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Management of Horizontal Root Fracture with Intraradicular splinting using glass fiber post and biodentin: A Case Report

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Abstract:*Traumatic dental injuries are among the main causes of emergency treatment in dentistry and occur frequently as a result of adverse incidents such as falls, traffic accidents, impact sports, and fights.Horizontal root fractures are rare in comparison to other types of traumatic dental injuries and the reported prevalence is between 0.5% to 7%. Case report: Thiscase report describes a case of complicated horizontal root fracture at the middle third of maxillary right central incisor for 8 years. The fractured root fragments of the upper right central incisor were united with the help of a glass fiber post after receiving an endodontic treatment. Conclusion; During a one year of follow-up evaluation, the root-fractured tooth of the present patient iswell retained in the arch, showing periodontal healing, even after endodontic treatment.*

Key Words*: Horizontal root fracture, Glass fiber post, Biodentine, Traumatic dental injuries.*

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I. Introduction

Traumatic injuries to a tooth can vary in severity from a simple enamel infraction to a complete ex-articulation of the tooth (avulsion).Among these injuries, tooth fracture (crown fractures, crown-root fractures, and root fractures) is considered to be the third most common cause of tooth loss. Root fracture trauma occurs at approximately 1% frequency within the permanent dentition and has a poor prognosis if not managed appropriately[1] . The root fractures are often clinically presented as a slightly extruded tooth; usually, they arelingually displaced. The tooth is generally mobile, but the degree of mobility is frequently determined by the fracture location[2,3].

The diagnosis of the horizontal root fracture is based on clinical and radiographic examinations. Clinical examinationsreveal whether the crown is normal or extruded, depending on the localisation of the fracture (apical/mid/cervical third), tooth mobility, and presence/absence of pain to palpationof the soft tissues and percussion of the teeth[4,5]. Several factors such as degree of dislocation, stage of root formation, location of the fracture, period between trauma and treatment, and type of trauma (displacement of the coronal fragment compared with no displacement of the coronal fragment) may affect the treatment success of horizontally fractured teeth[6].

Pathological complications encountered in horizontally fractured teeth might include pulp necrosis, root canal obliteration, external and internal root resorption, inflammation around the fracture, and periapical inflammation[7,8].The radiographic examination must be performed carefully to observe the fracture line. Aconventional periapical radiograph and two additional periapical radiographs (one with a positive angulation of $15^0$to the fracture line and one with a negative15^0angulation) should be taken[9, 10, 11].Recently, cone-beam computed tomography (CBCT) has been recommended as the imaging modality of choice for diagnosis and management of dento-alveolar trauma, including root fractures[12, 13].

Horizontal root fracture most commonly occurs in the middle third of the root and very rarely in the coronal and apical third. Apical fractures have the best prognosis, and then midroot, and then coronal. The apical fractures will be more surrounded by bone and therefore less mobile. And since the fracture will also be far away from any bacterial contamination this also increases the prognosis. As the fracture moves up the root, the prognosis decreases.Root fracture at the middle third have a favourable prognosis. When the coronal fragment is displaced, the initial treatment should be repositioning the fragment, followed by stabilization to allow healing of the surrounding periodontal tissues[14,15].The present case report describes the management of horizontal root fracture at the middle third of the maxillary right central incisor through a non-surgical approach.

II. Case report

A 42 year old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of a mobile tooth in the upper front teeth region of the jaw having a history of traumatic fall 8 years ago.A review of his medical and past dental history revealed no contraindications to dental treatment.Clinical examination revealed mild discoloration and a grade I mobility in relation to #11(Figure 1(a) and 1(b)).The patient also complained of pain on his right central incisor and slight tenderness to apical palpation and percussion.The tooth gave a negative response to the electric pulp test and pulp sensibility tests. Peri-apical pathology was absent in relation to #11.

Two periapical radiographs with different vertical angles of the maxillary anterior teeth and an additional OPG were taken. (Figure 1(d)).Radiographic examination revealed horizontal root fracture at the middle third of the right maxillary central incisor (Figure 1(c)) .The confirmatory diagnosis was asymptomatic apical Periodontitis with Ellis class VI fracture.

Management

After explaining the treatment plan to the patient and obtaining his consent, the tooth was stabilised (Figure 1(e)) and endodontic treatment of the upperright central incisor was initiated. The working length was correctly determined (Figure 1(f)) and the canal was cleaned, shaped using K files in a step-back manner to an apical file size #60. The remainder of the canal was shaped to obtain a uniform taper from apex towards coronal third. An inter-appointment calcium hydroxide dressing was given and the patient was recalled after 10 days.

On the second visit, root canal was sectionally obturated with gutta percha cone and calcium hydroxide sealer. A gutta percha cone of the same size of the prepared root canal (size #60, with a taper of 2%) was selected and tried into the canal to obtain a snug fit. It was then cut to obtain a section that would be 2-4 mm short of the apical fragment of the root. A suitable plugger which loosely fits its 2-4 mm short of the apical root fragment was selected and a stopper was set at this length. The sectioned gutta perchawas then coatedwithSealapexcalcium hydroxide based sealer. One end of gutta perchawasmounted to a heated plugger and then carried into the canal to the desired length. After this, gutta percha was disengaged from the plugger by slightly rotating the plugger in an anticlockwise direction and was radiographically confirmed (Figure 1(h)).

Next, a glass fiber post (size 2) was used to retain the fractured root fragment. It was then tried into the canal, adjusted to the desired length until they just passively touched the apical gutta percha (Figure 1(i).Biodentine was lightly coated on the root canal wallsand fiber post was luted immediately with glass ionomer cement, then inserted into the canal without applying any pressure (Figure 1(j)).The benefit of higher viscosity of the cement in the absence of pressure is that it reduces the flow of the cement. Also, the cement was used cautiously only in an amount necessary to achieve a desirable bond between the post and the dentin. Only the post was luted with the cement. Coating the root canal walls with biodentin was precluded to prevent the flow of excess cement laterally between the root fragments.

The patient was re-evaluated every three months on a regular basis. After 6 and 12months of recall,(Figure 1(k) and 1(l)) the patient presented with aesthetically pleasing results and sound periodontium, and the fractured root fragments were well retained with the aid of a post.

Fig1(a)

Fig1(b)

Fig1(c)

Fig1(d)

Fig1(e)


Fig (f)


Fig (g)


Fig (h)


Fig (i)


Fig (j)


Fig (k)


Fig (l)

III. III.Discussion

There are various treatment modalities for Horizontal root fracture cases with necrotic pulp. Maxillary central incisorsare most vulnerable to injury, sustaining approximately 80% of all dental injuries, followed by the maxillary lateral and the mandibular incisors [11].Hovlandreported that horizontal root fractures in the permanent dentition comprise 0.5-7% of all traumatic injuries to teeth[8]. The most common types of root fractures are in the middle third of the root (57%), followed by a fracture in the apical part (34%), and in the coronal part (9%) [14, 15].In the present case, the patient had a horizontal root fracture in the middle third of the maxillary central incisor with periodontal ligament injury.

A root-fractured tooth requires adequate initial intervention and periodic evaluations[14].Realizing the healing patterns of the root fracture is imperative for a successful treatment. Maintaining "the physiological and functional integrity" is the main goal while treating traumatized teeth. According to Andreasen and Hjorting-Hansen, there are 4 healing patterns, and preinjury and injury factors that can affect the prognosis and tissue response to dental trauma[6].

1. Healing with tissue, giving union across the fracture.
2. Healing with interposition of hard and soft tissue between the fragments.
3. Healing with interposition of only soft tissue.
4. No healing

Elimination of microorganisms from the root canal system determines the complete success of endodontic therapy, particularly in cases of pulp necrosis. To increase the effectiveness of endodontic therapy, various intracanal dressings have been used as adjuncts; calcium hydroxide, one of the most common dressings, was used in this case[16, 17].Four types of conservative endodontic treatment that have been commonly described are (i) cleansing and gutta percha filling of the root canal of the coronal fragment only; (ii) cleansing and filling of the root canal in both fragments; (iii) cleansing and gutta percha filling of the root canal of the coronal fragment and surgical removal of the apical fragment; and (iv) treatment of the root canal with calcium hydroxide followed by filling with gutta percha[16, 17].In our case we have decided to go for the fourth option as calcium hydroxide has antimicrobial and remineralising actions.[18]

In this case, a glass fiber post was used to fix the separated root fragments. For the same reason, other clinicians have used a metal pin or a dental post, which was positioned passively inside the root canal together with endodontic cement[18].Glass fiber post was used for intra radicular anchorage as it is aesthetic, has high fatigue strength, high tensile strength, and modulus of elasticity similar to that of dentin.Different types of post materials have been introduced into the dental practice such as carbon fiber, quartz, glass fiber, ribbond, Ever stick etc. The fiber posts offer several advantages such as a suitable elastic modulus, aesthetics, good bonding between post and cement, lower chair side time, and minimal tissue removal. In the present case report, only the apical fragment was obturated and the two fragments were splinted using a glass fiber post to act as an intra-radicular splint [19].

Linkow proposed that, by inserting a post through the tooth, deep into the bone and cementing the intradental part to the root canal walls, the fulcrum of movement of a loose tooth is moved deeper into the jaw, the support in the bone is increased, and thus the mobility of the tooth is lessened[20].Repositioning of the coronal fragment can be done by affixing a semirigid or rigid splint to the adjacent sound teeth. The splint should be maintained depending on the localization of the fracture and the vitality of the adjacent teeth should be checked for the following 2-3 months[14, 15].

Biodentine was used in this case for coating on the root canal wall of horizontal root-fractured teeth. Biodentine has been promoted as a favourable repair material due to its bioactivity and biocompatibility. It has a setting time of less than 12 min and high mechanical properties with excellent sealing ability. Its property to release calcium ions in enhancing the alkaline environment makes biodentine more conducive for osteoblastic activity[21].Also, calcium and hydroxide ions stimulate the release of pyro phosphatase, alkaline phosphatase, and BMP-2which, favours the mineralization process[22.] Biodentine has a compressive strength of 225 Mpa.Also, it induces the apposition of reactionary dentine by odontoblast stimulation and reparative dentine by cell differentiation[23].

A long-term follow-up is required in this type of cases to check for any possible pathological alterations. Follow-up of this case after one year (Figure 1(l) showed promising results with clinically pleasing aesthetics and radiographic healing with calcified tissue formation, the fractured line mildly discernible but fragments well stabilized.

IV. Conclusion

The multidisciplinary treatment presented here offers a systematic approach to the present case which is always a clinical challenge. However, achieving predictable success in teeth with horizontal root fracture is difficult. Prudent case selection and proper execution with knowledge and skills can lead to the successful treatment and long-term success and retention of the tooth. Clinical and radiographic follow up is essential for the success of a tooth with horizontal root fracture.Finally, future researches are needed to device biocompatible materials with adhesive, reinforcing, and esthetic properties for restoring horizontal root fracturedefects.

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