was obtained around the teeth (2.1 and 1.1) after a 48-month follow-up period. This may also be related with the successful sealing property and biocompatibility of this material. Thus, when intentional replantation is used in a growing child with root fractures, MTA can be a good choice as an apical plug to improve the outcome of the treatment, as shown in previous reports.<sup>3,19,27</sup>

When delayed referral with severe hopeless dental root fractures occurs, intentional replantation with biocompatible dental materials can be considered an alternative way for managing dental trauma in a growing child. Multidisciplinary approaches are required for the effective management of both the dental and surrounding tissues.

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#### **Yazışma Adresi**

Doç. Dr.Özgül BAYGIN  
Karadeniz Teknik Üniversitesi  
Diş Hekimliği Fakültesi  
Pedodonti Anabilim Dalı  
TRABZON  
0462 3774814  
GSM: 0532 7607660  
e-mail: dtozgul@gmail.com

