



Research Paper

Pathological root migration of endodontically treated teeth subsequent to vertical root fracture – A CASE REPORT

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ABSTRACT:

Introduction:

The early diagnosis of root fracture through conventional methods is formidable. The root fracture can be misdiagnosed as a supernumerary root in conventional radiographic imaging. The subsequent separation and migration of the fractured root may become evident clinically as an isolated deep periodontal probing depth and as a radiolucency on radiographs. This is a rare case report that describes a case of pathological root migration of endodontically treated teeth subsequent to vertical root fracture, which has been rarely described in the literature.

Observation

Clinical examination revealed endodontically treated mandibular right first molar (46) with a visible mesiobuccally placed root. The position of the root was confirmed by RadioVisioGraphy (RVG) with parallax method. The treatment consisted of the removal of the fractured root, followed by curettage of the periapical lesion associated with the same tooth.

Conclusion

The fracture resistance of endodontically treated teeth can be increased by preservation of the marginal ridge, rounding of line angles and selection of obturation technique, thus ensuring the preservation of enamel and dentin.

KEYWORDS: pathological root migration, endodontically treated teeth, vertical root fracture, case report.

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I. INTRODUCTION

The early diagnosis of root fracture through conventional methods is formidable. The root fracture can be misdiagnosed as a supernumerary root in conventional radiographic imaging. The subsequent separation and migration of the fractured root may become evident clinically as an isolated deep periodontal probing depth and as a radiolucency on radiographs.

This case report aims to describe an atypical case of pathological root migration of endodontically treated teeth subsequent to vertical root fracture. Literature search in PubMed, Medline and Cochrane yielded only one article describing three cases.

II. Observation

A 75-year-old woman presented with the chief complaint of pain in the lower left teeth region and pus discharge for the past 2 months. Intraoral examination revealed endodontically treated (20 years ago) mandibular right first molar (46) with a visible mesiobuccally placed root (Figure 1). The gingiva surrounding the mesiobuccally placed root was bluish red in colour, swollen and exhibited bleeding upon probing with an increased probing depth. Radiographic examination of an orthopantomogram (OPG) revealed fracture of the mesial root of 46 and a periapical lesion in the mesial root. RadioVisioGraphy (RVG) with parallax method was taken to confirm the position of the fractured root (Figure 2). The management consisted of the removal of the fractured mesiobuccal root and curettage, followed by the placement of interrupted sutures (Figure 3). The patient was recalled after one week for removal of sutures. Hemisection was not considered as an option for

treatment because the patient wanted to retain her teeth. The patient will be recalled after a month for replacement of the endodontic crown.



Figure 1



Figure 2



Figure 3

III. Discussion

Pathological tooth migration (PTM) is defined as the “Change in tooth position that occurs when there is disruption of forces that maintain teeth in a normal relationship”. In toto migration of teeth is a common manifestation of periodontitis with a reported percentage range of 30–55%, while pathological root migration (PRM) occurs as a post-surgical complication of coronectomy^{1,2}. A long-term analysis of coronectomy cases by Leung et al revealed that the root migration occurred in 91.1% of the cases within 6 months³. Sporadically, tooth fracture may demonstrate an exaggerated PRM⁴. A vertical root fracture (VRF) occurs as a complete or an incomplete line of fracture extending obliquely or longitudinally through enamel and dentin of an endodontically treated root⁵. Risk factors for vertical fracture in endodontically treated teeth include excessive root canal preparation, overpreparation of post space, overzealous lateral and vertical compaction forces during obturation, excessive pressure during placement of post and compromised tooth integrity as a result of large carious lesions or trauma⁶. The early diagnosis of root fracture through conventional methods is formidable. The root fracture can be misdiagnosed as a supernumerary root in conventional radiographic imaging. The subsequent separation and migration of the fractured root may become evident clinically as an isolated deep periodontal probing depth and as a radiolucency on radiographs⁴. Literature search of PRM after vertical fracture involving endodontically treated teeth in PubMed, Medline and Cochrane yielded only one article with three case reports discussing PRM secondary to VRF and full-coverage crowns⁴.

The forces exerted on endodontically treated teeth include the forces produced during the instrumentation of lateral and apical condensation as well as the masticatory forces. The influencing factors of such forces include magnitude, frequency, locations and direction of force⁷.

The aim of root canal preparation is to achieve a conical shape of the canal from the apex to the coronal portion, preservation of the apical foramen with its original shape and position and to maintain the curvature of the canal. The instrumentation must end at the apical constriction if present or at the radiographic apex or 0.5–1 mm coronally to it. Intentional or unintentional over instrumentation results in apical transportation and formation of microcracks, leading to a vertical root fracture^{8,9}. Tavanafar et al assessed the effect of different instrumentation techniques involving nickel-titanium hand K-file, WaveOne reciprocating single file and BioRaCe rotary file on VRF resistance of endodontically treated teeth. They found that all the three instrumentation techniques weakened the root structure and rendered them susceptible to fracture under a much lesser load than unprepared roots¹⁰. The increasing loss of tooth substance during the preparation of a coronal cavity weakens the tooth further, causing root fractures or dentinal cracks when the tensile stress in the root canal wall exceeds the tensile stress in dentin¹¹. Katalinić et al compared the vertical forces exerted during root canal obturation with those of the cold lateral condensation technique, Thermafil technique and ProTaper gutta-percha. They reported that the cold lateral condensation technique exerted a higher vertical force, compared to the other techniques¹².

Under functional load, the dentinal cracks caused by stress may cause the cracks to extend further to form complete fractures¹³. Awawdeh et al compared the maximal bite force (MBF) in root canal treated teeth with that in vital teeth on the contralateral side. They found that the root canal treated teeth had a significantly higher difference in the mean MBF, compared to the vital teeth, suggesting that the decreased sensitivity to occlusal load can lead to a greater risk of damage to root canal treated teeth¹⁴. Loewenstein and Rathkamp suggested that intradental mechanoreceptors in the pulp can be responsible for increased threshold for the mechanical force, on teeth without pulp than on vital teeth¹⁵.

Decreased residual dentin thickness associated with large endodontic crowns increases the susceptibility to fracture⁷. A crowned tooth, unlike a tooth with supragingival tooth structure, cannot rotate freely in response to occlusal forces due to a fulcrum formed between the tooth structure and the crown. Thus, the occlusal forces cause stress, leading to fracture of the tooth over time¹⁶. Zeng et al studied the induction of

vertical root split and concluded that the VRF of molar is associated with greater occlusal force. Ertas et al studied fracture resistance and how it is affected by the physical and morphological properties of roots. They suggested that compared to the mesial-distal or buccal-lingual dimensions of roots, the volume and weight of roots were greater factors for increasing the root fracture resistance¹⁸.

IV. Conclusion:

A fracture of the root into two occurs when a complete fracture of the furcation stress plane results¹⁶. The force involved in endodontically treated teeth is exerted during instrumentation and mastication, leading to a cumulative effect which alters the physical, chemical and mechanical properties of the enamel and dentin causing VRF and subsequent migration of the fractured root. Preservation of the marginal ridge, rounding of line angles and selection of the obturation technique ensure the preservation of enamel and dentin, thus increasing the fracture resistance of endodontically treated teeth.

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List of abbreviations

1. Orthopantomogram (OPG)
2. RadioVisioGraphy (RVG)
3. Pathological tooth migration (PTM)
4. Pathological root migration (PRM)
5. Vertical root fracture (VRF)
6. Maximal bite force (MBF)

Declarations

Ethics approval and consent to participate – Not applicable

Availability of data and materials – Not applicable

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