

# A Multidisciplinary Approach to the Management of inadequate clinical crown of Maxillary Central incisor: A Clinical Report

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## ABSTRACT

**Introduction:** Anterior tooth fracture is the most commonly presenting clinical condition during routine dental practise. Restoration of such tooth is challenging task due to fracture position and amount of remaining coronal tooth structure. Tooth fracture at or below the gingival level usually have a poor prognosis. Treatment options for such clinical conditions range from tooth extraction to prosthodontic rehabilitation with surgical crown lengthening and/or orthodontic extrusion. This clinical report describes a multidisciplinary approach for management of such cases by the orthodontic forced eruption and clinical crown lengthening followed by the final restoration with indirect resin customized post core and crown.

**KEYWORDS:** Biological width; Crown lengthening; Esthetics; Forced eruption; Indirect resin; Post and core; Tooth fracture

## INTRODUCTION

The most common type of dental trauma is fracture of anterior tooth. Crown fractures have been documented to account for up to 92% of all traumatic injuries to the permanent dentition.<sup>1</sup> Crown or root fractures commonly affect the maxillary anterior teeth, whereas the mandibular anterior teeth are least affected.<sup>2</sup> Loss of the coronal part of permanent incisor may create esthetic, functional and emotional problems.<sup>3</sup>

Damage restricted to the dental hard tissues is simpler to deal with than that associated with the inclusion of pulpal and/or periodontal tissue trauma.<sup>4</sup> Such teeth need endodontic therapy, followed by a prosthetic rehabilitation with post and core placement and crown fabrication; however, fracture of a tooth below the gingival attachment or crest of the alveolar bone presents a very difficult restorative problem, and such fractured teeth were often considered hopeless and were consequently extracted.<sup>5</sup>

Restoration of such tooth without the presence of a 2.0mm crown ferrule surrounding remaining tooth structure may be disappointing.<sup>6,7</sup> Treatment possibilities for such clinical conditions are tooth extraction, surgical crown lengthening, and orthodontic extrusion<sup>8</sup>. Extraction seems to be the easiest choice, yet it requires prosthetic

treatment or implant therapy. Surgical crown lengthening can be successfully used in the posterior region, where the aesthetics is not a major concern. The surgical approach requires osseous and gingival contouring which also affects adjacent teeth. A highly satisfactory alternative to the surgical approach is the controlled orthodontic extrusion of the fractured tooth. First reported by Heithersay<sup>5</sup> and Ingbeß, controlled orthodontic extrusion is considered the easiest orthodontic tooth movement that can produce excellent results with a good prognosis and a low risk of relapse. The method is also called forced eruption, orthodontic eruption, vertical extrusion or assisted eruption.<sup>10,11</sup>

This case describes a multidisciplinary approach using the orthodontic forced eruption facilitating the final restoration with indirect resin customized post and crown. It also requires the minimum of specialized materials and orthodontic skills.

## Case Report

21-year-old male patient was referred to the Department of Prosthodontic and Maxillofacial Prosthetics with a chief complaint of loose crown on upper front teeth region. He reported a history of trauma 5 years back in which his maxillary right central incisor was fracture and was

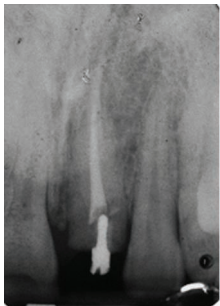
restored with crown after the root canal treatment. He had also given the history of repeated dislodgment and re-cementation of the crown.



**Figure 1** Clinical preoperative presentation of patient.



**Figure 2** Clinical Condition after removal of loose metal ceramic Crown



**Figure 3** IOPARadiograph of affected tooth after removal of Metal ceramic Crown

On clinical examination of the oral cavity, all teeth were present in normal complement except metal ceramic crown on maxillary right central incisor. Metal ceramic crown was loose and shape and color was not satisfactory. (Fig.1) Loose metal ceramic crown was removed. Pre-fabricated metal post with fracture core was present. There was inadequate tooth structure and gingival margin was shifted more apical than the adjacent central incisor. (Fig.2). An intraoral periapical radiograph revealed radio-opacity representing root canal treatment and pre-fabricated metal post. Endodontic treatment was satisfactory. (Fig.3) Coronal tooth structure was inadequate with proper root length. Using the Prosthodontic Diagnostic Index for completely dentate patients developed by the American College of Prosthodontists, the condition was classified as Class II, moderately compromised completely dentate patient.<sup>12</sup>

The treatment modalities for such cases include the extraction of teeth followed by rehabilitation with Fixed Partial Denture / Dental Implant and preservation of tooth by either surgical crown lengthening or forced eruption. Considering the visual treatment outcomes, it was decided that the best course of action would be to preserve the tooth and restore it prosthodontically by a customized indirect resin post and core retained indirect resin crown following orthodontic extrusion as the remaining tooth structure was inadequate and the gingival level was apical than the adjacent teeth.



**Figure 4** Placement of Orthodontic Bracket and bent in arch wire for extrusion of central incisor



**Figure 5** Orthodontic extrusion of maxillary right central incisor



**Figure 6** IOPA Radiograph demonstrating extrusion of tooth

At first luting cement and the core material was removed with the ultrasonic scaler. (Cavitron® BOBCAT® Pro Scaler) Pre-fabricated metal post was stable and firm in its position so we planned to extrude the tooth orthodontically with the help of pre-fabricated metal post. Orthodontic brackets were placed from the maxillary right first premolar to the left canine and a low intensity extrusive force was applied over the root by engaging the prefabricated post fixed to the root with the elastics. (Fig.4) Proper Bucco-palatal position of the extruded teeth was maintained by the bent in the arch wire. The patient was reviewed at the interval of 2-3 weeks. After 12 weeks of activation, the amount of tooth movement was evaluated with clinical and an intraoral periapical radiograph (Fig.6) and the root was found to be extruded by 4 mm and was stabilized for 6 more week before de-bonding of the orthodontic brackets.<sup>13-15</sup>(Fig.5)

It was observed that the gingiva around the root had also migrated coronally along with the root. For this reason, gingivectomy was performed. Pre-fabricated metal post was removed and customized indirect resin post and core (Ceramage, Shofu Inc, Japan) was fabricated and the tooth was prepared to receive indirect resin crown. (Fig 7) A provisional crown was cemented over the prepared tooth for a week until healing of gingiva. Gingival retraction was done and final impression was made with poly vinyl siloxane impression material by double mix single impression putty wash technique. (Dentsply Aquasil Soft Putty and Reprosil Light body)



**Figure 7** Tooth Preparation for Indirect Resin crown



**Figure 8** Postoperative presentation after cementation of indirect resin crown.



**Figure 9** Follow-up after 5 years

The impressions were poured in die stone and sent to the lab for crown fabrication. Try in procedure of the crown was done to evaluate the fit, esthetic and occlusal premature contact. Finishing and polishing was done and final crown was cemented over the prepared tooth using dual cured resin cement (Calibra™, Dentsply). (Fig.8) Follow-up was conducted regularly and clinical and radiographic examination showed healthy tissues and teeth with satisfactory functional and esthetic outcomes.(Fig.9)

## DISCUSSION

Surgical crown lengthening, extraction with subsequent prosthetic replacement, or forced eruption of the involved tooth to expose sound tooth structure are the three options available for the management of the insufficient tooth structure.<sup>8</sup>

Surgical crown lengthening is the most commonly employed simple and less time consuming method procedure for this purpose. This process may not fit in all cases and may lead to unsatisfactory esthetics, especially in the anterior tooth area and unfavorable crown-root relationship.<sup>2</sup>

Orthodontic tooth eruption should always be considered in esthetic areas. There are two methods of orthodontic extrusion slow and accelerated. In slow orthodontic extrusion, light forces are applied, and during this process all periodontal structures (gingiva, periodontal ligament, and alveolar bone) are also extruded along with the root or tooth. In accelerated orthodontic rapid tooth extrusion, the tooth is pulled from the alveolus while marginal bone and periodontal structures do not move, which is achieved through larger magnitude of force.<sup>15, 16</sup>

In the present case, the slow orthodontic eruption was used to extrude the root. Low intensity extrusive force was applied for about 12 weeks (3 months) so as to achieve the required amount of extrusion and stabilization was done for 6 weeks (1 and half month). Since the periodontal structures follow the moving root/tooth to clinically expose the tooth structure, a surgical procedure is required in which the gingiva and alveolar bone, if required, is resected, and the biological width is re-established.<sup>2, 17</sup> An advantage of slow orthodontic extrusion is that bone and gingival level may be maintained according to adjacent teeth and chance to relapse also decreases. Fibrotomy should be performed every 7 to 10 days to maintain inflammation around marginal bone so as to prevent relapse and coronal migration or growth of marginal bone after moving the root/tooth in case of accelerated orthodontic rapid tooth extrusion.<sup>2, 15</sup>

The biologic width is of particular importance when considering the restoration of the tooth whose gingival margin is at the level of the alveolar crest. Violation of biologic width results in periodontal inflammation, bone resorption and further deepening of the pocket. The average biologic width is 2.04 mm. An additional 1-2mm of the sound tooth structure should be available coronally to the epithelial attachment to place the margin of a restoration. The distance from the alveolar crest to the coronal extent of the remaining tooth structure should be at least 3-4 mm. With any less tooth structure, the dentist risks impinging upon the junctional epithelium and connective tissue attachment in a sub gingival preparation.<sup>18</sup>

In similar cases by Heda et al<sup>19</sup> and Goenka et al<sup>20</sup>, a problem encountered was the buccal movement of the root, which was later corrected. To avoid this problem, the treatment procedure was planned properly and bent in the arch wire (Fig.4 and Fig.5) was given to avoid any buccal vector of force while extruding the tooth. All the adjacent teeth were stabilized with a stainless-steel ligature wire, and elastics were used to cause movement of the tooth to be extruded and extrusive forces were directed along the long axis of the tooth.

Crown: root ratio is an important factor in determining the amount of extrusion that can be safely achieved. It is imperative to maintain an appropriate crown:root ratio to provide a favorable prognosis for the restored tooth. Shillingburg et al<sup>20</sup> suggested a 1:1.5 crown: root



ratio as optimum for an FPD abutment, or a 1:1 ratio as a minimum ratio for a prospective abutment under normal circumstances. A less than optimum crown: root ratio increases the probability of damage caused due to lateral forces.<sup>21,22</sup>

A number of treatment options are available for the management of tooth with inadequate coronal tooth structure. However, none should be used as rule. The present clinical report demonstrated the need of a multidisciplinary intervention during the treatment. Selection of the treatment plan should always be customized to the individual case, and a multidisciplinary approach should always be considered to rehabilitate such cases.

## CONCLUSION

We report a case of the multi-disciplinary approach between the orthodontist, periodontist and prosthodontist to extrude and ethically restored a tooth with inadequate coronal tooth structure. Restoration of the teeth with the repeated history of dislodgment (failure) can be saved and restored with a functional and esthetically pleasing result. The key to success are the right indications for the treatment and the dedication of the dentist to reassure and motivate the patient throughout the whole course of treatment.



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