

A Review on Vertical Root Fracture

Dr. Chandhana ,R.Saipavithra
Savitha Dental college and Hospital, Chennai

Aim:

The aim of this study was to evaluate clinical and radiographical findings of vertical root fracture in endodontically treated teeth and other causes of VRF

Objective:

The objective of this study is about the factors that govern the vertical root fracture and prognosis of VRF.

Background:

Vertical root fractures are characterized by an incomplete or complete fracture line that extends through the long axis of the root toward the apex. Vertical root fractures are between 2 and 5 percent of crown/root fractures. The greatest incidence occurs in endodontically treated teeth and in patients older than 40 years of age.

This review enlightens the various aspects of the vertical root fracture and its prognosis.

INTRODUCTION :

According to American dental Association of endodontists "A True vertical root fracture is defined as a complete or incomplete fracture initiated from the root mostly or can also initiate at any level above the CEJ .^[1]

Many factors that predispose teeth to vertical fracture cannot be altered or controlled by the clinician .These include masticatory accidents (1) natural tight cusp- fossa relationship,(2) Steep intercuspation .VRFs in teeth without endodontic treatment are relatively uncommon .They are more common in the posterior teeth of people over 40years of age and may be caused by excessive forces from mastication or occlusion.^[2,3]

Vertical root fractures are classified into two types. a) Based on position of the fracture in relation to alveolar crest, Class 1: Incomplete supraosseous fracture as one terminating coronal to the alveolarcrest not creating a periodontal defect, Class 2: Incomplete supraosseous fracture as one terminating at or slightly apical to the alveolar crest creating a shallow osseous lesion and Class3: Complete or incomplete intraosseous fracture resulting in loss of periodontal attachment. b) Based on separation of the fragments, 1. Where total separation is visible or fragments can be moved independently. This is defined as complete fracture and 2. An incomplete fracture is said to occur in the absence of visible separation.^[4]

CAUSES OF VERTICAL ROOT FRACTURE:

Causes of vertical root fracture associated with endodontically treated teeth as follow :

- Vigorous and injudicious instrumentation if narrow canals
- Excessive force during obturation , specially during lateral condensation
- Wedging effects of endodontically posts .
- Corrosion and expansion of posts
- Pathologic fractures secondary due to periodontics lesion
- Abutment teeth with unfavourable forces .

According to the results of previous survey we can state that treatment procedures can influence the outcome because failure in 48% of cases occurred in one year period after the treatment was ended. So it

is important to understand that all vertical pressures exerted during treatment procedures can predispose vertical fractures.^[9,10,11]

Causes of vertical root fracture associated with coronal restorations:

- Excessive removal of tooth structure during cavity preparation ,causing weakening of cusps.
- Delayed expansion of amalgam
- Excessive polymerization shrinkage of composite resins
- Improper reproduction of occlusal anatomy causing deflection occlusal contacts .^[12]

Clinical signs and symptoms of vertical root fracture :

Clinical presentation of a vertical root fracture is extremely variable. The clinical signs and symptoms vary according to the position of the fracture, tooth type, time after fracture, and the periodontal condition of the tooth and the architecture of the bone adjacent to the fracture.^[5]

- Swelling of the soft tissue and tenderness over the root,
- Presence of a sinus tract close to attached gingiva, rather than in the apical region,
- Development of deep, narrow, isolated periodontal pockets,
- A repeated dislodgement of a post or post crown,
- Sharp cracking sound at the time of condensation of gutta percha or cementation of a post and
- Bleeding during condensation of a root filling material and an apparent lack of resistance within the canal during condensation leading to an almost unlimited ability to condense guttapercha in to the canal. ^[6,7,8]

Radiographic appearance :

Radioluceny seen •

Fracture (radiolucent) Lines: Separation of root fragments makes fracture clearly visible. Proliferation of granulation tissue between the separated fragments often results in the rapid movement of the fragment away from the remaining root. ^[19]

Double images: When separation of fragments occurs in a direction other than parallel to the X-ray beam, overlapping of fragments may result in double images of the external root surface. But this effect is

sometimes seen in normal teeth, for example, in the mesial concavity of maxillary premolar teeth.^[20]

Clinical signs and symptoms

The clinical signs and symptoms vary (according to the position of the fracture, tooth type, time elapsed since fracture, periodontal condition of the tooth and the architecture of the bone adjacent to the fracture) and are difficult to detect or reproduce during patient examination. The patient's symptoms may mimic many other possible diagnoses such as sinus problem, vague headaches or ear pain.

Pain and swelling:

Local chronic inflammation due to infection leads to discomfort and soreness, mild to moderate pain, pain on biting, bad taste and swelling of soft tissues. Some swelling of soft tissues is usually present. The swelling is usually broad-based, and mid-root in position compared to apical location in peri-apical abscess. Palpation will often show swelling and tenderness over the root itself.^[21]

SINUS TRACT

Sinus tract A sinus tract is commonly found in VRF cases (13-42%). In VRF, sinus tract is located close to the gingival margin as opposed to non-vital teeth where sinus tracts are located more apically (differential diagnosis from endodontic infections). The presence of two sinus tracts (at both buccal and lingual aspects) or multiple sinus tracts is almost pathognomonic for a VRF.

Management :

In a multi-rooted tooth with VRF, Root amputation or hemisection can save the tooth depending on the level and position of fracture^[10] However, in single rooted teeth with VRF, the prognosis is unfavorable. Extraction will be the treatment of choice in cases of extensive bone loss due to uncertain prognosis. However, many innovative attempts to treat and retain anterior teeth have been reported in recent past.

Extraction and replantation after bonding: Studies have reported successfully treating tooth with VRF by extracting the fractured tooth atraumatically, bonding the fragments, and then replanting the tooth either directly or with a 180 degree rotation (especially in case of anterior teeth).^[13]

Application of a bio-resorbable membrane to reinforce periodontal healing, by preventing any gingival connective tissue from making contact with the curetted root surfaces during healing and allowing for regeneration of periodontal ligament cells around the teeth has been suggested in few reports.^[14]



Other treatment options include :

- i) Use of CO₂ and Nd:YAG laser to fuse fractured tooth roots.^[15]
- ii) Bonding the fractured segments with glass ionomer bone cement and replanting the tooth in conjunction with an e-PTFE membrane^[16]
- iii) Two stage surgical procedure of bonding with silver glass ionomer cement, placement of a bone graft material and GTR therapy..^[17]
- iv) Use of 4-META/MMA-TBB resin through the root canals to bond the fractured teeth^[18]
- v) Use of dual-cured adhesive resin cement is preferred for bonding the fractured fragments, as it has a controlled polymerization and is easy to apply.

CONCLUSION:

It has been reported from the literature that management of cases with VRF involves extensive procedures often with poor outcomes. Where successful outcomes have been claimed, the long-term prognosis is yet to be proven. Therefore, there is a need for further clinical research on the treatment of teeth that with VRF with long term follow ups.

REFERENCE:

- 1) American Association of Endodontics. Endodontics: Colleagues for Excellence- Cracking the cracked tooth code: Detection and Treatment of Various Longitudinal Tooth Fractures. Chicago: American Association of Endodontics; summer 2008:1-8.
- 2) Yang SF, Rivera EM, Waiton RE. Vertical root fracture in nonendodontically treated teeth. J Endod 1995;21:337-9.
- 3) Yeh CJ. Fatiguerootfracture: aspontaneous root fracture in nonendodontically treated teeth. Br Dent J 1997;182:261-6.
- 4) Luebke R. Vertical crown-root fractures in posterior teeth. Dental Clinics of North America. 1984;28(4):883-94
- 5) Moule AJ, Kahler B. Diagnosis and management of teeth with vertical root fractures. Australian Dental Journal. 1999;44(2):75-87.
- 6) Schettrit A, Steffensen B. Diagnosis and management of vertical root fractures. Journal of Canadian Dental Association. 1995;61(7):607-13.
- 7) Cohen S, Blanco L, Berman L. Vertical root fractures: clinical and radiographic diagnosis. The Journal of the American Dental Association. 2003;134(4):434-41
- 8) Ingle JI. Vertical root fractures of endodontically treated teeth. Ingle's Endodontics. 6th ed: BC Decker INC; 2008. p. 676-89.
- 9) Helfer AR, Melnick S, Schilder H. Determination of the moisture content of vital and pulpless teeth. Oral Surg 1972; 34: 661-7. 12.
- 10) Lewinstein I, Grajower R. Root dentin hardness of endodontically treated teeth. J Endod 1981;7: 421-4. 13.
- 11) Tidmarsh B., G. Restoration of endodontically treated teeth. J Endod 1976; 2: 374-6.
- 12) Cameron CE. Cracked tooth syndrome. J Am dental association 1964 :68:405-11

- 13) Kawai K, Masaka N. Vertical root fracture treated by bonding fragments and rotational replantation. *Dent Traumatol* 2002;18:42-5.
- 14) Trope M, Rosenberg ES. Multidisciplinary approach to the repair of vertically fractured teeth. *J Endod* 1992;18:460-3.
- 15) Arakawa S, Cobb CM, Rapley JW, Killooy WJ, Spencer P. Treatment of root fracture by CO₂ and ND: YAG lasers: An in vitro study. *J Endod* 1996;22:662-7.
- 16) Trope M, Rosenberg ES. Multidisciplinary approach to the repair of vertically fractured teeth. *J Endod* 1992;18:460-3.
- 17) Masaka N. Long-term observation of fractured tooth roots preserved by adhesion. *J Adhes Dent* 1995;3:156-71.
- 18) Oztürk M, Unal GC. A successful treatment of vertical root fracture: A case report and 4 year follow-up. *Dent Traumatol* 2008;24:e56-60.
- 19) Meister F Jr, Lommel TJ, Gerstein H, Bell WA. An additional clinical observation in two cases of vertical root fracture. *Oral Surg Oral Med Oral Pathol* 1981;52:91-6.
- 20) Pitts DL, Natkin E. Diagnosis and treatment of vertical root fractures. *J Endod* 1983;9:338-46.
- 21) Moule AJ, Kahler B. Diagnosis and management of teeth with vertical root fractures. *Aust Dent J* 1999;44:75-87.