ENDODONTIC MANAGEMENT OF VERTICAL CROWN - ROOT FRACTURE OF A TRAUMATISED MAXILLARY ANTERIOR TOOTH

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ABSTRACT

Vertical fractures of teeth often poses a major dilemma to the dentist in terms of diagnosis and treatment plan. This paper reports the successful endodontic management of a traumatised permanent maxillary central incisor with complicated vertical crown root fracture by immediate coronal segment reattachment, endodontic therapy, intraradicular resin reinforcement and subsequent placement of fibre post which rendered the tooth asymptomatic and fully functional during a follow up period of one year.

Keywords: Vertical Fracture; Crown Root Fracture; Intraradicular Reinforcement; Reattachment

Introduction

Traumatic injuries to anterior teeth are commonly encountered by the dentist in their clinical practice. This can vary from a simple enamel infraction to complete avulsion of the involved tooth. Among these injuries, tooth fractures the crown fractures, crown-root fractures and root fractures are considered to be the third most common cause of tooth loss. A complicated crown root fracture involves enamel, dentin, cementum and pulp. The severity of presentation varies depending on the strength of the impact force and its vector. Some cases may present as vertical crown root fracture, oblique crown-root fracture or with multiple crown-root fractures.

Vertical root fractures (VRF) are longitudinally oriented fractures extending from the root canal to the periodontium and they can extend from the coronal tooth structure or at the apex. Most of the cases of VRF are reported in endodontically treated teeth although some cases in unrestored teeth are also described. The prevalence of VRF ranges from 2–5% of crown/root fractures. Complicated crown root fractures are extremely rare. Most of the treatment options available in literature involve removal of the fractured coronal segment followed by endodontic treatment and restoration with a post crown. Supplementary treatment options like gingivectomy, osteotomy, orthodontic / surgical extrusion, intentional replantation with 180 degree rotation are also discussed. However most of the studies reveal that complicated crown root fractures in anterior teeth has a poor prognosis often requiring extraction and prosthetic rehabilitation.

Intraradicular reinforcement with composite resin is practised for the treatment of flared root canals and weakened anterior roots with poor dentine thickness prior to post placement but this treatment option for the management of complicated crown-root fractures has not yet been discussed extensively in the available literature. This case report presents the endodontic management of a complicated crown root fracture of the permanent maxillary right central incisor in which immediate reattachment of the fractured coronal segment was done with restorative resin prior to endodontic therapy followed by intraradicular reinforcement with composite resin and fixation of fibre reinforced composite post to stabilize the radicular segment.

Case Report

A 35 year old healthy male patient reported to our clinic four days after a road traffic accident with a presenting complaint of broken upper front tooth and severe pain in relation to the involved tooth. History revealed bleeding from the involved tooth immediately after the traumatic incident. Extraoral examination revealed abrasions on the lower lip and intraoral abrasions were evident on lower labial mucosa. Coronal oblique fracture of the maxillary right central incisor was evident and the fractured segment was mobile and tender (Figure 1). The fracture line was extending from the labial to the palatal aspect and was extending subgingivally on the palatal aspect. Pressure applied with an explorer revealed slight mobility of the fractured radicular segment. Periodontal probing revealed normal sulcus depth of 2-3mm around all aspects of the involved tooth. Pulpal involvement was present. Radiographic examination suggested a complicated crown root fracture of the involved tooth with the fracture line extending till the middle 3rd of the root (Figure 2).

The treatment plan, potential risks and benefits, were explained to the patient and a written informed consent was obtained. After administration of local anesthesia the fractured coronal segment was gently repositioned and after etching and bonding, flowable composite was used to reattach the segments labially and palatally. After initial reattachment the putty template was removed and the tooth was restored with light cure composite resin (Figure 4).

Access opening was done in the same appointment, pulp tissue extirpated with a No. 15 BP blade and the palatal portion of the impression was used as a template for reattachment of the coronal fragment. The fractured segments were bevelled and after etching and bonding, flowable composite was used to reattach the segments labially and palatally. After initial reattachment the putty template was removed and the tooth was restored with light cure composite resin (Figure 4).

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opposing teeth. Routine analgesics and anti-inflammatory agents were prescribed and the patient was recalled after one week.

On the recall examination the involved tooth was asymptomatic. A master cone radiograph was exposed with a No. 50 gutta percha cone in place and sectional filling was done to the working length which obturated the apical 6mm of the root canal. After rubber dam isolation the root canal was dried using paper points and a fibre reinforced composite post (FRCP) of the appropriate size was selected and cut to the required length coronally using diamond coated fissure bur. The coronal reference point was marked on the fibre post. The canal was etched, rinsed and dried with paper points. Bonding agent was applied using micro brush within the canal. The layer of bonding agent within the canal was allowed to dry and was not light cured. This was to ensure that no clogging of the canal shall take place which may hinder with the complete insertion of the FRCP to the calculated length.

Light cured restorative composite resin was plugged into the root canal with the aid of No. 40 size finger plugger and the fibre post which was selected was inserted gently in a watch winding motion into the canal till the coronal reference point was reached. The FRC Post was gently rotated within the canal and the excess flash of the composite resin was pushed out coronally. This created space for the cementing material for the post. Keeping the post within the canal light curing was done keeping the light source as close as possible to the access opening. The FRCP itself served as the spacer as well as the light transmitter for curing of the resin within the canal. The post was gently rotated in between the curing process to ensure that it does not bond with the resin. The curing time was set at 40 seconds following which the FRCP was gently rotated in a counter clockwise direction and taken out (Figure 5).

The FRCP was reinserted to ensure complete seating within the resin reinforced root canal. Then the post was etched, side coupling agent was applied and dried, following which bonding agent was applied and dried without curing. Dual cure resin cement was mixed and was coated within the root canal using paper points. The post was also coated with the resin cement and was gently inserted within the canal using a watch winding motion until the coronal reference point was reached. Light curing of the resin-post system was done in a single step using the FRC post as the light transmitter. The curing time was again set at 40 seconds. Thus a monobloc could be created within the root canal which ensured adequate seal as well as stabilization of the fractured radicular segment (Figure 6). The access opening was restored with composite resin. In subsequent appointments the tooth was permanently restored with a full ceramic crown (Figure 7). The patient was recalled at 4th month, 6th months and at 1st year (Figure 8) for follow up examination which revealed that the tooth was completely asymptomatic clinically and radiographically, fully functional and esthetically very appealing.

Discussion
Management of vertical root fracture remains a major challenge to the endodontist because of the multitude of variabilities in clinical as well as radiographic presentation. Although different pathognomonic signs are referred to in the literature like multiple sinus tracts, isolated narrow & deep periodontal pockets, cement trail, J shaped radiolucency, radiolucent halos, double images, isolated deep periodontal pocket, apical spaghettili in radiograph, isolated area of bone loss etc. the diagnosis has more of a predictive value rather than a definitive one.\textsuperscript{10,11}

Vertical root fractures (VRFs) are classified either on the basis of separation of the fragments (complete or incomplete) or on the basis of relative position of fracture to the alveolar crest (supraosseous and intraosseous). A complete fracture occurs when total separation is visible or fragments can be moved independently and fracture is said to be incomplete when there is an absence of visible separation but segments can easily be separated by an instrument. A VRF is said to be Supraosseous fracture when it terminates above the bone, and does not create a periodontal defect. An Intraosseous fracture is one which involves the supporting bone, creating a periodontal defect.\textsuperscript{12} A variety of approaches have been attempted and used to treat the VRF including; cyanoacrylates, glass-ionomer cement with Guided Tissue Regeneration Therapy, adhesive resin cement, repositioning; and fixation with wire, and Mineral Trioxide Aggregate. However most of the previous studies conclude that extraction is the only available treatment option for most cases of VRF in anterior teeth.

Success of treatment of complicated crown–root fracture is generally based on the degree of impact of the trauma to the tooth supporting structures especially the periodontium, root-crown length ratio and extent and complexity of the fracture.\textsuperscript{13} One of the main problems with complicated crown-root fracture is the relationship of the fracture line to the alveolar crest. Extension of the fracture line sublingually may have an effect on the periodontal status and the survival of post-trauma restoration if it encroaches into the biologic width. However in a case report the fractured palatal segment was built up using glass ionomer cement and calcium hydroxide was used for apexification of the involved tooth. The authors suggested that treating a complicated oblique crown root fracture that extends below the alveolar crest without any surgical or orthodontic extrusion may be an alternative option, provided the fractured tooth has substantial remaining crown-root

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image1.png}
\caption{Preoperative view, Preoperative radiograph, Putty template showing fracture line, Coronal fragment reattached, Intracanal reinforcement done with composite resin, Immediate postoperative radiograph, Full ceramic crown cemented, At 1 year follow up.}
\end{figure}
ratio, with immature apex. Another case report suggests the use of calcium hydroxide for promoting healing of the fractured radicular segment.14

Intraradicular reinforcement using composite resin and light transmitting posts is suggested as a possible treatment option for reinforcing anterior teeth with flared root canals and thin dentinal walls that are more prone to fracture. These teeth are then restored with quartz fibre post to retain a composite core.6,8 But little information is available in the existing literature regarding this treatment option being used as a method of reinforcing fractured roots especially for vertical root fractures of anterior teeth.

Conclusion

In this case report the vertical root fracture was incomplete with the fracture line extending till the middle 3rd of the root. However there was no associated periodontal pocket formation or osseous defects in relation to the fracture site. The fractured radicular segment was not separated although the segments were slightly mobile when pressure was applied to the coronal portion using probe. Hence in incomplete vertical root fractures without osseous involvement and normal periodontium, intraradicular resin reinforcement and Fibre Reinforced Composite Post can be an effective treatment option following endodontic therapy. But this again highlights the need for early diagnosis and treatment planning of vertical root fractures. More studies with larger sample size and longer follow up periods are recommended to exploit the possibilities of this treatment option for the management of root fractures.

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