

Salvation of severely fractured anterior tooth: An orthodontic approach

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ABSTRACT

Restoration of severely fractured teeth presents a challenge to the endodontist and may require an interdisciplinary approach for proper management. When the available crown structure is less, orthodontic forced extrusion is the option where the coronal root structure is exposed for proper restoration. This report describes the management of severely fractured maxillary right lateral incisor with extensive loss of coronal structure and fracture line extending below gingival margin. Endodontic treatment of the fractured tooth was followed by controlled orthodontic extrusion to expose fracture margin and providing sufficient coronal tooth structure to support the prosthesis. Orthodontic extrusion may be considered as a viable option for the salvation of fractured anterior teeth.

Key words: Crown-root fracture, endodontic treatment, orthodontic extrusion, traumatic dental injuries.

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INTRODUCTION

Trauma involving anterior teeth are frequently encountered in a general dental practice. Maxillary teeth if proclined are even more susceptible to trauma.¹ Managing dental trauma is challenging and requires an interdisciplinary approach to address esthetics, function and psychology of the patient.² Patient may present with root fracture, intrusion, extrusion, luxation and avulsion, and most of them require stabilization.^{3,4} Epidemiological studies reported that 25% of all school children experienced dental trauma and 33% of adults experienced trauma to permanent dentition, with more commonly occurring before 19 years of age.⁵ Complicated crown root fracture represents 5% of dental injuries.⁶

Crown-root fracture commonly seen as oblique "chisel type" fracture, usually extend below the attachment apparatus of the tooth, often complicating the condition by extensive loss of tooth structure and exposure of pulp. Such condition often leads to restoration challenges and the success of therapy depends upon the viability of restoration with a good margin. Defective permanent restoration results in bacterial

contamination in the root canal after obturation.⁷ For the management of such cases any of the several methodologies may be followed; fragment reattachment, fragment removal followed by restoration, gingivectomy, and osteotomy (crown lengthening), orthodontic extrusion with/without gingivoplasty, forced surgical extrusion, vital root submergence.⁸ If it is not possible to save the remaining tooth structure such that in the case of deep crown-root fracture, vertical fracture or any other unfavorable condition for the success of restoration, extraction followed by surgical implants or fixed partial denture may be an approach to the treatment.

Orthodontic extrusion method is also called as vertical eruption, assisted eruption or forced eruption. Orthodontic extrusion can be slow or rapid depending upon the demand of the case. Slow extrusion is preferred to facilitate the growth of bone and soft tissue with the root or tooth fragment and can reduce crestal bone defects. Rapid extrusion leads to coronal movement of tooth lagging behind the alveolar bone and soft tissue because it exceeds the physiologic adaptation capacity.⁹ For the ideal rapid extrusion of the tooth,

the required force is 0.7N to 1.5N which could bring about 4 to 6mm of movement in 6 to 8 weeks.¹⁰

Case Description

A 19-year-old male patient reported with a recent fracture of upper front tooth. Clinical examination revealed crown fracture w.r.t. 12, extending below gingival margin, the tooth was tender and the coronal fragment was mobile. Radiographic examination revealed, "Chisel type" crown-root oblique fracture in maxillary right lateral incisor (Fig.1). The fracture involving enamel, dentin, and cementum with the loss of tooth structure, and exposure of the pulp, which extend below the CEJ in the palatal surface. (Fig.2)

Treatment options:

Re-approximation of the coronal fragment was not possible because it was completely detached from the tooth. Different treatment options, their advantages, and disadvantages, discussed with the patient were; surgical crown lengthening, orthodontic extrusion, forced surgical extrusion, extraction followed by a dental implant. Also due to the location of the tooth in the esthetic zone, gingivectomy and osteotomy procedures to expose the subgingival fracture region was not considered. The case was discussed with an orthodontist. Controlled orthodontic extrusion of the tooth was planned.

Treatment progress:

Access cavity preparation, shaping, and cleaning was performed w.r.t. 12. Canal shaping was done according to 'Crown-down' instrumentation technique. The apical preparation of the canal was enlarged to no. 40 k file (Mani, Inc, Japan) during instrumentation, the canals were irrigated copiously with 2.5% sodium hypochlorite solution and root canal conditioner (Glyde file prep, Dentsply, Maillefer, USA). Drying of the canal was done with absorbent paper points (Dentsply, Maillefer). The tooth was obturated with gutta-percha points (Dentsply, Maillefer) using AH Plus (Dentsply De Trey.GmbH, Konstanz, Germany) root canal sealer followed by cementation of the prefabricated post (Mani, Japan) (Fig. 3 & 4). Orthodontic extrusion at the rate of 1 mm per week was done for the period of 4 weeks (Fig. 5) and 4 mm extrusion of the tooth was achieved (Fig. 6). To aid in retention, circumferential supracrestal fibrotomy was done and the tooth was retained in the same position for 4 months. Core build up with Composite (Tetric N-Ceram Bulk Fill, Ivoclar Vivadent) & tooth

preparation was done (Fig. 7). Metal ceramic Crown cementation was done over the core of the tooth (Fig. 8).

DISCUSSION

The management of complicated fracture of tooth involves the treatment of both endodontic and periodontal components. For the placement of good restorative margin, fracture resistance of teeth and retention of the crown, sufficient circumferential coronal tooth structure is needed. If the subgingival fracture prevents this, then there is the necessity of gingivoplasty or alveoplasty, alternatively it can be orthodontically or surgically extruded so that the exposed surface of the root fracture is treatable. Although orthodontic extrusion is time-consuming procedure and requires multiple visit and patient cooperation, the advantage of this technique is that it restores the periodontal attachment and preserves alveolar bone thus provides good aesthetic results.⁸ Studies suggest surgical extrusion can also be used to treat crown-root fracture successfully, with subsequent surgical repositioning of the root in a more coronal position, but with the increased possibility of failure of reattachment of the periodontal ligament and increased risk of root resorption.¹¹

If re-approximation of the fractured segments is not possible, extraction of the coronal segment is indicated. The level of fracture and length of the remaining root are evaluated for restorability. Orthodontic extrusion should be planned such that reasonable root length can be achieved after extrusion. For long term stability of the restoration and to ensure adequate periodontal support, the functional root length and the crown-root ratio of at least 1:1 should be maintained.¹²

Since root fractures are usually oblique, a single radiograph can easily miss its presence thus multiple radiographs (45, 90 and 110 degree angled) are required to ensure fracture line is visible on the radiograph.¹³ Cone-beam computerized tomography (CBCT) aids in the more detailed localization of the traumatic injuries but due to limited availability, its use is not considered routine.

Fractured tooth with significant loss of crown structure often requires a post and core for restoration.¹⁴ The post can be used as the site for application of orthodontic force. The severing of the gingival fibers before and after extrusion and application of heavy force prevents movement of

the gingival tissue along with the tooth structure during extrusion.^{9,15} Erupted tooth structure must be sufficient to provide adequate biologic width and for resistance form (ferrule effect).

As the tooth is extruded from the socket, transient periapical radiolucency is seen which is later filled with bone. This pseudo-apical lesion appears after forced extrusion which is different from a true periapical lesion. But a true lesion may develop by orthodontic extrusion of the tooth with incompletely treated root canal due to the presence of inflammatory mediators during orthodontic treatment.¹⁶ Retention after forced extrusion is also important to prevent relapse. A retention period of at least eight weeks is recommended for potential relapse in the apical direction.¹⁷ Planning of appropriate and well-constructed prosthesis is of

considerable importance for the success of treatment. Patient compliance with follow-up visits, meticulous oral hygiene maintenance, and avoidance of further injury contributes to better healing.

CONCLUSION

Orthodontic extrusion is a reliable and predictable option to save a tooth, it should be considered as an option for crown fracture extending the subgingival region thereby restoring the function and esthetics of the tooth, and it may be the last option to prevent the extraction. Case selection for this approach must be carefully analyzed before treatment. Studies with a higher level of evidence are needed to establish the long-term success of the treatment modality.



Figure 1: Diagnostic IOPAR



Figure 2: Pre-treatment



Figure 3: Obturation of tooth 12



Figure 4: Cementation of prefabricated post



Figure 5: Controlled Orthodontic extrusion



Figure 6: Radiographic view of tooth extrusion



Figure 7: Core build-up with composite resin



Figure 8: Post treatment view

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