Non-Surgical 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, Zirconia

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. 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. 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 after that replacement with prosthesis.

Healing in teeth with horizontal root fracture can be following types: healing
The patient wanted to preserve the natural tooth. Hence, root canal therapy of 21 fragments was completed (Figure 2 A,B,C). A week later, the post space preparation was done along extending from the coronal segment into the apical, allowing placement of Radix® fiber Post (Dentsply Maillefer) size No2 to stabilize the two root segments (Figure 3) and fiber post cementation was done following step by step procedure -Conditioning with DE Trey® 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 seconds and finally cementation of fiber post done with dual cure resin cement Core-XTM (Dentsply Maillefer) (Figure 4). Core Build – Up was done with Hybrid composite Filtek™Z250 (3MESPE, St Paul, MN, USA) and crown prepration done (Figure 5), finally porcelain fused to metal crown was given (Figure 6 A,B).

Clinical Case Report

A 26-year old male patient reported to the department of conservative dentistry &endodontics, Maitri dental college and research institute, with an impact injury in the maxillary anterior teeth and complained of broken teeth in upper front region of the jaw. On clinical examination Maxillary left 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 near to cervical level with Ellis class III Radiographic examination revealed horizontal mid-root fracture of tooth 21 along with loss of crown structure at near to cervical level (Figure 1 A,B) 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, analysed and explained to the patient of tooth 21; extraction of the tooth followed by placement of either an Osseo integrated 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.

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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]. Management of horizontal root-fracture cases are reposition the tooth and confirm its position radiographically. Sequelae to root fractures may be divided into four types, as proposed by Andreasen and Andreasen: Healing with calcified tissue Radiographically, the fracture line is discernible, but the fragments are in close contact; Healing with interproximal connective tissue Radiographically, the fragments appear separated by a narrow radiolucent line, and the fractured edges appear rounded; Healing with interproximal bone and connective tissue fragments are separated by a distinct bony bridge; 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 prognoses 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 intra-radicular splint. The mechanical principle is simple; by pushing a rigid post through the tooth deep into the bone and cementing the in 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, post space 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 cylindrico-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 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.

References