

# An interdisciplinary approach to treat crown-root-fractured tooth

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## ABSTRACT

Restoration of a crown-root subgingival fractured tooth, especially at anterior aesthetic zones is still a great challenge for restorative dentists. Crown lengthening procedure alone has the disadvantage of high gingival curve of the final restoration, which was not discontinuous to adjacent teeth and thus compromise cosmetic outcomes. The objective of this report is to display a new interdisciplinary approach which combining endodontic root canal treatment, orthodontic extrusion, periodontal crown lengthening surgery and prosthodontic post-core-crown restoration procedures to restore a crown-root subgingival fractured maxillary central incisor and achieved a satisfied cosmetic result. Computer-based spectrophotometer was also used to accurately select colour without objective interference to achieve ideal cosmetic effects.

**Key words:** Crown lengthening surgery, crown-root fractured tooth, endodontic root canal treatment, fractured tooth, orthodontic appliance, orthodontic extrusion, prosthodontic post-core-crown restoration, prosthodontic treatment

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## INTRODUCTION

Crown-root fracture is defined as a fracture involving both the crown and root of the teeth, usually display an oblique fracture and compromise the pulp. Subgingival crown-root-fractured tooth restoration presents great challenge to prosthodontic dentists. In such situations, prosthodontic treatment alone or when only combined with crown lengthening procedure will cause the problems of discontinuous gingival margin, gingival irritation and crown/root ratio imbalance, etc., We, hereby, report a multidisciplinary approach using the endodontic root canal treatment (RCT), orthodontic extrusion, crown lengthening surgery and post-core-crown procedure to restore a left maxillary central incisor and achieved a satisfied cosmetic result.

## CASE REPORT

A 26-year-old healthy female had traumatic fractured of left maxillary central incisor for 1 day. Clinical examination showed a cervical fracture with pulp exposure. For the tooth

fracture, only the labial part was 1 mm above the gingival margin; all the other parts, including mesial, distal and lingual parts, were 3-5 mm subgingival. Patient presented class I occlusion relations and good oral hygiene [Figure 1]. Gingiva was slightly swollen and no gingival laceration was present. Further periapical radiography showed that the root canal was vacant, the fracture line was oblique, the periodontal membrane was normal and the remaining root length was about 14 mm, with no additional root fracture image on the remaining part of the root [Figure 2]. After full discussion with the patient about the advantages and disadvantages of the alternative treatment approaches, including immediate implant and tooth-extraction followed by fixed or removable partial denture replacement, the patient chose to preserve the remaining root and perform a multidisciplinary treatment. Then the treatment plan was divided into four phases as follow:

### Phase I: Endodontic RCT and periodontal basal therapy

Root canal therapy was performed for left maxillary central incisor and the periapical radiography after RCT was satisfied [Figure 3].

Full mouth periodontal prophylaxis cleaning and initial periodontal therapy were done before orthodontic extrusion.

### Phase II: Orthodontic extrusion

A 0.8 mm Stainless Steel (SS) wire was cemented into the root canal space for the retention of orthodontic arch wire.

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**Figure 1:** Subgingivally fractured left maxillary central incisor



**Figure 2:** Pre-treatment periapical radiography



**Figure 3:** Periapical radiography after root canal treatment completed



**Figure 4:** Orthodontic extrusion finished



**Figure 5:** Crown lengthening surgery (in operation)



**Figure 6:** Crown lengthening surgery (post operation)



**Figure 7:** Fibre post and core



**Figure 8:** Final all ceramic crown restoration

The standard edge wise brackets were bonded on maxillary teeth and 0.018 × 0.025 inch Nickel-Titanium (NiTi) full arch wire (TP Orthodontics. Inc.) was engaged into maxillary brackets. A 0.2-0.3 N levelling and alignment extrusion force was applied, readjusted every 2 weeks. After 9 weeks engagement, 2 mm tooth structure was occlusally elevated with the simultaneous elevation of the surrounding periodontal bone tissue [Figure 4].

### Phase III: Periodontal crown lengthening surgery

After 4-month retention to prevent relapse,<sup>1-3</sup> the crown lengthening surgery including gingival flap operation, alveoloplasty and gingivoplasty were performed to create an optimal relation between the gingival and margin of restoration. During the operation, the necessary clinical crown and suitable gingiva anatomy were reserved [Figures 5 and 6].

### Phase IV: Prosthodontic restoration and follow-up

Two month after the periodontal crown lengthening surgery for the proper wound healing process, prosthodontic restoration was performed. After fibre post and resin core (Tenax Fiber White, Coltene Whaledent Inc.) had been built up [Figure 7], an accurately fitting provisional crown was fabricated and cemented. Tooth preparation and silicon rubber impression were made, and all-ceramic crown was fabricated by LAVA (3M ESPE).

Colour-selection was performed using a new Crystaleye Spectrophotometer (Olympus, Japan). After transferring the colour-selection picture to computer, dentist discussed the shape and shade of final restoration with the patient and finally decided to reproduce the colour by simulating the right maxillary central incisor.

Final restoration was cemented with RelyX Unicem resin cement (3M ESPE). Patient was satisfied with the result of prosthodontic restoration [Figure 8]. One year follow-up evaluation indicated the restoration and gingival profile were healthy and stable without relapse.

## DISCUSSION

Restoration of subgingival crown root fracture teeth is always a clinical challenge for the restorative dentist. Prosthodontic treatment alone or when combined with crown lengthening procedure will have the potential problems such as discontinuous gingival margin, gingival irritation and crown root ratio imbalance, etc., thus compromising the periodontal health and cosmetic profiles, especially at anterior aesthetic zone. Orthodontic extrusion is recommended when existing clinical crown height cannot permit the placement of a crown ferrule.<sup>4,5</sup> It has been demonstrated in experimental and clinical studies that levels of gingival attachment and bone

will follow the extrusive movement for single teeth.<sup>1,2,6</sup> So, we combined orthodontic extrusion with crown lengthening surgery to obtain an optimal gingival margin of restoration between the fractured tooth and adjacent teeth.

Orthodontic extrusion procedure to elevate cervical fractured tooth for restoration was introduced by Heithersey in 1973.<sup>7</sup> Only light forces are permissible when considering orthodontic extrusive movements.<sup>1,6</sup> If the level of fracture does not invade the biological width and the residual tooth structure allows an adequate ferrule, it is possible to reconstruct the tooth and to prepare a viable prosthesis while maintaining an equilibrium between dental and periodontal structures.<sup>8,9</sup> If the apical extent of the line of fracture involves the biologic width, no matter it is above or below the ridge, restorative therapy will not be feasible unless the remaining tooth structure has been exposed beyond the gingival margins. This exposure allows the tooth to be restored, provided that the health and stability of the gingival margin have been re-established with a proper biologic width.<sup>10</sup>

What's more, Crystaleye Spectrophotometer was employed for colour selection procedure. As we know, colour selection is one of the most difficult parts in single anterior tooth restoration to achieve harmony to adjacent teeth. This new computer-based spectrophotometer provides two advantages. First, it could avoid subjective interference and acquire optimal objective cosmetic effect. Second, it could record and reproduce the tooth colour accurately, which made it possible for the dentist to communicate with the patient on the computer and decide the colour of different parts of the tooth, including the cervical part, middle part and incisal part of the tooth.

In a word, the combination of endodontic, orthodontic, periodontal and prosthodontic disciplines is a satisfied and promising way to restore the crown-root-fractured tooth and the computer-based spectrophotometer plays an important role in the colour-selection procedure.

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