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Clinical Management of Horizontal Mid-Root Fracture in Maxillary Central Incisor - A Case Report

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ABSTRACT

Root fractures are defined as fracture of tooth that involves cementum, dentin and pulp, comprising from 0.5 to 7% of injuries in permanent dentition. Diagnosis is made through clinical and radiographic examination, the later frequently being limited by the position of the fracture. Treatment varies according to the displacement and vitality of the fragments. The objective of this clinical case report is to represent the reinforcement of a mid- root fracture using fiber post as intraradicular splint and restoring its esthetics by porcelain fused to metal crown. The fragments were stabilized with a glass fiber post and patient has been on follow-up for one year. Follow-up of the case showed promising results both clinically and radiographically.

Keywords: mid root fracture, intraradicular splint, fiber post, porcelain fused to metal crown

Introduction

A mid-root fracture occurs most frequently in the upper anterior teeth due to their position in the arch. These fractures are generally transverse to oblique and may be single or multiple as well as complete or incomplete. In most cases the root fracture is located in the middle third but in fewer cases in the apical or cervical thirds of the root [1-2]. The initial treatment consists of repositioning of the displaced segments, followed by stabilizing of the tooth to allow the healing of periodontal ligament supporting the segments. The amount of dislocation and the degree of mobility of the coronal segment affects the prognosis outcome.

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Achieving stable fracture reduction is inversely proportional to the severity of dislocation, mobility, and pulpal injury [3-5].

Endodontic intervention is required for non- healing fractures. The following are the treatment options carried out with varied levels of success:

1. Root canal therapy of both segments is indicated in case of root fracture at the apical and middle third levels when the segments are not separated, but leakage from the fracture line can lead to failure[6].
2. Endodontic therapy of only coronal segment of the fracture tooth is indicated in case of root fracture at the apical third levels when coronal segment shows no mobility (Flores *et al*, 2007). This is the current recommendation, particularly with the view that the apical segment may contain vital, healthy pulp tissue. [7]

3. Orthodontic root extrusion is solution of apical segment of fractured teeth with root fractures at or near the alveolar crest when coronal segment is lost after root canal treatment of retained apical segment. [8]
4. The use of an intra-radicular splint has been recommended by Weine *et al.* 1971 in case of root fracture at mid third levels, Since then various techniques have been implemented to provide intra-coronal strength and for the attachment of the fractured segments.[9]
5. Placement of endodontic implant with or without periapical surgery in case of root fracture at apical third containing non-vital , necrosed pulp tissue with mobile coronal fragment. [10]
6. The last resort where the natural tooth cannot be saved would be; Extraction and subsequent replacement with prosthesis.

Healing in teeth with horizontal root fracture can be following types: healing with interposition of calcified tissue, healing with interposition of connective tissue, healing with interposition of bone and connective tissue and healing with interposition of granulation tissue. While the first three types are considered favorable as 'healing with hard tissue' is most desired but the last one represents inflammatory state and is unfavorable (11-13). The present paper describes a case of a horizontal mid-root fracture treated by intraradicular fixation through insertion of glass fiber post healed successfully with interposition of calcified tissue.

Clinical Case Report

A 20-year old female patient reported with an impact injury in the maxillary anterior teeth and complained of broken teeth in upper front region of the mouth.

On clinical examination

Maxillary Right Central Incisor

Showed Ellis class II fracture and there was no mobility or sensitivity and electric pulp test showed normal response with respect to tooth 11. Treatment planning was Composite build up with respect to tooth11.

Maxillary Left Central Incisor

Presented with crown fracture at cervical level. Radiographic examination revealed horizontal mid-root fracture of tooth 21 along with complete loss of crown structure at cervical level (Figure- 1a, 1b) but there was no mobility of root fragment. The space between the fractured root segments appeared widened but intact PDL was visible surrounding the root fracture.

Various treatment options were considered, analyzed and explained to the patient of tooth 21; extraction of the tooth followed by placement of either an osseointegrated implant or fixed partial denture or the preservation of the natural tooth by using fiber post as intraradicular splint followed by core build up and restoring its esthetics by all ceramic crown The patient wanted to preserve the natural tooth , due to economical reason patient opted porcelain fused to metal crown instead of all ceramic crown.

Hence, root canal therapy of both fragments was completed (Fig-2) followed by surgical crown lengthening by gingivectomy, to achieve ideal biological width (Fig-3). A week later, the post space preparation (Fig-4 a) was done along with crown preparation (Fig-4 b) upto size 1 mm extending from the coronal segment into the apical one by using Largo® Peeso Reamer No1 & No2, Easy Post™ Precision Drill No3 & No4 , allowing placement of Radix® fiber Post (Dentsply Maillefer) size No4 to stabilize the two root segments and fiber post cementation was done following step by step procedure -Conditioning with DeTrey® Conditioner 36(a blue-tinted gel containing 36% phosphoric acid for conditioning of root dentine prior to bonding with resin-based materials) for 15 seconds , rinse for 10 seconds, dry with paper points, mix one drop of Prime & Bond® NT and self cure activator (Nano-Technology light cure adhesive system) apply mixture for 20 seconds, apply a gentle stream of air for 5 secons and finally cementation of fiber post done with dual cure resin cement Core-X™ (Dentsply Maillefer) (Fig-5a,5b). Core Build -Up was done with Hybrid composite Filtek™Z250 (3M ESPE, St Paul, MN, USA) (Fig- 6 a, 6 b), finally porcelain fused to metal crown was given (Fig -7). Follow-up of the case after 1 year showed promising results both clinically and radiographically (Fig -8).

Figure 1a: Pre-operative Buccal-view

Figure 1b: Pre-operative Lingual-view

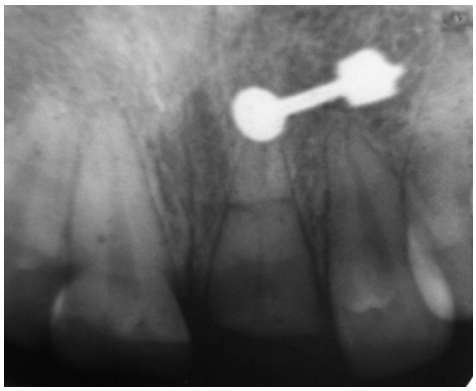


Figure 1 c: Pre-operative IOPA

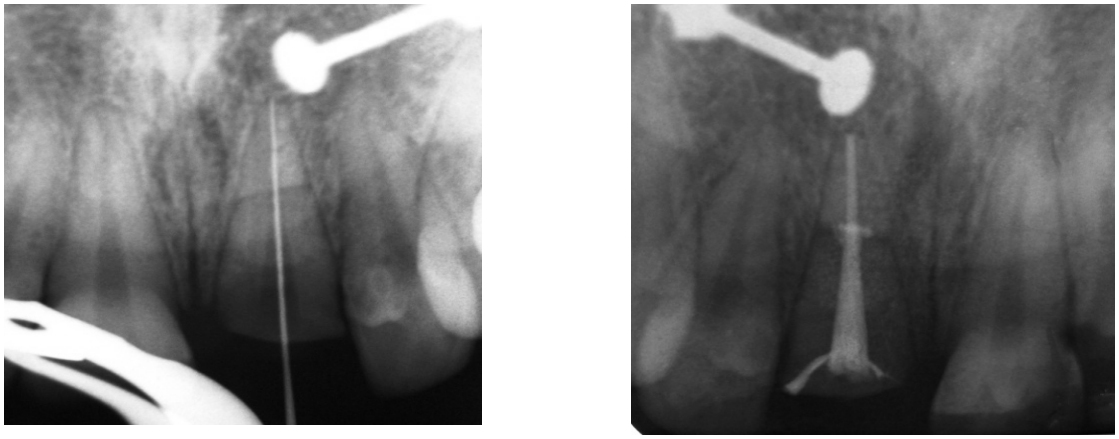


Figure 2 a, 2 b: Root canal therapy of both fragments

Figure 3 a, 3 b: Surgical crown lengthening by gingivectomy to achieve ideal Biological width

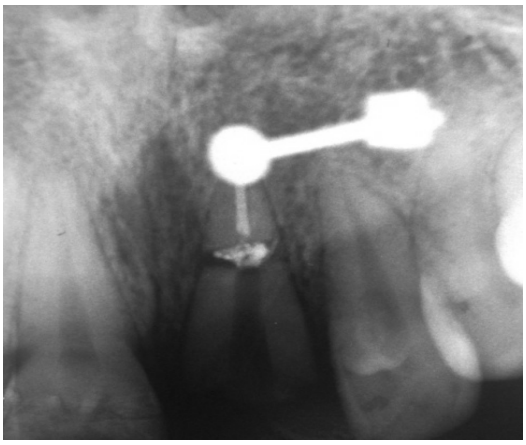
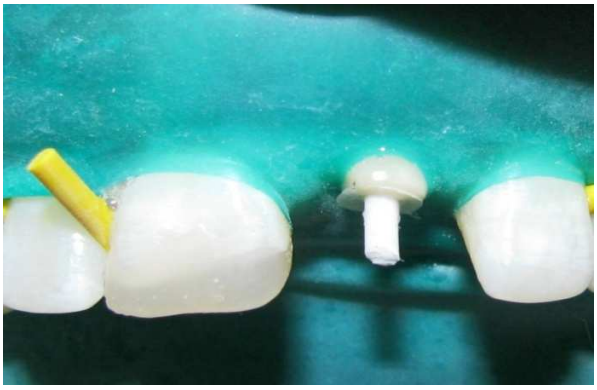


Figure 4 a: Post space preparation

Figure 4 b: Crown preparation



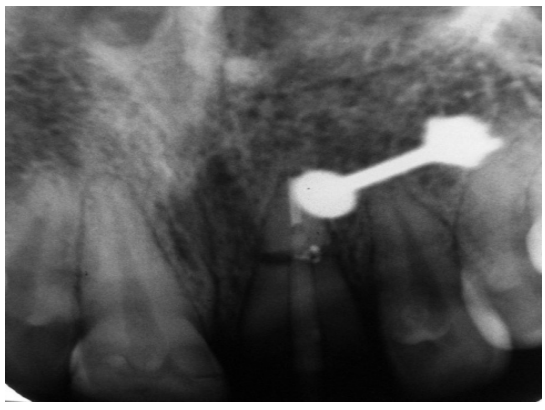


Figure 5a, 5 b: Fiber post cementation done


Figure 6 a, 6 b: Core build up

Figure 7: Post operative

Figure 8: Follow up IOPA (After 1 Year)

Discussion

Preservation of the natural dentition and restoration of the oral cavity to a normal functional state is a primary goal in dentistry. Extraction and subsequent replacement with other prosthesis should only be considered after all other means of retaining the natural tooth have been fully explored [10].The first step for management of horizontal root-fracture cases are to reposition the tooth and confirm its position radiographically [1]. Sequelae to root fractures may be divided into four types, as proposed by Andreasen and Andreasen (1993):

1. Healing with calcified tissue - Radiographically, the fracture line is discernible, but the fragments are in close contact;
2. Healing with interproximal connective tissue - Radiographically, the fragments appear separated by a narrow radiolucent line, and the fractured edges appear rounded;
3. Healing with interproximal bone and connective tissue - Radiographically, the fragments are separated by a distinct bony bridge;
4. Interproximal inflammatory tissue without healing - Radiographically, a widening of the

fracture line and/or a developing radiolucency corresponding to the fracture line becomes apparent.

Long term clinical studies regarding various treatment options and their prognosis are not available in the literature. The healing of mid-root fractures was described by Cvek *et al*. [11] in a retrospective study of 208 root-fractured incisors, treated with or without external stabilization. Hard tissue healing of the fragments was observed in 33% and interposition of PDL alone in 36% of the teeth. Healing could not be confirmed in 23% of the teeth. Cvek *et al*. [13] had concluded that the pattern and frequency of healing remains the same, regardless of the location of the root fracture in relation to the gingival crevice, although the frequencies may vary to some extent. Long-term prognosis of permanent anterior teeth with root fractures are related to the amount of dislocation, stage of root development, and probably whether treatment was done [4].The treatment of present case was based on the level of fracture line in middle third so integrated treatment approach was employed by splinting both of the fragments by using a glass fiber post as intraradicular splint.

The mechanical principle is simple; by pushing a rigid-post through the tooth deep into the bone and cementing the intra dental part to the root canal walls, the fulcrum of the movement of a loose tooth is moved deeper into the jaw, and the support in the bone is increased and the mobility of the tooth is lessened [10]. This means that the vicious spiral of excessive mobility causing destruction of the periodontium, which in turn causes even more mobility, is halted and immediately healthier conditions prevail.

Traditional metal posts have a high modulus of elasticity [14]; whereas the fiber- reinforced post system has a modulus similar to that of the dentin. The glass fiber-reinforced post has been reported to exhibit high flexure strength, high tensile strength and a modulus of elasticity closer to dentin minimizes the risk of root Fractures [15].

Following root canal therapy of both fragments a postspace was prepared in the canal to extend from the coronal segment into the apical one, followed by placement of a Radix® fibre post to stabilize the two root segments.

Radix® fibre post made up of Zirconium-Enriched high density uni-directional glass fibers which provides excellent strength and optimal flexibility that mimics the stress distributions of healthy teeth, thereby preventing fissures or fractures. Radix® Fiber Post is light conducting thus allowing its use with light and dual-cured cements and core materials giving you greater control over cement and material set times. The micro-structured surface ensures that an optimal bond is achieved between post and cement, minimizing the risk of post decementation or dislocation. This fiber post system respects the tooth Ergonomy as optimized cyclindrico-conical endo-design limits the removal of dentin, thereby increasing the strength and clinical quality of the restoration. Follow-up of the case after 1 year showed promising results both clinically and radiographically as healed with calcified tissue, the fracture line is discernible, but the fragments are in close contact. Patient should be reviewed after one year to confirm the success of such integrated treatment approach for mid root fractures.

Conclusion

Mid-root fractures have been considered to have hopeless prognosis because of poor understanding of the biologic concept of such fracture and lack of availability of biocompatible materials. Availability of bondable material like fiber posts and biocompatible materials like titanium have put forth varied treatment options for clinicians in the management of mid root fractures.

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