

Management of Subgingival Root Fracture with Decoronation and Orthodontic Extrusion in Mandibular Dentition: A Report of Two Cases

Abstract

Incidence of horizontal root fracture in permanent dentition is relatively uncommon with reported incidence being <7%. Treatment and prognosis of such injuries vary with the location of fracture line. More apical the fracture lines more likely the favorable outcome. Treatment includes immobilization for 2–4 weeks and root canal treatment to allay any chance of failure. Subgingival root fracture with possible bacterial contamination and insufficient crown height require multidisciplinary approach for the successful treatment and help patients to retain their natural dentition. In cases of extreme mobility of coronal fragment, endodontic treatment, decoronation, and orthodontic extrusion provides clinicians easy and conservative treatment option to functionally and esthetically rehabilitate the fractured tooth. This case report describes similar treatment plan in the management of subgingival root fracture in two different cases involving mandibular lateral incisor and mandibular premolar.

Keywords: Endodontic treatment, orthodontic extrusion, root fracture

Introduction

Traumatic dental injuries often lead to damage to the dental and surrounding periradicular structures complicating its management and prognosis. Root fracture is a relatively rare form of traumatic dental injury with the incidence being <7%.^[1] Horizontal root fracture often results from the frontal impact^[2] and is most often observed in the maxillary teeth with the highest reports in central incisor. Middle third of the root is the most common site followed by the apical and coronal segments.^[1,3] Management of horizontal root fracture depends on the fracture site. Horizontal root fracture of coronal third of the root may displace the coronal segment establishing communication with oral cavity leading to contamination and subsequent pulpal necrosis, whereas its occurrence in middle and apical third is associated with comparatively fewer complications and better prognosis.^[3,4]

Multidisciplinary approach in the management of traumatic dental injuries is well-documented. Subgingival fracture of teeth leaves inadequate crown height, also the absence of a ferrule effect leads to failure of restoration in long run. In the case of extreme

mobility of coronal fragments, decoronation and orthodontic extrusion provide a simple conservative and cost-effective technique to retained teeth that could have been lost because of the unfavorable location of fracture line.^[5] Orthodontic extrusion causes coronal migration of root ensuring optimum crown-root ratio.

Root fracture in mandibular teeth is a rare occurrence.^[4,6] This case report describes successful management and prosthetic rehabilitation of complicated horizontal root fracture in the mandibular lateral incisor and mandibular left first premolar.

Case Reports

Case 1

A 22-year-old male patient reported to the department with mobile coronal segment of mandibular left lateral incisor. On clinical examination, horizontal root fracture of the involved tooth was evident. No other associated hard/soft-tissue injury was discernible. It was decided to reposition the fractured segment and immobilize it with flexible splint for 4 weeks. On follow-up examination, the patient complained of pain and sensitivity to hot–and–cold in the fractured tooth. Diagnosis of irreversible pulpitis was confirmed of the fractured tooth.

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Endodontic intervention

Root canal treatment was initiated with the administration of local anesthesia using 2% lignocaine hydrochloride with epinephrine 1:80,000 (ICPA Health Products Ltd., Ankleshwar, India) and the tooth was isolated under rubber dam. Access cavity was prepared using carbide burs in high-speed handpiece with copious irrigation. The pulp chamber was debrided, and the canal was coronally enlarged with low-speed Gates-Glidden drills (Mani Inc., Utsunomiya, and Tochigi, Japan). The additional lingual canal was found on careful exploration. Working length of both the canals was determined using Root ZX apex locator (J. Morita, Irvine, CA, USA) and verified radiographically. Irrigation was carried out using 5 mL of a 5.25% sodium hypochlorite (NaOCl; Prevest Denpro Ltd, Jammu, India) solution between files with 26-gauge side vented needle (Neelkanth Healthcare Pvt. Ltd., Jodhpur, Rajasthan, India). After preparation, the root canals were irrigated with 5 mL of 17% ethylenediaminetetraacetic acid (Canallarge, Ammdent, Mohali, India) for 1 min to remove the smear layer, followed by final irrigation with 5 mL of 5.25% NaOCl. The root canal was then dried using paper points and filled with laterally condensed gutta-percha (Meta Biomed Co Ltd., Korea) and zinc oxide eugenol sealer (Dental Products of India Ltd., New Delhi, India). Gutta-percha was cut with a heated instrument and vertically condensed, and coronal segment of the tooth was removed. After the completion of endodontic treatment, fractured coronal segment was removed, postspace was prepared, and metal post was cemented. Coronal portion of the post was modified, and the loop was made to attach the orthodontic appliance which could then provide the necessary extrusive force.

Orthodontic intervention

After bonding molar and canine, a cantilever extrusion spring was fabricated using 0.017×0.025 titanium molybdenum alloy wire. The extrusion spring was attached to the lateral incisor. The spring was attached to the post by 0.010 ligature wire. After 21 days, intermediate activation of the appliance desired extrusion of 3 mm of the tooth was achieved. Tooth was stabilized in its new position for 8 weeks followed by supracrestal fiberotomy, full-coverage restoration was given to the patient thereby successfully rehabilitating the tooth both functionally and esthetically [Figure 1].

Case 2

A 25-year-old male patient reported to the department with traumatic dental injury. On examination, complicated crown-root fracture of mandibular left first premolar was evident. Fracture line was visible on clinical examination as well as on intraoral periapical radiograph. The coronal segment was mobile and the tooth was tender. Owing to coronally located fracture line and patients desire to retain

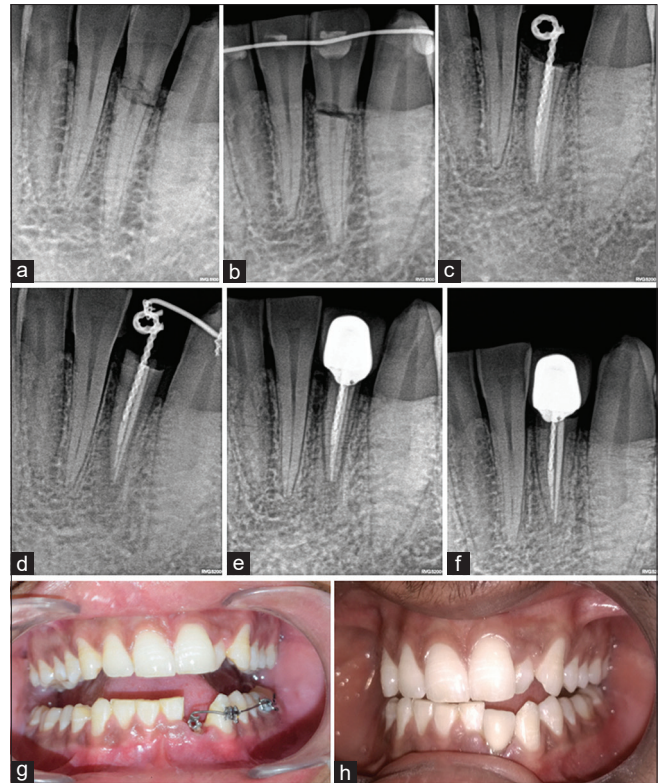


Figure 1: Case 1: (a) Preoperative radiograph. (b) Immediate postsplinting radiograph. (c) Postobturation and postplaced. (d) Postextrusion radiograph. (e) Postprosthetic rehabilitation radiograph. (f) Follow-up radiograph. (g) Clinical photograph of extrusion spring attached. (h) Follow-up photograph

natural dentition, it was decided to complete endodontic treatment, followed by gentle orthodontic extrusion to enable full esthetic rehabilitation.

Endodontic intervention

Endodontic treatment was completed following a similar protocol as described for Case 1. After obturation of root canal, the mobile coronal segment was removed, postspace was prepared, and orthodontic wire 0.7 mm in diameter, hooked at one end was cemented into the canal.

Orthodontic intervention

After fabricating an attachment (post) made up of stainless steel wire of 0.7-mm diameter. Orthodontic extrusion was started from hooked end using helical coiled 0.014 inch wire attached to canine and molar. Helix was tied to the hooked end of post with ligature wire. After desired extrusion was achieved, the tooth was stabilized with stainless steel wire for 8 weeks followed by prosthetic rehabilitation [Figure 2].

Discussion

Root fracture also known as transverse or intra-alveolar fracture involves dentin, pulp, and cementum. Diagnosis of root fracture is established by mobile coronal segment and/or radiographic demonstration of fracture line.

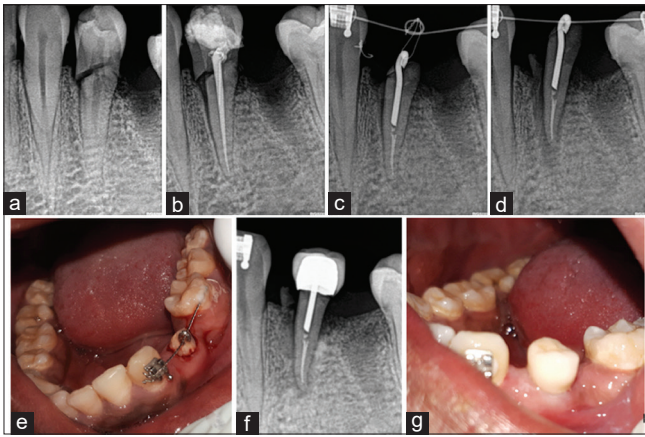


Figure 2: Case 2: (a) Preoperative radiograph. (b) Postobturation. (c) Postplaced and orthodontic extrusion initiated. (d) Postextrusion radiograph. (e) Clinical photograph of extrusion wire attached. (f) Postprosthetic rehabilitation radiograph. (g) Postprosthetic rehabilitation photograph

More recently, cone-beam computed tomography has been suggested for accurate demonstration of extent and direction of the horizontal fracture line. However, high-radiation dose and cost remain a significant deterrent for its application.^[1]

Various treatment modalities depending on the location of fracture for the management of horizontal root fracture have been adopted ranging from no treatment at all to extraction. Vital tooth submergence to allow retention of alveolar bone height, osteotomy, gingivectomy, and orthodontic/surgical extrusion may also be used in the management of such cases. Intentional replantation (IR) is deliberate extraction and reinsertion of tooth in its socket after extraoral endodontic manipulation.^[7] It is usually reserved as a last resort to salvage a tooth after all other means to do so have been exhausted. It is less invasive, less time-consuming, provides better accessibility and handles both root end infection and extraradicular infection. IR has also been proposed for the management of complicated crown-root fracture.^[8]

Orthodontic extrusion is conservative and reliable method to achieve supragingival margin for restoration absence of which seriously jeopardizes restoration survival. Orthodontic extrusion can be achieved by both removable as well as fixed appliance. Anchor teeth, occlusion, and periodontal status typically dictate type of extrusion device used. Advantage-like no bone or periodontal support loss, being easy and simple procedure led us to employ it in both the cases reported here.^[9]

Cantilever springs are simple and efficient orthodontic appliances. Biomechanically, cantilevers can produce statistically determinant force systems, giving clinician opportunity to deliver quantitatively and qualitatively precise forces.^[10] A cantilever spring consists of two arms, the fixed and free end. The fixed end is inserted into a bracket, and the free end applies a point contact. Helical

loops enhance the flexible properties of the wire and a continuous light force is applied to the tooth for effective extrusion. In this case report, the force generated was around 50 gm as measured with a Dontrix gauge.

Coronal fractured segments were removed in both the cases and the post was placed to facilitate orthodontic extrusion. Metal post was used in Case 1 and the orthodontic wire was modified and hooked and then utilized as post in Case 2. The extrusion rate was controlled at 1 mm/week as reported by Ingber^[11] and Bondemark *et al.*^[12] in their case report.

We stabilized the extruded teeth in their new position by orthodontic appliance itself for 8 weeks. Supracrestal fiberotomy was done in both the cases to prevent any coronal migration of periodontal tissue-associated with the extruded teeth. Resection of supracrestal fibers is recommended to mitigate any tensile stress on crestal bone and inhibits the attachment apparatus to migrate coronally.^[13,14]

Finally, retention of natural teeth provides innumerable benefits to the patient such as time-saving and cost effective, and esthetic and functional superiority. The alternative to it, the extraction and prosthetic rehabilitation with implant apart from being costly and time-consuming are also associated with postimplant disease.^[15]

Conclusion

Orthodontic extrusion provides an opportunity to patients to retain natural teeth with unfavorable fracture line. Good prognosis with minimal chance of relapse makes it a viable alternative in the management of complicated crown-root fracture.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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