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Horizontal root fractures in posterior teeth: a case series

CASE REPORT

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Abstract – This case series describes observations of 12 patients who developed horizontal root fractures in non-endodontically treated teeth. Using clinical and radiographic examination, horizontal fractures were observed in eight maxillary first molars, one maxillary second molar, one mandibular first premolar and four mandibular second premolars. A total of 12 teeth had clinically intact crowns and 2 had carious. Eight fractures of maxillary molars occurred in the palatal roots, while one fracture was observed in the distobuccal root. Eleven patients experienced pain from the affected teeth during mastication. Within the limits of this case series, it was concluded that these fractures were related to; root morphology, damaging masticatory habits and excessive occlusal forces.

Horizontal root fracture is usually characterized by a fracture line perpendicular to the long axis of the root of a tooth. Horizontal root fractures most commonly occur in the anterior teeth of young adults following traumatic injuries (1). Other than as a result of trauma, horizontal root fractures are rare in the absence of previous endodontic treatment. Previous reports (2–4) have described one, two and five cases, respectively, of horizontal root fracture in non-endodontically treated teeth.

Why non-endodontically treated teeth exhibit horizontal root fractures remains unknown. Legan et al. (5) reported a case of horizontal root fracture in a premolar, possibly caused by excessive traumatic force exerted during the cementation of an adjacent over-contoured crown. Jerome (6) detected a horizontal fracture in the mesiobuccal root of a maxillary molar, caused by traumatic injury during surgery involving the maxillary sinus.

This article describes 12 patients who developed horizontal root fractures in 5 mandibular premolars and nine maxillary molars without having undergone endodontic treatment.

Materials and methods

Our study included 14 non-endodontically treated teeth with horizontal root fractures from 12 Chinese patients. Oral diagnoses were performed in the endodontic clinic of the School of Stomatology, Fourth Military Medical University, from 2006 to 2009. Data were collected from each patient's dental history, clinical examination and radiographic findings. Clinical information included age and gender of the patient, the tooth involved and location of the fracture. Signs and symptoms associated with the horizontal root fractures were also recorded, and the possible causes of the horizontal root fractures were postulated from the patient's dental history or from any unusual phenomena in the clinical and radiographic findings.

Results

A total of 12 patients (5 males and 7 females) were diagnosed with horizontal root fractures based on radiographically observable horizontal root fracture lines. The patients were aged from 41 to 70 years. The fractured teeth had previously received neither root canal treatment nor prosthodontic treatment. All horizontal root fractures of non-endodontically treated teeth in this series occurred in posterior teeth: eight maxillary first molars, one maxillary second molar, one mandibular first premolar and four mandibular second premolars. Eight of the nine fractures of maxillary molars occurred in the palatal root (Fig. 1), while one occurred in the distobuccal root of the maxillary first molar. The distobuccal root fracture was accompanied by extensive bone loss around the root (Fig. 2).

The patients were unaware of any traumatic event that might have caused the fractures, and only six patients habitually chewed hard food such as nuts or hardened dried food. Eleven of the 12 patients exhibited persistent dull pain in the affected teeth during mastication. The teeth were sensitive to percussion. Only one patient presented without complaint, and this patient's fracture being an incidental finding. Four patients complained of thermal sensitivity and symptoms of pulpalgia. Altogether, the occlusal surfaces of the teeth

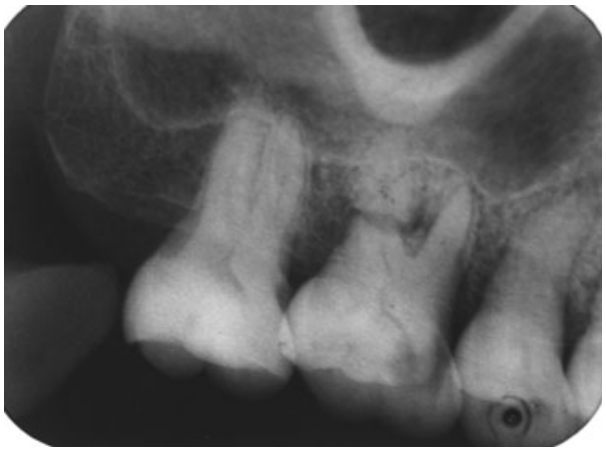

Fig. 1. Radiograph of the maxillary right first molar showing a horizontal fracture in the palatal root.

Fig. 2. Radiograph of the maxillary right first molar showing a horizontal fracture in the distobuccal root.

showed moderate to severe attrition; 12 teeth displayed clinically intact crowns, while 2 teeth presented with caries without pulp exposure. None of the teeth had associated sinus tracts or inflamed gingivae. Three root fractures in the maxillary first molars occurred above the level of the marginal gingivae. These fractures could be seen directly (Fig. 3). Nine of the fractured maxillary molars were tested with an electric pulp tester eliciting a positive response in five teeth while four were non-responsive.

Interestingly, a 66-year-old female with a habit of chewing hard food presented with horizontal root fractures in both left and right mandibular second premolars. The patient had experienced pain in her mandibular left second premolar during mastication for 1.5 years, but the pain in the mandibular right second premolars did not appear until 3 weeks prior to examination (Fig. 4a,b). One 70-year-old patient displayed a horizontal fracture in the palatal roots and a vertical fracture in the mesiobuccal roots of both left and right

Fig. 3. Lingual view of a horizontal fracture in the palatal root of the maxillary left first molar.

maxillary first molars with the patient reporting discomfort or pain during mastication for approximately 10 years prior to diagnosis. Localized swelling in both areas of the affected molars had occurred several times previously (Fig. 5a-d). His wife (age 66) presented with a horizontal root fracture in the palatal root of her maxillary left first molar (Fig. 6).

Discussion

In this case series, the common signs and symptoms of horizontal root fractures were chronic, mild and intermittent pain when biting on the affected tooth which was concurrent with sensitivity to percussion. Radiographic examination was conclusive in the diagnosis of root fracture.

Following a root fracture, if there is no mobility, the patient may present with no apparent complaint and be unaware of the need for treatment. Over time, the symptoms and signs frequently become more obvious as the pulp and periodontal tissues become progressively involved.

Visual examination of the patients in this study revealed no inflamed gingivae. Three root fractures in maxillary first molars could be seen directly because of gingival recession. In other cases, radiographic examination showed bone loss around the fractured roots that closely resembled a periodontal lesion, presumably caused by the persistence of the fracture. There was no relationship identified between the patients' periodontal status and the likelihood of root fracture.

The causes of spontaneous horizontal root fracture are unclear. Teeth with horizontal root fractures in this series exhibited attrition, although none of the cases were linked to endodontic treatment. Yeh (4) found that all patients exhibiting non-endodontic root fractures habitually chewed hard materials over a long period of time. The majority of patients in this study exhibited excessive attrition of the occlusal surfaces of their posterior teeth, indicating that these teeth had sustained heavy, repeated and prolonged stress. This finding indicated that the teeth had incipient fractures, later resulting in complete fracture. Although only six patients in the present study

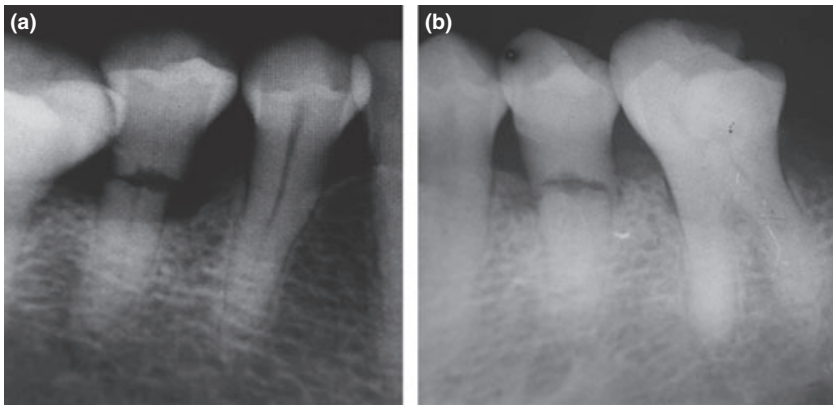

Fig. 4. Radiograph of the mandibular right second premolar (a) and left second premolar (b) showing horizontal root fractures with surrounding bone loss.

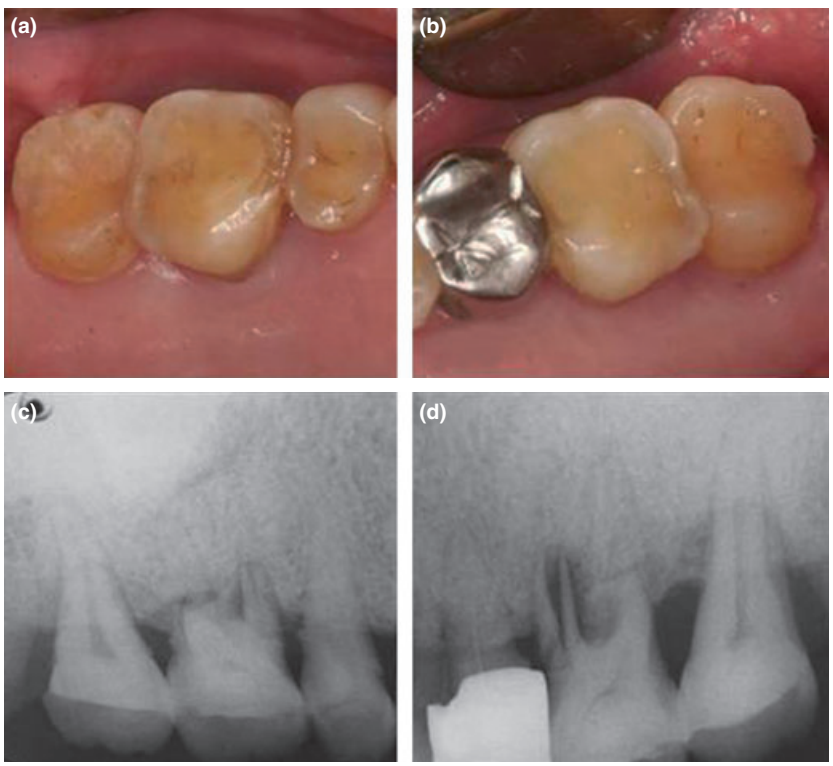

Fig. 5. Occlusal wear on the maxillary right first molar (a) and left first molar (b). Radiographs of the maxillary right first molar (c) and left first molar (d) showing vertical fractures in the mesiobuccal root and horizontal fractures in the palatal root.

displayed the habit of chewing hard food, the people living in this area of China present with some distinctive chewing habits. For instance, residents of this area excessively chew food that cannot be sheared easily when biting. Repetitive masticatory forces may therefore initiate root fracture. A married couple displayed horizontal fractures in the palatal root of their maxillary first molars which suggested that these individuals likely practiced the same damaging, diet induced chewing habits.

The reason for the involvement of the palatal roots of maxillary molars and mandibular premolars in horizontal root fractures is unclear. Lu (7) described 33 non-endodontic horizontal root fractures, the majority of which involved the palatal roots of the maxillary molars. These horizontal fractures were distributed quite differently from vertical root fractures (4, 8, 9). Specific root morphology, such as flat root shape, may be one of the most important predisposing factors for non-endodontic vertical root fracture (9) with one patient presenting with horizontal and vertical root fractures in the same teeth, indicating that there were common factors contributing to both types of root fracture and differences in root fractures may possibly be attributed to root shape. The distobuccal and palatal roots of the maxillary first molar are generally circular in cross section, while the mesiobuccal root is buccopalatally wider than the distobuccal root (10). The outline form of the root of the mandibular premolar may be oval, rectangular or triangular in cervical cross-section (11), which may influence the fracture susceptibility of such teeth.

Fig. 6. Radiograph of the maxillary left first molar showing a horizontal fracture in the palatal root and a thickening of the periodontal ligament space on the surface of the mesiobuccal root.

Conclusion

Our study identified a higher prevalence of horizontal root fractures in the palatal roots of maxillary molars and mandibular premolars than in other teeth. These fractures may be related to root morphology, damaging chewing habits and excessive occlusal force. The sample size however is too small to support this hypothesis conclusively. Collection of additional data may help to clarify if root morphology, oral habits, and occulsal forces are significant contributing factors.

References

1. Caliskan MK, Pehlivan Y. Prognosis of root-fractured permanent incisors. Endod Dent Traumatol 1996;12:129–36.
2. Lin CC, Tsai YL, Li UM, Chang YC, Lin CP, Jeng JH. Horizontal/oblique root fractures in the palatal root of maxillary molars with associated periodontal destruction: case reports. Int Endod J 2008;41:442–7.
3. Borelli P, Alibrandi P. Unusual horizontal and vertical root fractures of maxillary molars: an 11-year follow-up. J Endod 1999;19:136–9.
4. Yeh CJ. Fatigue root fracture: a spontaneous root fracture in non-endodontically treated teeth. Brit Dent J 1997;182:261–6.
5. Legan JJ, Brown CE, Andres CJ. Unusual fracture of a maxillary second premolar. J Endod 1995;5:285–6.
6. Jerome CE. Maxillary molar root fracture caused by sinus surgery: case report. Endod Dent Traumatol 1994;10:286–8.
7. Lu HF. Tooth root fracture-report of 81 cases. Chinese J Stomatol 1980;15:29–31.
8. Yang SF, Rivera EM, Walton RE. Vertical root fracture in nonendodontically treated teeth. J Endod 1995;21:337–9.
9. Chan CP, Tseng SC, Lin CP, Huang CC, Tsai TP, Chan CC. Vertical root fracture in nonendodontically treated teeth - a clinical report of 64 cases in Chinese patients. J Endod 1998;24:678–81.
10. Whitworth JM Rational root canal treatment in practice. London: Quintessence Publishing Co. Ltd, 2002. 42 pp.
11. Ash MM Dental anatomy, physiology and occlusion. Philadephia: W.B. Saunders Company; 1984. 310–11 pp.