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Dr. Anila Nadeem Sayyed
Post Graduate Student, Department of Conservative Dentistry and Endodontics, Dr. Rajesh Ramdasji Kambe Dental College and Hospital, Akola, Maharashtra, India

Dr. Utkarsha Gudadhe
Post Graduate Student, Department of Orthodontics and Dentofacial Orthopedics, Dr. RR Kambe Dental College and Hospital, Akola, Maharashtra, India

Dr. Manoj Likhitkar
BDS, MDS Professor, HOD, & PG Guide, Department of Conservative Dentistry and Endodontics, Dr. R R Kambe Dental College and Hospital, Akola, Maharashtra, India

Dr. Sameer Parhad
BDS, MDS, Professor, HOD, & PG Guide, Department of Orthodontics and Dentofacial Orthopedics, Dr Rajesh Ramdasji Kambe Dental College and Hospital, Akola, Maharashtra, India

Dr. Anantkumar Heda
BDS, MDS, Professor and PG Guide, Department of Conservative Dentistry and Endodontics, Dr. Rajesh Ramdasji Kambe Dental College and Hospital, Akola, Maharashtra, India

Dr. Meher Ingole
Post Graduate Student, Department of Orthodontics and Dentofacial Orthopedics, Dr. Rajesh Ramdasji Kambe Dental College and Hospital, Akola, Maharashtra, India

Corresponding Author:
Dr. Anila Nadeem Sayyed
Post Graduate Student, Department of Conservative Dentistry and Endodontics, Dr. Rajesh Ramdasji Kambe Dental College and Hospital, Akola, Maharashtra, India

Rehabilitation of subgingivally fractured lateral incisor: An orthodontic - endodontic collaboration

Anila Nadeem Sayyed, Utkarsha Gudadhe, Manoj Likhitkar, Sameer Parhad, Anantkumar Heda and Meher Ingole

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Abstract
During the restoration of severely compromised teeth, the indispensable factors in achieving a sufficient ferrule includes the retention of the most coronal and radicular tooth structure and respecting the supracrestal tissue attachment (STA). Minimally invasive method such as forced orthodontic extrusion allows for hard- and soft tissue conservation. This article marks out the treatment of a severely damaged maxillary lateral incisor that was managed by using an orthodontic extrusion method with an overlay technique on a rigid arch wire to prevent a forward clockwise advancement during vertical extrusion and followed by the biologically oriented preparation technique (BOPT).

Keywords: Orthodontic extrusion, severely compromised teeth restoration, ferrule, biologically oriented preparation technique (BOPT), supracrestal tissue attachment (STA)

Introduction
The most prevalent age group for dental trauma to occur is 7-19 years. During dental trauma accidents maxillary central incisors are the most commonly involved teeth [1]. Increased overjet and incompetent lips are the associated risk factors for traumatic dental injuries [2]. Traumatic dental injuries in the anterior region stand out as a challenge to dentists, particularly if the fracture line is located subgingivally then the prognosis is questionable [3]. In order to preserve and restore the natural tooth structure, innumerable techniques have been mentioned. Such treatment modalities need a multidisciplinary approach which includes endodontic treatment, periodontal crown lengthening, and/or orthodontic extrusion followed by prosthetic rehabilitation [4].
This case report presents the treatment of a severely fractured maxillary lateral incisor which was managed by endodontic treatment along with orthodontic extrusion followed by aesthetic rehabilitation.

Clinical Report
A 16-year-old female patient reported to the Department of conservative dentistry and Endodontics, with the chief complaint of broken teeth in upper front region of the jaw following a roadside accident.
Clinical examination revealed a horizontal coronal fracture of the maxillary left central incisor (21) and maxillary left lateral incisor (22) with pulpal exposure [Figure 1] and multiple craze lines with maxillary right central incisor 11. With respect to 21, Ellis class III fracture was diagnosed involving coronal enamel, dentin and pulp. In tooth 22, the extension of the fracture line was subgingival from the labial towards the palatal side, with no mobility on either of the teeth. Radiographic examination revealed subluxation with 21 and intact periodontium with no signs of root fracture with 22 [Figure 1].

Fig 1: Clinical picture and periapical radiograph of traumatically fractured maxillary incisors

The alternative of reattachment was omitted because the fractured coronal tooth fragments were lost. The parents of the patient were presented with different treatment modalities like extraction versus multidisciplinary approach and they opted for the latter. After taking parent's consent, endodontic and restorative treatment was performed with 21 and 22. [Figure 2]

Fig 2: Clinical picture and periapical radiograph showcasing completed RCT with 21, 22 and post endo restoration with 21 and IRM with 22

One week later when the patient was symptom-free, Adjunctive Orthodontic Treatment (AOT) for extrusion was started. MBT brackets 0.022 x 0.028" were bonded on maxillary teeth excluding 22 and palatal button was bonded on the facial surface of subgingivally fractured 22. A rigid stainless steel pre-fabricated archwire 0.017x0.025'' was engaged in the brackets of maxillary teeth. Orthodontic extrusion of 22 was carried out with piggyback technique using round 0.012" NiTi wire. The NiTi wire was engaged to the palatal button using ligature wire. [Figure 3] Sequential extrusion was carried out using 0.014'' NiTi wire. After achieving desired extrusion in 6 weeks, a round Stainless steel archwire was placed for a period of 3 weeks to provide stability to the extruded tooth. [Figure 4, 5] The brackets were debonded after a total orthodontic treatment duration of 2 months. [Figure 6].

Fig 3: Orthodontic treatment mechanics for extrusion of subgingiyally fractured 22

Fig 4: 6 weeks after orthodontic treatment

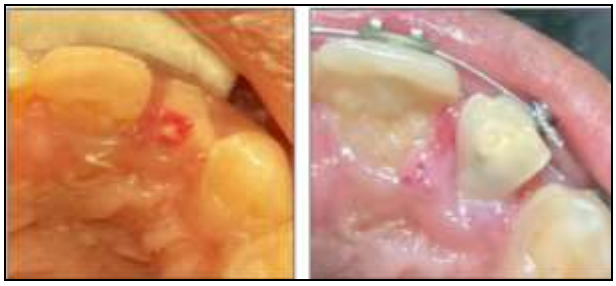

Fig 5: Occlusal photographs pre & post orthodontic extrusion

Fig 6: Intraoral photographs post extrusion and debonding

After gaining the desired extrusion, post endodontic treatment was performed with 22, that is post and core. [Figure 7] Later on, crown preparation was done with 21, 22 and veneer preparation was done with 11. [Figure 8] The impression of the prepared teeth was taken with elastomeric impression material as well as intraoral scanning was done to carry out the printing of resin model. A wax mock-up of the prepared teeth on the resin model was made and then the putty index of the wax mock-up was taken to make the interim prosthesis. [Figure 8]. A week later, the final prosthesis was delivered to the patient that is Emax crowns with 21, 22 and Veneer with 11. [Figure 9]

Fig 7: Periapical radiograph showcasing post endo restoration with 22 after achieving desired amount of extrusion

Fig 8: A) Crown preparation, B) putty index taken after crown preparation, C) Digital model printed, D) Mock up preparation, E) Clinical picture showcasing interim, restoration

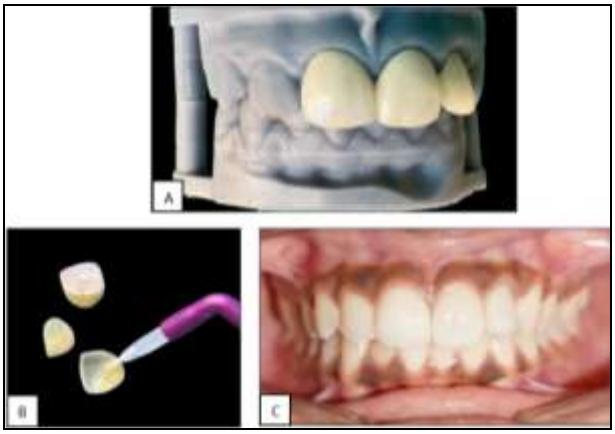

Fig 9: A) Final prosthesis on model, B) Application of silane coupling agent over venners, C) Intraoral picture depiciting final prosthesis

Fig 10: A) Pre-treatment extraoral smile photograph, B) Post-treatment extaoral smile photograph

Fig 11: Palatal retainer bonded for the stability of extruded tooth

Discussion

Restoration of a compromised tooth with the involvement of STA may require crown lengthening to ensure lasting periodontal health. It is essential to place the margins of restoration on a sound tooth structure for long-term stability [7]. A 1.5 mm to 2-mm ferrule is deemed necessary, to enhance the biomechanical function of the tooth [8]. The ferrule for a post-and-core retained crown is critical for preventing tooth or root fracture, possibly making the ferrule more important than the post material or the post's adhesion to the radicular dentin [7]. Surgical extrusion or intra-alveolar repositioning which entails the intentional displacement of the remaining root more coronally within the socket, offers an alternative to improve restorability and re-establish the supracrestal tissue attachment [9]. Orthodontic extrusion is effectual for crown lengthening as well as restoring the STA, maintaining the alveolar bone, and achieving good esthetics [10].

All the desired factors mentioned above favours orthodontic forced eruption as the preferred treatment. Extracting the tooth would entail a removable appliance worn, which is unbearable, facilitates plaque buildup leading to increased risk of cavities on neighbouring teeth and may cause psychological distress to the patient. As in young patient at 16 years of age, the shifting gum line and large pulp chambers of adjacent teeth make a fixed prosthesis unsuitable. Orthodontic extrusion with crown lengthening provides a more present-day solution for teeth fractured below the gum line [11].

In 1973, Heithersay proposed using orthodontic extrusion for a therapeutic end other than orthodontic tooth alignment [5]. Ingber described the use of orthodontic extrusion to treat insufficient clinical crown length for adequate ferrule, which otherwise would require either surgical crown lengthening or extraction as the definitive treatment [6].

The planned procedure posed no obstacles since the patient had normal overbite, overjet, and Class I skeletal and dental alignment. The estimated 3mm of extrusion, accounting for biologic width, was deemed feasible [12, 13]. The fractured incisor's root length was sufficient to allow for the necessary extrusion while maintaining a healthy 1:1 crown-root ratio, which is crucial for periodontal support. Essentially, the tooth's root was long enough to safely undergo orthodontic extrusion.

In young patients, Orthodontic extrusion along with restoration presents a more conservative treatment option compared to that of extraction followed by prosthetic rehabilitation.

Summary

For the management of compromised teeth with the provision of a sound tissue margin for the definitive restoration, forced orthodontic extrusion combined with the biologically oriented preparation technique can be used. Moreover, restoration after orthodontic eruption may be less invasive than prosthetic restoration after extraction.

Conflict of Interest

Not available

Financial Support

Not available

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