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CASE STUDY

MANAGEMENT OF A CERVICAL, MIDDLE AND APICAL HORIZONTAL ROOT FRACTURE PATIENTS

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ABSTRACT

Horizontal Root Fractures (HRF) are uncommon consequences of traumatic dental injuries. Although anterior tooth are primarily involved, HRF can occur in posterior tooth as well. From a therapeutic stand point middle and apical root fractures are considered to have a favourable prognosis while cervical root fractures are considered least favourable. This article reports on successful management of cervical, middle and apical third HRF by conservative treatment approaches. Authors suggest an accurate diagnosis followed by reduction, fixation & endodontic therapy can lead to favourable outcome in HRF patients.

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INTRODUCTION

Traumatic injuries to anterior tooth is one of the main cause for a patient to seek dental treatment as it becomes an aesthetic emergency (Polat-Ozsy, 2008). It accounts for approximately 5% of the overall traumatic injuries. The predominant age group include Pre-school to young adults (Diangelis *et al.*, 2012). Injury to the tooth may vary from crown fracture to luxation injuries to root fractures (Polat-Ozsy, 2008). Among these different type of injuries Horizontal Root Fractures(HRF) account for 0.5-7% in permanent tooth (Diangelis *et al.*, 2012; Choi *et al.*, 2014; Andrea *et al.*, 2010) and can involve dentine, pulp, cementum, periodontal ligament & even alveolar bone in some instances leading to complex treatment strategies. Maxillary central incisors (68%) followed by maxillary laterals (27%) & mandibular incisors (5%) are the most commonly involved tooth (Karhade, 2016). Very rarely HRF in mandibular & maxillary posterior tooth have been reported (Wang *et al.*, 2010). This report describes the management of three cases of HRF in coronal, middle and apical third with a periodic follow upto one year.

CASE REPORT

Case 1

A male patient aged 23 years reported to the department of conservative dentistry & endodontics with a history of trauma to the upper anterior tooth, a day after the trauma. Clinical examination revealed crown fracture with visible pulp exposure in 12 and grade 2 mobility in 11. The tooth 11 elicited acute tenderness which further aggravated on biting. Radiographic examination revealed Horizontal Root Fracture (HRF) in 11 at cervical level (Figure 1). Multiple radiographs in 45, 90 & 110 degrees were taken to check for any oblique extension in bucco-lingual direction. Both 11,12 did not respond to Pulp Sensibility Tests (Cold & EPT) Approximation of the fractured fragments was done by finger pressure under local anaesthesia and stabilised by a semi-rigid splint, twist flex wire fixed by light cure composite resin from canine to canine. The repositioning was confirmed by IOPA radiograph. A two visit conventional root canal therapy was initiated immediately in 11,12. Four weeks after completion of obturation the fractured segment of tooth 11 was stabilised by flexible glass fibre post (Radix Fibre Post, Dentsply India) (Figure 2) and the semi-rigid splint was removed. The patient was advised oral hygiene instructions.

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Figure 1. IOPA radiograph showing cervical fracture in relation to tooth 11



Figure 3. Working length IOPA radiograph showing HRF at middle level of 11 and 21



Figure 2. Post operative IOPA radiograph showing stabilisation of tooth 11 by flexible glass fibre post



Figure 4. Post operative IOPA radiograph after obturation of 11 and 21

Case 2

A 28 year old male patient reported with a complaint of discoloured upper anterior tooth. Clinical examination revealed dark brown discoloration in relation to 11,12. Other than the discoloration the patient had no other bucco-dental signs & symptoms. Radiographic examination revealed HRF in middle level of 11, 21(Figure 3). CBCT imaging did not reveal any dislocation of the fractured segments in bucco-palatal direction which revealed no dislocation. It further revealed the healing along the fracture line by hard tissue formation and the diastases between fractured fragments was negligible. Pulp sensibility test (Cold & EPT) was Negative for both 11, 21. After stabilisation by a semi-rigid splint, twist flex wire fixed by light cure composite resin from canine to canine, a 2-visit conventional endodontic therapy along the entire length of the canal was done in 11,21 (Figure 4). Four weeks after obturation both the fragments were stabilised with a flexible glass fibre post and the semi-rigid splint was removed followed by post endodontic restoration(full coverage crown) in 11,21.

Case 3

A 26 year old female patient reported with a history of pain in left upper posterior region for a month, gave a history of beetle nut chewing for the past 10 years.



Figure 5. Pre operative IOPA radiograph showing HRF at apical level in 25

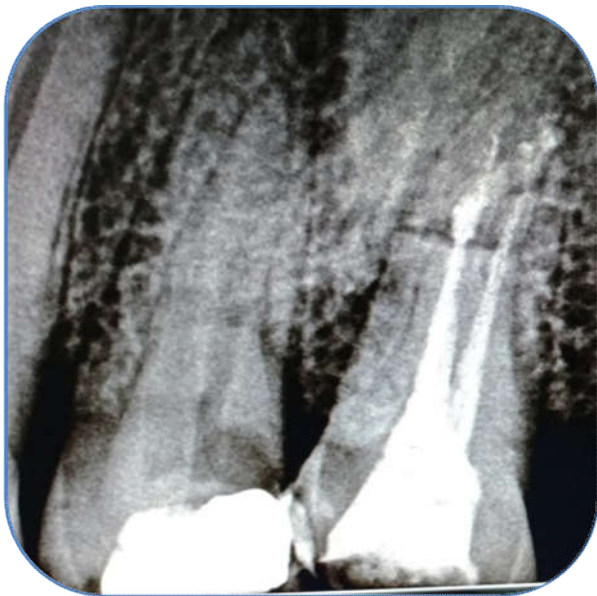


Figure 6. Post operative IOPA radiograph after obturation of 25

Clinical examination revealed deep carious lesion in tooth 25 which was tender on vertical percussion. Tooth 25 exhibited dark discolouration & compressibility into the socket. Radiographic examination revealed carious lesion approximating pulp & HRF in apical level of tooth 25 (Figure 5). Radiographic finding of HRF at apical level was incidental. Pulp sensibility test (Cold & EPT) was Negative. The tooth 25 was relieved from occlusion, a semi-rigid splint was placed from 24 to 26 and a 2-visit conventional endodontic therapy was performed in 25 as the canals were negotiable along the entire root canal length, including the apical segment (Figure 6).

DISCUSSION

In traumatic HRF the offending impact force is directed on the top of the tooth with frontal forces effecting a compression zone labially /palatally fracturing the root into two segments (coronal & apical), (Karhade *et al.*, 2016) whereas in case of posterior teeth the impact force has to be heavy & direct, HRF is classified as cervical third, middle third & apical third based on the location of fracture line & degree of dislocation of coronal segment, (Andrea *et al.*, 2010). HRF in middle third is most common with favourable prognosis, cervical third is very rare with poor prognosis & apical third requires no therapeutic intervention (Karhade *et al.*, 2016). In addition to routine clinical findings (mobility test, palpation, percussion & pulp sensibility testing), diagnosis of traumatic dental injuries have relied heavily on 2-D radiographic & clinical examination (Polat-Ozsy *et al.*, 2008; Fagundes *et al.*, 2014). Multiple radiographs in different angles are examined to detect the angle of fracture (Karhade *et al.*, 2016). Furthermore the advent of CBCT has increased the accuracy in diagnosis of traumatic injuries by overcoming the pitfalls of 2-D radiography (projection geometry, superimposition of anatomic structures and processing errors (Cohenca, 2017). Therapeutic strategies in HRF depends upon a number of factors namely location of the fracture line, stage of root formation, level of displacement of coronal segment & status of pulp, (Polat-Ozsy *et al.*, 2008; Karhade *et al.*, 2016). General treatment protocol includes repositioning (approximating the fractured fragments), stabilization (semi-rigid splinting), endodontic therapy & continuous monitoring

(clinical, radiographic (Polat-Ozsy *et al.*, 2008; Diangelis *et al.*, 2012; Choi *et al.*, 2014; Hassan, 2015). The main goal of this therapeutic strategy is to achieve physiological and functional integrity of the affected tooth by promoting healing⁽⁶⁾. The healing in HRF can occur in any of the four ways 1. healing with interposition of the soft tissue 2. healing with interposition of soft and hard tissue 3. healing with tissue giving union across the fracture (hard tissue) 4. no healing, with ideal one being healing with hard tissue (Polat-Ozsy, 2008). This can be achieved by immediate approximation (reduction) and splinting of the affected tooth as suggested by the International Association of Dental Traumatology (IADT) guidelines (Polat-Ozsy *et al.*, 2008; Choi *et al.*, 2014; Cohenca *et al.*, 2017). In case 1&2 repositioning and stabilizing of the fracture fragment was done by twist flex wire and light cured composite resin. Twistflex wire (18.4Nm) was selected because it satisfies the most important criteria in literature for splinting in treatment of HRF: 1. The splint should be as flexible as possible permitting physiological tooth movement 2. should not allow the tooth to be displaced from the socket. Fishing line, power chain and single layered fibre glass splint are the other materials suggested for splinting (Hassan *et al.*, 2015).

In case 3 since the fracture was in the apical third and the tooth was compressible into the socket splinting was performed. IADT guidelines suggest the duration of splinting for HRF to be from 4 weeks to 4 months (cervical) (Diangelis *et al.*, 2012). However in case 1 the splint was removed in six weeks, as the tooth was stabilized by a intra radicular splint (fibre post). As the fracture was in the cervical region of the root it was decided to use the glass fibre reinforced post as intra-radicular stabiliser since they exhibit high fatigue strength, high tensile strength, higher modulus of elasticity closer to that of the dentin, acceptable aesthetics, enhanced support, stability to the tooth & radicular anchoring providing retention via a friction bond (Wang *et al.*, 2010). In case 2 one month after obturation at the end of six weeks the splint was removed, after stabilising with a Intra-Radicular Splint (Fibre Post). Permanent pulpal necrosis in HRF depends on the following factors - age of the patient, extent of damage to the pulp, bacterial contamination, mobility of the coronal fragment, dislocation of the fractured fragment & fracture diastases (Choi *et al.*, 2014; Andrea *et al.*, 2010; Westphalen *et al.*, 2008). Immediate endodontic intervention is not advised (Diangelis *et al.*, 2012; Andrea *et al.*, 2010; Westphalen *et al.*, 2008). IADT guidelines proposes endodontic therapy only on the coronal segment when signs & symptoms (minimum two) of the pulpal necrosis are noticed⁽²⁾. since the tooth 11,21 in case 1 were symptomatic even after splinting and since they exhibited signs of pulpal contamination (gingival sulcus lacerations proximity to the groove and swelling) conventional endodontic treatment was initiated immediately. In case 2 and 3 since the tooth was non-vital with chronic diseased pulp conventional endodontic therapy was done in both coronal and apical fragments as the two fragments were in close approximation and the canals were negotiable till the apex. HRF in posterior teeth are rare, however damaging chewing habits, excessive and repetitive mastication forces, chewing hard and difficult to shear materials can predispose to HRF in posterior teeth (Wang *et al.*, 2010). In case 3 the patient was a habitual betel nut chewer for the past 10 years, therefore it can be postulated that the betel nut chewing habit may have predisposed to HRF in 25. Follow up & periodic evaluation are as important as clinical management in HRF (Diangelis *et al.*, 2012; Choi *et al.*, 2014;

Hassan *et al.*, 2015). IADT guidelines proposes follow up of 4 weeks, 6-8 weeks, 4 months, 6 months, 1 year and 5 years to check for any clinical and radiographic signs and symptoms. Cases 1,2,3 were periodically followed up to 1 year and showed signs of satisfactory healing.

Conclusion

Horizontal Root Fractures are always challenging to the dental practitioner right from diagnosis to management. Proper diagnosis, prompt critical care of Horizontal Root Fracture at cervical, middle and apical region can lead to be successful management and carry a good prognosis with continuous follow ups.

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