

Vertical Root Fracture: A Case Report and Review

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ABSTRACT

Vertical root fractures (VRF) are a commonplace occurrence especially in endodontically treated teeth. Given the dicey nature of the pathology, most practitioners opt to have the tooth extracted and rehabilitate the patient later. This article aims to do away with the misgiving that every tooth which has undergone a VRF has to be extracted and that salvaging such a tooth is possible thereby giving the patient a chance to save his natural dentition with a few modifications.

Keywords: Vertical Root Fracture, extraction, salvaging, natural dentition

Introduction

Vertical root fracture (VRF) is one of the chief reasons for extraction of teeth, both vital and the ones treated endodontically. While trauma lists as the primary cause of VRF in vital teeth, excessive force during cold lateral compaction is indicted as the cause in endodontically treated teeth. VRF accounts for an estimated 2-5% of all cases seen in a dental office.

American Association of Endodontists defines "A "true" vertical root fracture as a complete or incomplete fracture initiated from the root at any level, usually directed buccolingually" (1).

In order of decreasing frequency of occurrence, most affected teeth are premolars, molars, incisors then canines. The chances of VRF in a mandibular molar is twice as high as that in a maxillary molar (2). Most frequently, VRF is seen due to

iatrogenic causes in an endodontically treated tooth (3).

VRF can be classified as complete or incomplete fracture (1). Early diagnosis is a key for success of the case. In most of the cases, extraction is the choice of treatment but in multi rooted teeth, removal of fractured root and retention of the remaining portion of the tooth should be considered (4).

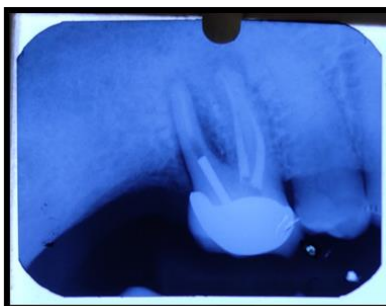
The aim of the paper is to present a case of vertical root fracture of distal root of mandibular first molar and its successful management.

Case report

A 38-year old male patient reported with the chief complaint of pain in the lower left back tooth region. On clinical examination, 36 had temporary restoration, no sinus tract with isolated pocket in the mid root region. On radiographic examination, 36 was endodontically treated, with a metal post in relation to distal root and a lesion in relation to distal root near the furcation.

The initial treatment plan was as follows – removal of the metal post followed by re-treatment of all the canals. Metal post was removed with the help of ultrasonics. Upon removal of the metal post, vertical root fracture was suspected in relation to distal root. The situation was explained to the patient and a hemisection was planned as the further treatment of choice for the patient. The distal root was removed

following hemisection and the mesial root was retained. A porcelain fused to metal



Pre-operative Radiograph-Metal post in the distal root, with the radiolucency beyond the post and poorly obturated distal canal

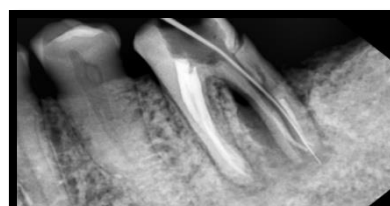
(PFM) crown was placed on to the mesial portion of the tooth. The patient is kept under observation.



Pre-operative View



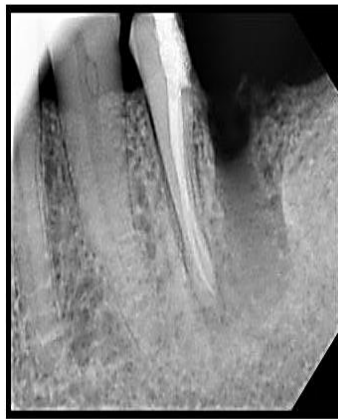
Removal of metal post



IOPAR- reveals Vertical Root Fracture in the distal root



Tooth restored with cermet before hemisection



IOPAR-retained mesial root



Healing- 2 weeks post-operative



Metal post retrieved using Ultrasonics



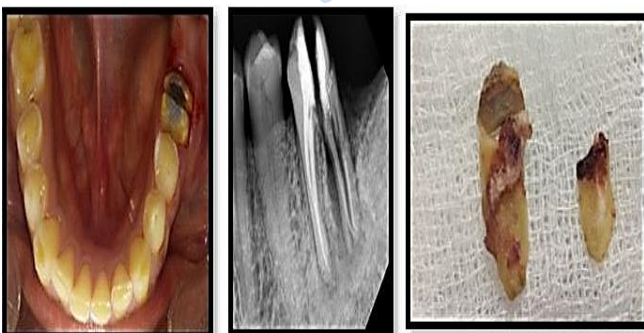
Tooth preparation for crown



Crown fabricated after die cutting



VRF



Distal root removed- Hemisection done



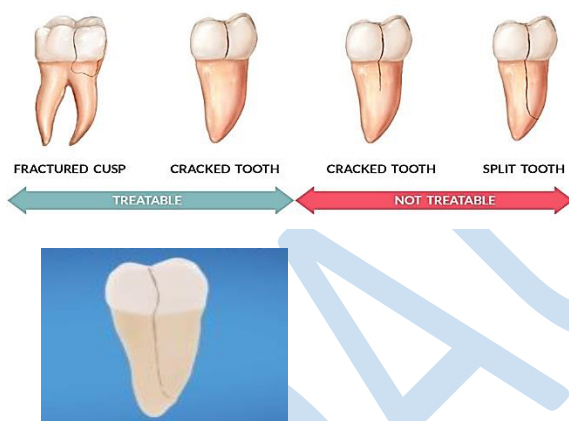
Post Restorative View



In the above case, as the fracture was along the entire length of the root, bonding of the fracture segments was not possible and therefore hemisection was planned. The distal root was removed and after a week tooth preparation was made for the mesial root.

Discussion

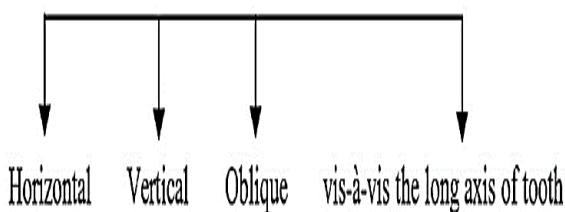
A third of all extractions are done due to fracture or split in the tooth. But owing to the chronicity of the pathology, it is more often than not difficult to pin point the exact etiology of the fracture (5).



Questionable Prognosis

Classification (1):

Depending on the direction of the fracture line



Luebek's Classification

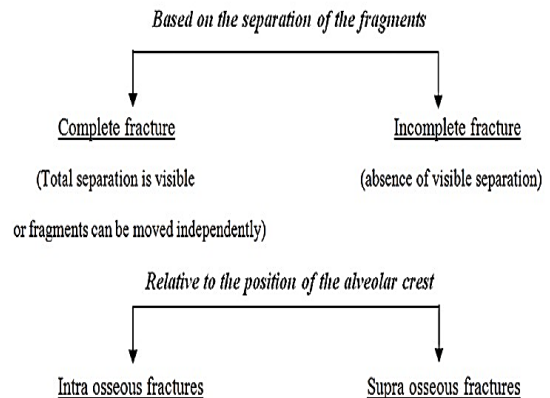


Table 1 - Pre Disposing Factors and Causes of vertical root fracture (7,8) (non-vital teeth):

Root canal anatomy	<ul style="list-style-type: none"> Roots narrower in mesiodistal dimension Developmental depression such as mesial root of mandibular molars and buccal roots of premolars
Change in dentin characteristics	<ul style="list-style-type: none"> Dehydration of human dentin increases its Young's modulus (increases stiffness) due to the change in collagen cross linking.
Residual dentin thickness after removal of intracanal procedures	<ul style="list-style-type: none"> Coronal enlargement Post space preparation Irrigants Long term Calcium hydroxide
Root fractures associated with corrosion	Corrosion product of metal post
Use of spreader and vertical root fracture	Wedging effect of spreader during lateral condensation
Obturation techniques and vertical root fracture	Lateral condensation technique produces more apical strain, whereas thermoplasticized gutta percha techniques produce more coronal strain
Post placement and vertical root fracture	<ul style="list-style-type: none"> Tapered end posts produce wedging effect near the apex Zirconia posts are rigid, and cause vertical root fracture

Table 2 - Pre disposing factors and causes of vertical root fractures (8,9) (Vital teeth):

Occlusal Forces	<ul style="list-style-type: none"> ▪ Malaligned teeth causing excessive and abnormal forces not directed along the long axis of the opposing teeth. ▪ Bruxism
Trauma	<ul style="list-style-type: none"> ▪ Sudden biting on hard objects
Restorative Procedures/ Materials	<ul style="list-style-type: none"> ▪ Excessive preparations involving and weakening the cusps ▪ Delayed expansion of amalgam restorations ▪ Excessive polymerisation shrinkage of composite restorations ▪ Improper reproduction of occlusal anatomy causing deflective occlusal forces

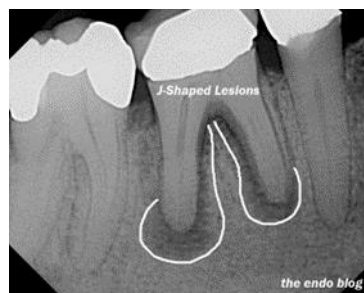
Clinical Manifestations

The presentation of VRF is debatable with variable signs and symptoms, and hence requires a great degree of skill, knowledge and aptitude to correctly diagnose the same (6,9). Some of the most common signs and symptoms are listed here under:

1. Mild pain and discomfort in the region on mastication.
2. Presence of a sinus tract.
3. A sharp click is noted if a VRF happens during obturation. This is accompanied by bleeding from the canal, excessive space demanding too many accessory cones to complete the procedure & sharp and spontaneous pain.
4. Tenderness on percussion.

Radiographic features

The reliability of an intra-oral periapical radiograph (IOPAR) for detection of VRF is lesser as compared to advanced imaging modalities such as a Cone Beam Computed Tomography (CBCT). CBCT is a highly sensitive, but expensive modality (10). If it is an endodontically treated tooth, the specificity is decreased but accuracy is not altered (5). According to one study, IOPAR helps to detect a VRF in only 35.7% cases (4,5). However, the following features can be hallmark to detection of a VRF on an IOPAR because of the limited feasibility of advanced imaging modalities.



Hair-like radiolucency in the dentin body.

J-shaped periapical hallow.

Diffuse periodontal widening.

Separation of root fragments.

Displacement of apical portion of roots.

Angular bone loss.

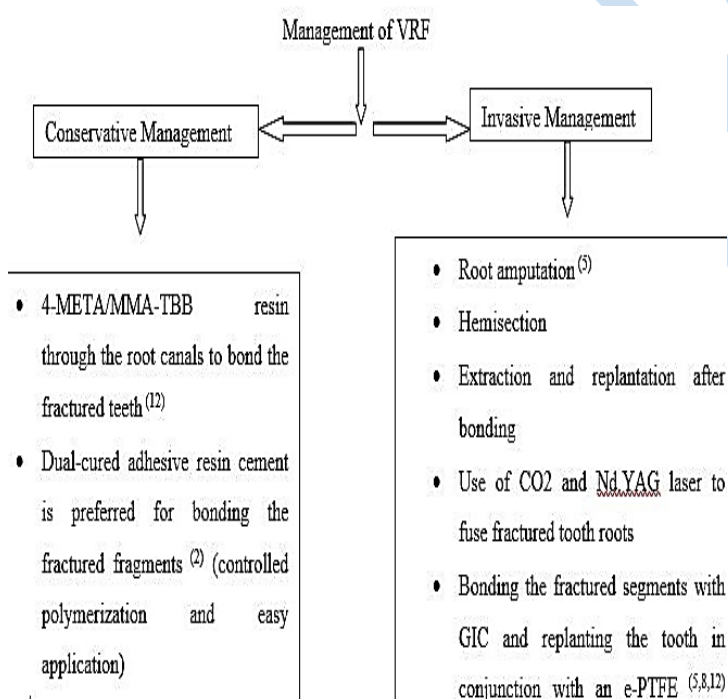
The reduced sensitivity of a periapical region to VRF may be due to superimposition of fracture lines on root canals/anatomic structures, improper radiographic technique and inaccessibility of the area to radiographic films (10).

Medico legal aspect of Vertical Root Fracture:

Poor quality root canal fillings complicate the diagnosis of vertical root fracture, which in turn extend the time for accurate diagnosis and medico legal risk (11). Premolar and mandibular molar teeth are more prone to medico legal claims related to vertical root fracture following root canal treatment (6).

Post should be placed only when essential for additional core support to avoid medico-legal risk.

Management(1-8) :



In case of anterior teeth with VRF, the teeth can be bonded extra-orally and re-implanted. The materials that can potentially serve as bonding agents are glass ionomer cements, cyanoacrylate, 4-

META/MMA-TBA, dual cure resins and/or MTA. This is because anterior teeth are not subjected to heavy occlusal loads and the fact that their maintenance is easier as compared to the posterior teeth (4).

Conclusion:

Saving a tooth is more difficult than having it extracted. VRF usually initiates at the apical part where forces are concentrated and moves coronally. In case of teeth treated endodontically or with posts, the crack begins in the apex or the middle third. The initiation and propagation of the crack is influenced by the magnitude, frequency, locations and directions of the forces.

The enigma of such cases lies in the fact that it is frustrating to both the practitioner and the patient. Early and accurate diagnosis, correct treatment planning and execution can reap benefits for both practitioners and patients by reducing the complications of the case and increased probability of saving the tooth.

However, as the adage goes "Prevention is better than cure", the responsibility lies with the practitioner to carry out procedures diligently and cause no undue maleficence to the patient either intentionally or unintentionally. In the above-mentioned case, a poor root canal obturation and improper technique for post

space preparation and cementation can be implied as the need for such an extensive exercise being carried out to save the tooth.

Declaration:

The authors declare that there is no conflict of interest whatsoever with respect to the publication of this article.

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