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Esin Özlek
Department of Endodontics,
Faculty of Dentistry, Yüzüncü
Yıl University, Van, Turkey

Gizem Kadi
Department of Endodontics,
Faculty of Dentistry, Yüzüncü
Yıl University, Van, Turkey

Five-year follow-up of reattachment of crown fracture with polyethylene fiber post: A case report

Esin Özlek and Gizem Kadi

Abstract

Tooth fractures should be treated urgently. Different treatment options can be applied according to localization of the fracture. In the restoration of fractured roots after endodontic treatment, bringing the crown-root fragments together can be preferred. This article aimed to report that reattachment of crown fracture with composite resin using a polyethylene fiber post.

A 40-year-old male patient was admitted to a dentistry faculty with the complaint of tooth fracture. The patient's dental history revealed that the left upper lateral incisor tooth was broken 2 hours ago. The fragment was removed atraumatically. After the root canal treatment the mucoperiosteal flap was removed and reattachment of crown fracture with composite resin using a polyethylene fiber post. At 5 years follow-up, it was observed that there was no significant discoloration in the restoration of tooth number 22, that the compatibility of the restoration with the gingiva did not deteriorate and it maintained its integrity. Restoration of tooth fragment with polyethylene fiber post and composite materials could be a good alternative procedure to conservative treatments in traumatized anterior teeth.

Keywords: Traumatic dental injuries, polyethylenes, ribbon, composite resins

1. Introduction

Tooth fractures due to dental trauma are a common problem in children and adults. Most of these injuries affect the maxillary incisor teeth due to their position in the dental arch^[1]. Tooth fractures that occur as a result of trauma were confronted as enamel fractures, enamel-dentin fractures, complicated enamel-dentin fractures, crown-root fractures or complicated crown-root fractures. Root fractures should be treated urgently as they cause pain, functional and aesthetic loss as well as psychological problems in the patient. Different treatment options can be applied according to localization of the fracture^[2]. In determining the appropriate treatment protocol, many factors such as restorability of tooth (presence/absence of root fracture), condition of soft tissues, presence/absence of fractured tooth part and its condition for using in the restoration, occlusion, aesthetics, economical situation and prognosis play a role^[3]. In the restoration of fractured roots after endodontic treatment, bringing the crown-root fragments together can be preferred because of the advantages such as meeting the aesthetic expectations of the patient in a single session, being more conservative treatment, maintaining the health of periodontal tissues and using the original tooth of the patient in original contour and color^[4]. Along with the positive developments in adhesive dentistry in recent years, with the emergence of new generation dentin bonding agents, resin cement and restorative materials, the treatment became possible by strengthening the endodontically treated teeth instead of long, expensive and complicated prosthetic restorations in the treatment of such broken teeth^[5]. The physical properties of the fiber posts are similar to dentin and thus stretch in the equivalent ratio as dentin, increasing the fracture resistance of the restoration on it. Clinical studies in recent years have increased interest in polyethylene fibers containing fiber bundles embedded in a special composite material^[6].

Recently, a new post called Ribbon was launched. This material has a shape of weave-strip containing plasma-reinforced polyethylene fiber and a lock-stitch structure. Due to its strong, biocompatible, easy adaptability and light transmission properties, it can be used with composite resin or acryl. This 0.4 mm thick weave-strip can maintain its dimensional stability when cutting or applying and is available in different width of 1 mm, 2 mm, 3 mm, 4 mm and 9 mm. Polyethylene fibers need to be plasma roughened and activated in order to chemically

Corresponding Author:
Esin Özlek
Department of Endodontics,
Faculty of Dentistry, Yüzüncü
Yıl University, Van, Turkey

bond with dental resins. For this reason, firstly, a polymeric hybrid is formed by applying plasma and due to this hybrid structure, a high level of interfacial bonding with dental resins is achieved, providing a structure resistant to incoming forces [7].

In this case, conservative treatment of an upper lateral incisor tooth with complicated crown-root fracture with Ribbond, composite post/core application and 5-year follow-up of the case are presented.

2. Case report

A 40-year-old male patient was admitted to the Department of Endodontics of the Faculty of Dentistry of Van Yüzüncü Yıl University with the complaint of tooth fracture. The patient's dental history revealed that the left upper lateral incisor tooth was broken 2 hours ago. In the oral examination, it was detected that the patient had a fracture line in the mobile and cervical area of the left lateral tooth (Figure 1a, 1b). Mobility of adjacent teeth was determined to be within normal limits. Extraoral examination revealed no signs in soft tissues. Radiological examination did not reveal periapical pathology or alveolar fracture. An oblique crown-root fracture was observed in the left lateral tooth approximately 2 mm below the enamel-cement boundary. It was determined that the fracture line was in bucco-palatal direction and that the fracture line extends below the gingival border in the palatal region. Before treatment, patient were informed about the treatment process. After the informed consent form was signed, the photos were taken.

The fragment was removed atraumatically under local anesthesia (Figure 1c), a well sized Ribbond-compatible socket was prepared and stored in saline solution until adhesion stage. Then, the gingiva covering the fracture line was removed by electrocautery (ART, Electrosurge, Bonart Co., LTD., Taiwan) to reveal the boundaries of the fracture line. Endodontic access cavity was opened and the working length was determined using electronic apex finder (Propex Pixi, Dentsply, US) and periapical radiography. The root canal was prepared using ProTaper Next (DentsplyMaillefer, Baillagues, Switzerland) rotary file system up to X3. In each file changes, irrigation with 2 ml of 5.25% NaOCl (Wizard Guide, Istanbul, Turkey) was performed by using the Endo-Eze (Ultradent, South Jordan, UT) irrigation needle. Final irrigation was performed by using 5 ml of 5.25% NaOCl, 5 ml of 17% EDTA (Imident Med, Konya, Turkey), 5 ml of 5.25% NaOCl and 5 ml of distilled water respectively and the root canal was dried using a sterile paper points (Diadent, Chongju, Korea). Then, root canal filling was performed by lateral condensation technique using gutta-percha (Diadent, Chongju, Korea) and MTA Fillapex (Angelus, Londrina, PR, Brazil) root canal sealer.

After the root canal treatment was completed, the mucoperiosteal flap was removed and the alveolar crest correction in the cervical region was performed. The canal fill was emptied up to 1/3 crown part of the canal length. In this case, medium length (3 mm) ribbond was preferred to be used in accordance with the canal width. The length of the post cavity was measured with the help of a periodontal probe, and the length of the Ribbond to be used was doubled in measured size and cut with scissors. The cut Ribbond was wetted with a dualpolymerizable binding agent (Liner Bond IIV, Kuraray Co., Osaka, Japan) and stored in a closed environment until use to avoid polymerization. The inner surface of the root canal was prepared for 30 seconds with the primer included in the same set. After drying with air spray, dual cure binder

resin material of the same system was applied into the canal and excess material was removed by applying light air spray. In order to prevent polymerization during this process, no operator lights and light devices were used. A high filler dual cure flowable resin composite (Variolink II Refill, Vivadent Ets, Schaan, Liechtenstein) was mixed for 20 seconds and then inserted into the canal with the help of a canal tool. The excess material on the Ribbond selected and previously wetted with the bonding agent was absorbed into cotton and applied into the canal via probe with pressure until hardness in the base was felt. The broken crown piece was adhered using the same dual cure flowing resin cement and polymerized by applying light for 40 seconds from all sides of the tooth. Mucoperiosteal flap was placed in place (Figure 2a) and sutured. Finishing and polishing of the restoration was completed with finishing drills (KG Sorenson, Denmark) and polishing discs (Sof-Lex 3M-ESPE, USA). Occlusion controls were performed. Stures were taken after seven days (Figure 2b, 2c, 2d) and the patient was recommended to come to routine clinical controls every 6 months.

At 5 years follow-up, it was observed that there was no significant discoloration in the restoration of tooth number 22, that the compatibility of the restoration with the gingiva did not deteriorate and it maintained its integrity (Figure 3a, 3b). Radiographic examination revealed no pathology in periapical and periradicular tissues (Figure 3c).

3. Discussion

In this case, restoration with ribbond of the upper lateral tooth with crown root fracture due to trauma was presented. Crown-root fractures including enamel, dentin and cement caused by sudden trauma to the teeth are seen as difficult cases for both patient and physician [1]. Restoring a canal-treated tooth so that it can remain in the mouth for a long time is the most important stage that completes the canal treatment. In the treatment of root fracture, it is a preferred method of treatment because it provides a good aesthetic with the bonding of crowns and root fragments and requires less cost and time compared to other restorative options. There are many treatment methods for crown-root fractures according to the location of the fracture line, periodontal health and various factors [2, 8]. Although metal posts are used frequently due to their superior physical properties, different materials were in search due to the fact that the discoloration created in the gingiva by the metallic infrastructure causes aesthetic problems, especially in the front group of teeth. Non-metallic posts developed in recent years have superior mechanical and biological properties as well as aesthetic compatibility. Polyethylene fiber post, a newly developed material, has been reported to be highly advantageous in terms of clinical ease of use over conventional post-core systems [9].

Due to the decrease in the amount of dental support tissue and the moisture content of the tooth tissue after canal treatment, the fragility of the teeth increases, so the use of less rigid materials close to the elastic modulus of the dentin should be preferred in the restoration of the teeth with endodontic treatment [7]. It is thought that a homogeneous integrity is provided by the use of resin cement and composite resins together with fiber posts having this characteristics [10]. Pest et al. [10] have shown that less rigid core materials distribute the force better than rigid ones. Eskitaşçıoğlu, Belli and Kalkan [11] in their studies have reported that the stress in cast post-cores accumulates in the 1/3 middle region of the tooth and in the cast post-cores; however, in fiber composite post-cores, the stress was distributed to the supporting bone structure and

cervical 1/3 region of the tooth. Woodpecker *et al.* [12] have used the polyethylene fiber post for central incisor tooth restoration with coronal damage and have stated in 5-year follow-up that the restoration was successful and there was an improvement in periapical tissues.

In the case that we presented, a polyethylene fiber post was used to adhere the coronal part to the root and reduce occurred stresses. It has been reported that the polyethylene fiber post we use provides a way to distribute stress among incoming forces, and also acts as a rigid band to prevent the opening of the fracture and deformation in pre-fractured

surface [13, 14]. Ribbond has excellent resistance to deterioration and high tensile strength due to its high molecular weight and high elasticity coefficient. This material, due to its special fiber network, can effectively absorb the applied forces unlike other post materials [15]. At the same time, using together the fiber-supported post systems and the original tooth piece, compared to metal post systems, offers more aesthetic results for the treatment of traumatized anterior teeth [16].



Fig 1: The patient had a fracture line in the mobile and the fragment was, removed atrumatically



Fig 2: Mucoperiostal fla was placed in place and suutures was taken after seven days



Fig 3: At 5 years follow-up, no significant discolorotion in the restoration and, no pathology in periapical tissue

4. Conclusion

In conclusion, restoration of tooth fragment with polyethylene fiber post and composite materials could be a good alternative procedure to conservative treatments in traumatized anterior teeth, with excellent esthetic and functional results.

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