AN INNOVATIVE TREATMENT APPROACH FOR ENDODONTICALLY TREATED VERTICAL ROOT FRACTURE.

S Vijay Singh*, Vineeta Nikhil**, Simranjeet Singh#

* Professor, Department of conservative dentistry and endodontics, D.A.V. (C) Dental College and Hospital, Yamuna Nagar, Haryana. ** Professor and Head, Department of conservative dentistry and endodontics, D.A.V. (C) Dental College and Hospital, Yamuna Nagar, Haryana. #Post graduate student, Department of conservative dentistry and endodontics, D.A.V. (C) Dental College and Hospital, Yamuna Nagar, Haryana.

Address for correspondence: Dr. S. Vijay Singh, SAIKRIPA, H. No: 1220-A,Sector – 17, HUDA, JAGADHARI, HARYANA – 135 001
Phone : +919416022630
Email: drvijay.endo@gmail.com

Abstract: Vertical root fractures are a diagnostic enigma for the clinician, since often they are symptom-free or may present with mild pain and discomfort. During the initial stages radiographs too fail to disclose vertical root fracture as the angulations used while taking the radiograph may obscure the fracture line. The vertical fracture may be complete or incomplete, may or may not include the root canal, and may extend from one surface to another. The prognosis of vertical root fracture is usually unfavorable and tooth extraction is indicated. This case report on vertical root fracture is an attempt to treat a tooth which otherwise was indicated for extraction. This case of vertical root fracture in maxillary right first molar treated with an innovative approach showed successful prognosis even after 12 months of recall.

Keywords: band, primary finish line, secondary finish line, vertical root fracture.

Introduction

Vertical root fractures have been described as longitudinally oriented fractures of the root, extending from the root canal to the periodontium (1) Vertical root fracture (VRF) of an endodontically treated tooth is one of the frustrating complications of root canal treatment. It represents between 2 and 5 percent of crown/root fractures, with the greatest incidence occurring in endodontically treated teeth and in patients older than 40 years of age (2). VTF may have incomplete or complete fracture line that extends through the long axis of the root toward the apex (3).

Leubke (4) described two types of root fractures based on the separation of the fragments:
- A complete fracture, where total separation is visible or fragments can be moved independently.
- An incomplete fracture is said to occur in the absence of visible separation.

Luebke has also defined root fractures relative to the position of the alveolar crest. According to him, intra osseous fractures (i.e., those terminating below the level of the alveolar bone) will result in periodontal problems whereas supra osseous fractures would not. Root fractures may originate at coronal tooth structure or at the apex. The whole length of the root or only a section of it...
may be involved and only one or both sides of the root may be effected (5, 6, 7). Various etiologic factors are involved (8,9). Iatrogenically it may result from excessive canal shaping, excessive pressure during compaction of gutta-percha (10,11), excessive width and length of a post space in relation to the tooth’s anatomy and morphology, or excessive pressure during placement of the dowel (12,13,14). Usually the affected root or tooth has an unfavorable prognosis and extraction is usually the only treatment option (15, 16) VRF of endodontically treated teeth usually necessitates extraction followed with a time consuming and expensive prosthetic rehabilitation measures. Therefore the use of minimal invasive treatment with the use of internal and external reinforcement may allow for cost effective, reliable therapeutic options for the treatment of VRF in endodontically treated teeth. This case report is an innovative approach to save vertically fractured tooth, which otherwise would have gone for extraction.

Materials and methods

Case report: A female, 43 years of age reported to the Department of Conservative Dentistry and Endodontics at D.A.V. (c) Dental College and Hospital, Yamuna Nagar, Haryana, with history of pain in Maxillary right first molar (16) since last four days. She had mild pain and pain got aggravated on chewing.

On clinical examination, visual inspection disclosed fracture line running mesiodistally along the midline of crown and slight separation of the segments was visible as shown in figure 1a. However the fracture looked to be incomplete (fracture line not approached to apex), as the fragments can’t be moved independently, although it was deep and appeared to be near the apex. Radiographic examination (Fig.4) revealed that tooth was root canal treated and there was absence of periapical radiolucency.

Before the initiation of the treatment, an informed consent was obtained from the patient after the nature of the procedure and possible discomforts and risks had been fully explained. Treatment planning was done to treat the fractured tooth by using external and internal reinforcement as shown in figure 1 and 2. An orthodontic band (RMO 0.180x0.005 mm) was fabricated around the tooth segment to stabilize the fractured segment. A groove of 0.5 mm depth was prepared along the fracture line with help of round bur [BR 41(Mani)]. The groove was then etched with 37% phosphoric acid (3M ESPE USA), washed and extra moisture was removed. Dentin bonding agent [Single Bond 2 (3M ESPE USA)] was applied with applicator tip and cured for 10 sec. Later this groove was restored with flowable composite [Wave (SDI)]. Around 3 mm of Gutta-percha was removed with the help of peeso reamer [Size #3(Mani)] from the root canal. Ribbond (Ribbond inc. USA) one cm in length was selected for each root canal. The root canal orifices were etched, rinsed & bonding agent was applied and then 3mm Ribbond fibers were inserted into each of three canals and was stabilized in the root canal with help of flowable composite [Wave (SDI)] and cured. After curing around 7 mm of fibers were outside the canal orifice. Then these fibers were spread on the floor of the pulp chamber and intermingled to create the mesh for the internal reinforcement. Flowable composite was placed over this fibrous meshwork and manipulated slightly with the help of plastic instrument (API) along the buccolingual and mesiodistal directions so as to form a unique composite Ribbond meshwork along the floor of the pulp chamber which was later cured. Subsequently access cavity was restored with core build up composite [Biscore (Bisco)] . After fifteen days orthodontic band was removed and crown preparation was done with champher finish line this was named as primary finish line. After crown preparation was completed a shoulder finish line (0.5mm) was prepared from the coronal end till middle third of the preparation for the placement of modified orthodontic band, this finish line was named as secondary finish line as shown in figure 2 and 3, this finish line was given for the space for the band adaptation so that there
FIGURE 1: Showing first step of clinical procedure: a- vertical fracture mesio-distal, b- metal band, c- band adapted to the tooth, d- cavity cleaned, dried and vertical groove prepared, e- cavity etched, f- Ribbon, g- dentin bonding agent applied, h-Ribbon fiber placed in cavity, i- composite restoration of tooth.

FIGURE 2: Showing second step of clinical procedure: a- crown cutting with primary finish line, b- crown with secondary finish line, c- band adapted on the tooth along the secondary finish line, d- metal crown seated.

FIGURE 3: Diagram (a,b) illustrating primary and secondary finish line with band adaptation.

Figure 4: Radiograph showing healthy bone at end of 12 months. (a- at 1 month, b- at 3 month, c- at 7 month and 12 months)
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are no undercut in the crown preparation. After the placement of the ortho band final finishing was done to remove any irregularities and undercuts. Occlusion was registered and elastomeric impression was taken for the fabrication of the full coverage metal crown. On next appointment the crown was cemented with GIC I (GC). Patient was rechecked after every three months for evaluation. Patient was asymptomatic and no periapical changes were appreciated on radiographic examinations till the completion of 12 months (Fig.4).

Discussion

In the early stages complete or incomplete VRF are difficult to diagnose. Radiographic images also do not always reveal a Vertical root fracture, unless the X-ray beam is parallel to the fracture line (± 4 degrees) (17)

In most cases, tooth extraction is the only choice of treatment when the VRF is finally diagnosed. Studies have shown that, out of total root filled teeth that were referred for extraction 11% and 20% of them were found to have vertically fractured (18, 19, 20).

In the early stage, patients may notice a mild discomfort on biting or chewing. In the more advanced stage, gingival swelling and moderate pain with or without a sinus tract can be seen. Therefore a thorough listening to the patient’s chief complaints and careful clinical examination by the use of dyes and magnification and radiographs with different angulation can help in detecting VRF. It may arise from a physical traumatic injury, occlusal prematurities, repetitive parafunctional habits of heavy stressful chewing or resorption induced pathological root fractures. However the most common cause of vertical root fractures may be iatrogenic dental treatment. Dental procedures such as placement of posts and pins or the tapping into place of tightly fitting post (21) or intracoronal restoration may induce a vertical fracture. The most common dental procedures contributing to vertical fractures is preparation of large endodontic access, excessive canal shaping and excessive compaction pressure during obturation resulting into fracture (22, 23, 24). According to Tamse A (8), lateral condensation of gutta-percha is considered one of the main etiologic factors of VRF. Therefore conservation of remaining dentin should be given to the teeth and roots most susceptible to fracture, i.e., the maxillary and mandibular premolars and the mesial roots of the mandibular molars

A few case reports have been published on attempts to save fractured roots from extraction (25). The use of CO2 and Nd–YAG laser to fuse fractured roots was tested in an in vitro study, but proved ineffective (26). Bonding of the extracted fragments with adhesive resin cement was also attempted (27, 28). In posterior teeth with multiple roots, hemisection or root amputation of the fractured root may be the treatment of choice, followed by a new restoration of the tooth.

In-vitro study demonstrated that stainless steel bands reduced the cuspal flexure by one-half compared to teeth without bands and, furthermore, doubled the fracture strength (29).

The case under discussion revealed the typical features of VRF. In this case we have tried an innovative approach to reinforce the vertically fractured tooth both internally and externally with the use of orthodontic band (RMO 0.180×0.005mm) and Ribbond (Ribbond inc. USA). Ribbond's unique combination of ultra-high strength fibers, enhanced bondability and patented cross-link lock-stitch leno weave makes for its strength. Full coverage metal crown was fabricated and cemented over the treated tooth, which gave the permanent stabilization to the tooth. Twelve months recall showed no periradicular changes in the radiograph and patient was asymptomatic.

The time of initiation of the treatment after the fracture and the type of fracture, whether complete or incomplete may play a vital role in the success. The early diagnosis and incomplete nature of fracture in this case provided a favorable long term prognosis. However more such studies are required to be done to see the effectiveness of such innovative procedure for successful
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Conclusion

VRF is diagnostic as well as treatment challenge. Most vertical tooth fracture has to be ultimately referred for extraction. This case study of VRF showed favorable prognosis even after 12 months recall. However more such studies are required to be done before coming to a definitive conclusion.

References


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