

An interdisciplinary approach to reconstruct a fractured tooth under an intact all ceramic crown: Case report with four years follow up

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ABSTRACT

Trauma causing the fracture of a restored tooth with the extracoronary full coverage prosthesis remaining intact is a common occurrence in dental practice. Reconstruction of the damaged tooth foundation and recementation of the crown can pose quite a challenge for the restorative dentist. This case report describes an innovative interdisciplinary chairside technique for the recementation of an all-ceramic crown on a fractured maxillary central incisor. The course of care described is effective, affordable, and saves time in comparison with other treatment options for such clinical situations.

Key words: All ceramic, biologic width, crown lengthening, retreatment, retrograde

The need for retreatment of a tooth and/or prosthetic restoration may arise due to secondary caries, pulpal involvement, trauma to the restoration, and/or foundation and subjective desires for a more aesthetic or durable restoration.

Crowned teeth requiring retreatment due to fracture of the underlying tooth structure and/or foundation restoration often possess an undamaged extracoronary restoration. In such cases, it may be desirable to reuse the restoration for the sake of cost and time. Many techniques have been reported in the dental literature describing repair of the damaged foundation below existing single or multiple prosthetic restorations by fabrication of a cast post and core or utilizing fiber post and composite resin core under an existing restoration.^[1-3] An original die or its replica have been utilized as a matrix for core build up. Materials such as polytetrafluoroethylene^[2]

and light body polyvinyl siloxane^[3] have been reportedly used both as separating agents and cement spacer between the restoration and the foundation.

Before the existing intact prosthesis is reused, a thorough investigation is mandatory to rule out any root fracture, violation of the biologic width due to trauma or damage to the supporting tissues. This article describes an interdisciplinary approach to salvage a fractured prosthetic foundation by using a fiber post and composite core and recement the existing, undamaged overlying all-ceramic crown.

CASE REPORT

A 21-year-old male patient reported to the prosthodontic clinic for treatment related to a recent traumatic injury to his maxillary anterior teeth.

On examination, an all-ceramic crown overlying the maxillary right central incisor was seen dislodged. The underlying tooth structure presented with an oblique fracture at the middle third of the crown, with the fracture line traversing subgingival palatally. The prosthesis was an intact IPS Empress II (Ivoclar Vivadent, Schaan, Liechtenstein, Germany) crown which had been bonded in place ten months prior by the author. This was done following a similar traumatic injury to the same tooth although of minor intensity [Figure 1], warranting endodontic therapy and restoration with the all-ceramic crown.

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The recent episode of trauma fractured the tooth at the same site and dislodged the prosthesis with the fractured palatal root fragment still attached to the crown [Figure 2]. The patient was given the option of: (a) retrograde post-supported core build up and recementing the same prosthesis, (b) orthodontic extrusion and fabrication of a new prosthesis, (c) extraction and implant-supported prosthesis, and (d) extraction and a tooth- supported fixed partial denture, complete coverage retainers or a resin-bonded prosthesis.

After discussing the advantages and disadvantages of the each treatment option given [Table 1], the patient chose to have the same prosthesis recemented, due to the costs involved in the fabrication of a new prosthesis and duration of other treatment plans.

In an attempt to keep the layer of resin cement still bonded to the crown, intaglio surface of the crown was cleaned using a slow speed number 6 round bur (SS White Burs, Inc, USA), cutting through bulk of the fractured tooth fragment within the crown moving from center outward. Utmost care was taken to prevent the contact between the rotating bur and the intaglio surface of the crown. A putty index (Express, 3M, ESPE) was made of the interior surface of the crown (with dual-cure resin cement still bonded to the crown) and the attached root fragment [Figure 3]. A self-cure acrylic resin (Rapid Repair, Ashvin, Mumbai, India) shell and a provisional crown were made using the putty impression so obtained. The crown was then sandblasted (50 microns Aluminium oxide, Bego, Germany) intermittently at very low pressure (10-15 lbs) to remove the previous resin cement. Uniform color of the intaglio surface of the crown indicated the complete removal of the resin

cement. The root fragment was now separated by applying digital pressure and kept in sterile normal saline at room temperature till its further use.

The palatal bone on the radicular aspect of the tooth was lost due to trauma, exposing the fracture line. An internal bevel gingivectomy was performed to lengthen the crown on the palatal aspect, in order to expose the fracture line. On raising the mucoperiosteal flap, the fracture line was evident and exact loss of radicular bone could be assessed. It was found that the distance of fracture line and the anticipated crown margin was 4 mm and the distance between the fracture line and the alveolar bone on the palatal aspect was 2 mm (Calibrated periodontal probe, UNC 15, Hu-friedy). This distance was adequate to re-establish a new biologic width; therefore, no further osseous recontouring was done at this time to establish a new biologic width.

The post-space was created and glass fiber post (Luscent anchor, Dentatus, USA) was cemented using dual-cure resin cement (Duoloink, BiscoInc, Schaumburg, USA). The post length was adjusted coronally till the temporary crown and the acrylic shell seated completely.

After tooth conditioning, the acrylic shell was lightly lubricated and filled with dual-cure composite resin (Multicore, Ivoclar Vivadent, Schaan, Liechtenstein, Germany) and placed on the tooth and light polymerized from all sides for 40 seconds each. The shell was removed by sectioning and the composite core was finished.

The provisional crown (extending onto fracture line on the root) was cemented in place using anon-eugenol temporary

Table 1: Brief description of pros and cons of proposed treatment options

Option	Advantages	Disadvantage
Retrograde post-supported core build up and recementing the same prosthesis	<ol style="list-style-type: none"> 1. Time saving. 2. Economical. 3. Bone support of adjacent teeth maintained as no ostectomy was done to establish a new biologic width 4. Temporary esthetic and functional rehabilitation possible at the first visit. 	<ol style="list-style-type: none"> 1. Meticulous attention to each step is mandatory. 2. Formation of Periodontal pocket in patients not able to maintain oral hygiene around the restoration. 3. Loss of supporting alveolar bone in cases where ostectomy is required.
Orthodontic extrusion and fabrication of a new prosthesis.	<ol style="list-style-type: none"> 1. Bone and soft tissue architecture is maintained. 2. Proprioception maintained. 	<ol style="list-style-type: none"> 1. Complete treatment time prolonged. 2. Narrowing of the tooth in the cervical area, making tooth preparation difficult. 3. Fiberotomy and retention appliance required. 4. Root resorption and relapse.
Extraction and implant-supported prosthesis	<ol style="list-style-type: none"> 1. Bone and soft tissue architecture preservation. 2. Immediate provisionalization possible 	<ol style="list-style-type: none"> 1. Complete treatment time prolonged. 2. Expensive as compared to other treatment options. 3. Loss of proprioception. 4. Loss of bone due to trauma can complicate treatment planning
Extraction and full coverage tooth supported FPD	<ol style="list-style-type: none"> 1. Cost effective as compared to implant supported prosthesis. 2. Immediate provisionalization possible 	<ol style="list-style-type: none"> 1. Destruction of natural tooth structure. 2. Continuous bone loss in the pontic area. 3. Healing of extraction socket required before final FPD cementation.
Extraction and resin-bonded prosthesis	<ol style="list-style-type: none"> 1. Minimal tooth preparation. 2. Immediate provisionalization possible. 	<ol style="list-style-type: none"> 1. Design and technique sensitive. 2. Frequent debonding is a possibility. 3. Difficult to plan in deep bite cases.

cement (Templute, Prime Dental, Mumbai, India) and the patient was placed on regular weekly recalls for one month to evaluate the plaque control. He was advised to maintain good oral hygiene and limit functional forces on this tooth.

After four weeks, the palatal gingival margin was found to be healthy and stabilized. The temporary crown was removed; crown foundation and the root were cleaned off the residual temporary cement. The positioning of the root fragment and the original all-ceramic crown was evaluated separately. After placing retention grooves in root dentin, root fragment and the tooth were conditioned.

First, the root fragment was bonded in place, which helped in visualizing its complete seating as well as improved the

visibility while recementing the crown. Subsequently, the Empress II crown was etched with 5% hydrofluoric acid (IPS Ceramic Etching Gel Ivoclar Vivadent, Schaan, Liechtenstein, Germany) and primed with silane coupling agent (Monobond-S, Ivoclar Vivadent, Schaan, Liechtenstein, Germany) for one minute. The crown was then painted with a thin layer of bonding agent, filled with luting agent, and bonded to its original place [Figure 4], using dual-cure cement (Duolo ink, Bisco Inc, Schaumburg, USA).

Patient was advised to attend for regular recall visits. At one year and four months post-recementation, attachment apparatus was healthy and the sulcular depth was normal all around on the palatal aspect [Figure 5]. After four years follow-up, the prosthesis has been functioning well.



Figure 1: Fractured maxillary right central incisor at the first episode of trauma



Figure 2: Internal surface of fractured restoration with attached palatal root fragment



Figure 3: Putty index of crown intaglio surface



Figure 4: Post-recementation radiograph showing precise fit of the prosthesis



Figure 5: Normal disto-palatal sulcus depth and healthy attachment apparatus at one-year four-month follow-up



Figure 6: Restored tooth at three-year follow-up

DISCUSSION

An essential requirement to facilitate retrograde reconstruction of a fractured tooth is the guide available through the original cast, a replica die of the tooth preparation or the internal surface of the intact restoration.

Treatment options for teeth fractured subgingivally or crown-root fractures are (a) crown lengthening procedures by flap surgery with osseous recontouring and (b) rapid orthodontic tooth extrusion to be followed by fragment reattachment or prosthetic restoration. Extraction would be indicated in severe unsalvageable cases.^[4,5]

In the reported case, a direct technique was used to reconstruct the foundation under an IPS Empress II crown using a fiber post and composite resin core to blend with the aesthetic demands of the prosthesis. The technique allowed the patient to go home with a functional and aesthetically acceptable provisional restoration on the first visit itself.

No spacer was required at the time of the core build up, since a putty index of the crown intaglio surface was fabricated prior to cement removal. Polymerization shrinkage and finishing of the composite core may also have created some additional space. It is possible that the use of spacers such as low viscosity polyvinyl siloxane impression material or varnish could have interfered with crown adhesion.

It was important to remove the previous resin cement completely as it would have interfered with the uniform etching and bonding of the crown, leading to decreased adhesive bond strength between the crown, luting cement, and the crown foundation, especially in the area of residual cement.

According to Stern and Becker,^[5] fractures violating the biologic width pose a problem of periodontal pocket formation if crown lengthening is limited to the fracture line. Ramfjord^[6] suggested that a new biologic width will re-establish itself or the periodontium will adapt itself to the restoration/reattached fragment in patients maintaining good plaque control and if the palatal margin of the crown is placed far away from the palatal bone. In the present case, the measured distance between the fracture line and crown margin was 4 mm and distance between the fracture line and the radicular bone was 2 mm. Therefore, no further bone removal was done to re-establish the biologic width.

This patient maintained excellent oral hygiene and the palatal crown lengthening limited to the fracture line placed the crown margin away from the fracture line. Figure 6 shows the successful outcome of the protocol suggested by Ramfjord with respect to this case at three years.

Reattachment of the fractured root fragment^[7] was preferred over other restorative options as the use of natural tooth structure not only eliminates the problem of differential wear of the restorative material, but also reproduces the exact anatomical contour and texture which is difficult to achieve even with best of the materials and techniques.

The durability of the reattached fragment is not predictable. Good short-term and medium-term esthetic and functional outcome are known, but long-term results are still unknown. However, the many advantages and modest longevity of such treatment options justify a search for the ways to improve the durability of the bond established between the adhering interfaces.

The complete protocol described here is time saving, affordable, and was preferred by this patient over the other treatment options proposed. Patient's motivation to maintain oral hygiene, complicated adhesive reattachment due to subgingival fracture, difficulty in achieving perfect adaptation between the fractured fragment and the tooth, lack of translucency, and unpredictable long-term durability of adhesive bond between attached surfaces are the limiting factors.

CONCLUSION

The technique elucidated resulted in a precise retrofitted fiber post-supported composite resin foundation which adapted well to the pre-existing crown. For a good long-term prognosis, trauma to the existing foundation/restoration demands a comprehensive interdisciplinary treatment plan for the tooth and the supporting tissues involved rather than concentrating only on the prosthetic restoration.

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