

CASE REPORT

Multidisciplinary Treatment Approach to Restore Deep Horizontally Fractured Maxillary Central Incisor

¹Pravinkumar G Patil, ²Smita P Nimbalkar-Patil, ³Aamod B Karandikar

ABSTRACT

This case report demonstrates sequential Periodontic, Orthodontic and Prosthodontic treatment modalities to save and restore deep horizontally fractured maxillary central incisor. The location of fracture was deep in the mucosa which reveals less than 2 mm of tooth structure to receive the crown. The procedures like surgical crown lengthening, endodontic post placement, orthodontic forced eruption, core build-up and metal-ceramic crown restoration were sequentially performed to conserve the fractured tooth. Forced eruption is preferred to surgical removal of supporting alveolar bone, since forced eruption preserves the biologic width, maintains esthetics, and at the same time exposes sound tooth structure for the placement of restorative margins.

Keywords: Crown lengthening procedures, Forced eruption, Post and core, Metal ceramic crown.

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INTRODUCTION

Traumatic injuries of teeth are the main cause of emergency treatment in dental practice.¹ It occurs most commonly in young patients, and varies in severity from enamel fractures to avulsion.² The incidence of horizontal root fractures ranges from 0.5 to 7% in permanent teeth and from 2 to 4% in primary teeth for all traumatic dental injuries.^{3,4} Horizontal root fractures are more frequently observed in the maxillary anterior region in the 11 to 20 years age group male patients.⁵ This kind of fractures usually occurs because of severe trauma, such as traffic accidents and sports injuries, and it has been reported to occur in less

than 3% of all dental injuries.¹ Fractured anterior teeth are usually restored with conventional post-core and crown techniques after being treated endodontically. Restoring a tooth fractured at cervical level challenges the prosthodontist to realize the treatment goals as maintaining biologic width, the ferrule effect, and esthetics.⁶ One treatment option for submerged roots is forced eruption.⁷ The other treatment option is crown lengthening procedure. This case report describes multidisciplinary (Periodontic, Orthodontic and Prosthodontic) treatment modalities to restore deep horizontally fractured (root canal treated) maxillary central incisor. Surgical crown lengthening procedure, Endodontic post placement, Orthodontic forced eruption and core-buildup were sequentially performed to receive the metal ceramic crown.

CASE REPORT

A 23-year-old male patient visited to our dental hospital for rehabilitation of maxillary central incisor, which was fractured in bike accident 7 days before our first clinical examination. The initial clinical examination revealed that maxillary right central incisor was horizontally fractured at cervical level deep in the mucosa (Fig. 1). The remaining root segment was firm. Both maxillary lateral incisors were congenitally missing. Radiographic examination revealed horizontal fracture of already endodontically treated maxillary right central incisor at the level of crestal bone with missing coronal structure. The dental history revealed root canal treatment with the same tooth 3 years



Fig. 1: Pretreatment intraoral view: note horizontal root fracture at cervical level deep in the mucosa

¹Senior Lecturer, ²Assistant Professor

¹School of Dentistry, International Medical University, Kuala Lumpur, Malaysia

²Department of Orthodontics, SDKS Dental College and Hospital, Nagpur, Maharashtra, India

³Private Practice, Mumbai, Maharashtra, India

Corresponding Author: Pravinkumar G Patil, Senior Lecturer International Medical University, Kuala Lumpur, Malaysia
e-mail: pravinandsmita@yahoo.co.in

before. The patient exhibited good oral health. His medical history, family background, and extraoral examination were noncontributory.

Surgical crown lengthening procedure and endodontic post placement: As the tooth was fractured deep in the mucosa, surgical crown-lengthening procedure was performed first to expose 2 mm of the root structure from labial side to gain root canal access to simulate esthetic contour with adjacent gingiva (Fig. 2). The root canal of the maxillary right central incisor was prepared for prefabricated metallic post (Gold Plated Anchorage Post; SDI Svenska Dental Instruments, Upplands, Sweden) with a 1.7 mm diameter drill (Ivoclar Vivadent) to a depth of 10 mm leaving apical 5 mm of filling intact (Fig. 3). The metallic post was cemented with the Glass ionomer cement (GC Fusi-I; GC Corp; Japan) (Fig. 4). The length of the root (estimated by calculating the proportion of relative image deformation) was found to be approximately 18 mm which indicated that the 'Orthodontic Forced Eruption' can be performed without significantly decreasing the crown-root ratio.

Orthodontic forced eruption: Orthodontic forced eruption was planned to carry out with resilient round Nitinol

archwire (0.014 in) (NiTi archwire; Jaypee general agencies, Calicut, India). The brackets (Light wire bracket; Jaypee general agencies, Calicut, India) were bonded to the right canine and left central incisor. Straight piece of resilient round Nitinol archwire was mounted to the brackets. The mounted Nitinol archwire was activated by pulling its center upward (in the region of fractured incisor) to form inverted 'U shape' and ligated to the neck of the metallic post with ligature wire (Fig. 5). About 3 mm of total forced eruption was achieved in 6 weeks, as the activated Nitinol archwire became straight because of its shape-memory property (Fig. 6).⁸ After 8 weeks of programmed retention and soft tissue healing, relapse of the resultant movement was not evident.

Core-buildup and metal ceramic crown restoration: Nitinol archwire was removed and brackets were debonded followed by core-buildup with composite resin core buildup material (Multicore; Ivoclar Vivadent Inc., Schaan, Liechtenstein). The composite core along with remaining coronal tooth structure was prepared to receive the metal ceramic crown (Fig. 7). Metal ceramic crown was fabricated in conventional manner.⁹ The crown was cemented with



Fig. 2: Surgical crown-lengthening procedure performed



Fig. 3: The root canal prepared to receive metallic post



Fig. 4: Intraoral periapical radiograph showing cemented post



Fig. 5: Orthodontic forced eruption procedure carried out with Nitinol archwire



Fig. 6: About 3 mm of total forced eruption achieved within 6 weeks



Fig. 7: Tooth preparation to receive metal ceramic crown



Fig. 8: Post-treatment intraoral view



Figs 9A and B: (A) Pretreatment extraoral view, (B) Post-treatment extraoral view

Glass ionomer cement (Fig. 8). Postoperative instructions were given to the patient. Patient was followed at regular interval of 6 months for routine check-up. The patient was pleased with esthetic outcome (Figs 9A and B).

DISCUSSION

Pathological complications following horizontally fractured teeth include pulp necrosis, root canal obliteration, external and internal surface resorption, inflammation around the fracture and periapical inflammation.^{3,10,11} Various treatment techniques for managing fractured teeth with necrotic pulp have been suggested. The proposed treatment modalities include disinfection and obturation of the coronal segment only, surgical removal of the apical segment, removal of the coronal segment and orthodontic or surgical extrusion of the apical segment, removal of the apical segment and stabilization of the coronal segment with endodontic implants, and intraradicular splinting to unite the fracture.^{3,12-17} In most of the situations, post-core and crown is a common treatment option in association with any of the above mentioned treatment modalities. Factors affecting the

retention and stability of the post-core and crown restorations are location of fracture, state of remaining tooth structure, post design (preparation length and diameter), and cementing material and technique.^{18,19} If the location of fracture reveals less than 2 mm of tooth structure present to receive the crown, then crown lengthening procedure or orthodontic forced eruption technique was performed. The histological process that accompanies the forced eruption procedure was first described in 1940.²⁰ Since then, its potential for solving a variety of clinical problems has been detailed in the literature, including its applications for the treatment of root fractures,²¹ extrusion of impacted teeth,²² infrabony pockets²³ and soft and hard tissue profiles.²⁴ Forced eruption is preferred to surgical removal of supporting alveolar bone, since forced eruption preserves the biologic width, maintains esthetics, and at the same time exposes sound tooth structure for the placement of restorative margins.^{25,26} Before initiation of forced eruption, the restorability of the root after completion of the orthodontic phase must be considered. It is suggested to calculate the root-to-crown ratio that will be created after root extrusion with respect to the coronal

level of sound tooth structure before treatment.²⁶ Buccal orthodontic forced eruption technique may be unacceptable for patients with serious esthetic concerns or needs. In such situations, lingual appliance may be an option.²⁷

CONCLUSION

This case report demonstrates that sequential Periodontic, Orthodontic and Prosthodontic treatment modalities can be performed to save and restore most commonly occurred maxillary central incisor fractures.

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