

Fractured Anterior Tooth Fragment Reattachment: A Case Report

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ABSTRACT

Background: Anterior crown fractures are a common form of traumatic injury that mainly affects children and adolescents due to their position in the oral cavity especially in the maxillary arch. Traumatic injuries of teeth involve varying degrees of damage to the supporting soft tissues or the teeth itself. Over time numerous techniques and materials have evolved for the reconstruction of injured teeth which involves steel crowns, ceramic crowns, orthodontic bands and resin composite restorations with or without pins. With the advent of adhesive dentistry, the process of fragment reattachment has become simplified and more reliable. Various epidemiological studies have shown that approximately one in six adolescents and one in four adults suffer a traumatic dental injury in their lifetime and that most dental injuries involve just one tooth. Following maxillary incisors, traumatic injuries occur most frequently in upper and lower lateral incisors and the upper canines [1,2,3,4].

Keywords: Tooth fracture, reattachment, dentin bonding agent, tooth colored posts, biologic width, resin composite restoration.

INTRODUCTION

Coronal fractures of the anterior teeth are a common form of dental trauma that affect the primary and permanent teeth. It has a severe impact on the social and psychological well-being of a patient [5]. The majority of dental injuries involves the anterior teeth, especially the maxillary incisors (because of its position in the arch), whereas the mandibular central incisors and the maxillary lateral incisors are less-frequently involved [2,3]. Crown-root fractures represent only 0.3% to 5% of these injuries and require a complex and multidisciplinary treatment [5,6]. Coronal fractures of permanent incisors represent 18–22% of all

trauma to dental hard tissues, 28–44% being simple involving enamel and dentin and 11–15% complex involving enamel, dentin and pulp. Out of these 96% involve maxillary central incisors [7]

Dental injuries usually affect at most a single tooth; however, severe trauma such as automobile accidents and sports injuries involve multiple teeth. Traumatic injuries of teeth involve varying degrees of damage to the supporting soft tissues or the teeth itself. Over time numerous techniques and materials have evolved for the reconstruction of injured teeth: resin crowns, steel crowns, orthodontic bands, ceramic crowns and resin composite restorations

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with and without pins. The treatment modalities varies from simple reattachment to complex interdisciplinary approach. Treatment alternatives for fractures involving biologic width include crown lengthening, flap surgery, osteotomy /ostectomy and rapid orthodontic tooth extrusion. Several factors influence the management of coronal tooth fractures, including extent of fracture (biological width violation, endodontic involvement, alveolar bone fracture), pattern of fracture and restorability of fractured tooth (associated root fracture), secondary trauma injuries (soft tissue status), presence/absence of fractured tooth fragment and its condition for use (fit between fragment and the remaining tooth structure), occlusion, aesthetics, finance and prognosis [8,9]

The choice of the esthetic restorative treatment of fractured anterior teeth remains the biggest challenge for the dentist. Treatment options include composite resin restoration, fragment reattachment, and ceramic restorations (full crowns, laminate veneers, or ceramic fragments). When the tooth fragment is present and in good working condition, the best option for the treatment of a coronal fracture fragment is reattachment [10]

Proposed as a simple and conservative option, fragment reattachment restores the morphological, functional, and esthetic aspects of the dentition, while maintaining the shape, contour, texture, color, and alignment of the natural teeth. Furthermore, fragment reattachment can be considered a fast and low-cost treatment solution, creating a positive emotional and psychological response in the patient [11]

This technique was first published in 1964, when Chosak and Eidelman described a case involving the reattachment of a natural tooth fragment. Since then, different preparation techniques (bevel, circumferential chamfer, buccal chamfer, overcontour, internal dentin groove) as well as adhesive materials have been described throughout the literature, designed to increase the chemical and mechanical retention of fragments [12]

The development of adhesive restorative materials has provided new perspectives for the treatment of fractured teeth. Common restorative treatments, such as ceramic laminates or crowns, tend to sacrifice large amounts of tooth structure, making

the color matching to the adjacent teeth difficult [13]

The variety of materials, such as adhesive systems and composite resins, combined with the skill and knowledge required to mimic the shape, color, and texture of a tooth make the realization of direct composite resin restorations difficult. Thus, fragment reattachment becomes a fast, simple, and conservative technique that provides excellent rehabilitation of the esthetics and function. However, in order to make feasible the most favorable long-term results, the dental clinician needs to have knowledge of the materials and follow the correct treatment protocol by first performing periodontal procedures, followed by the endodontic treatment, and, lastly, by facilitating fragment reattachment[14]

The following case report describes the management of a anterior crown fracture, in which the dental fragment was used as the main restorative material.

CLINICAL CASE REPORT

Case report

A 40 year male patient reported to the Dept of BVP dental college and hospital Navi Mumbai with a chief complaint of fractured anterior tooth. Patient had a fall from bike and sustained some injuries on the face for which he got treated and reported to dental college. After ruling out the fracture of the jaws, clinical intra oral examination revealed a complicated crown fracture on 21. On clinical examination of the palatal side the fracture was very deep invading into the gingival sulcus. The fragment was still attached to the tooth. The periodontal assessment of the teeth was done with a Williams probe to check for periodontal status and rule out vertical fracture of the root. The fracture line was above the alveolar crest. Radiographic examination revealed absence of root and bone fractures.

Different treatment options were given to the patient. Upon examination, the treatment options were presented to the patient including (1) no treatment, (2) post and-core and crown, (3) crown build up restoration with a resin based composite, and (4) reattachment of the tooth fragment. After

some deliberation about the advantages, disadvantages, prognosis, and cost of every treatment option, the patient opted to have the tooth fragment reattached. It is important to note that the reattachment option was presented only after confirming that the fragment was in good condition and that it fit reasonably well on the fractured tooth. A treatment plan was compiled that comprised immediate endodontic treatment of tooth 12 and reattachment of the fractured crown fragment.

The treatment plan for the patient comprised of single-sitting root canal treatment followed by placement of a fibre post for retention. The fractured segment was separated from the tooth. Fractured segment was preserved in Hank's balanced salt solution to prevent dehydration.

Fig 1: Initial view of the fractured element.



Fig 2: Radiographic view of fractured element.



One important complication of this case was the subgingival extension of the fractured margin on the palatal area. The gingival aspect of the fractured site revealed a shallow, knife-edge subgingival fracture margin. Upon probing this area during the clinical examination, it was determined that the biological width was only minimally invaded and that bone recontouring via crown lengthening would not be indicated or required as long as the restorative margin were placed at or above the level of the cemento enamel junction.

Fig 3: Palatal view of fractured element after removal of fragment



Fig 4: Dental fragment.



Fig 5: Root Canal Treatment.



Fig 6: Post Space Preparation.



Fig 9: Dental fragment repositioned and exhibiting excellent adaptation.



Fig 7: Post Placement.



Fig 8: Fragment reattachment.



Root canal therapy of the affected teeth was carried out as there was pulpal exposure. Resin based [AH-PLUS, DENTSPLY] sealer was used for endodontic treatment. The line of fracture was exposed palatally and haemostasis was achieved. Post space was made with the corresponding drill to receive a prefabricated light transmitting post [DT LIGHT POST]. The prefabricated post was checked in the canal for adaptation. After isolation, root canal walls were etched with 35% phosphoric acid for 20 seconds, rinsed and dried with paper points. Bonding agent [ADPER SINGLE BOND2, 3M ESPE] was then applied to the root canal walls with a micro brush in two coats and gently air dried followed by light curing for 15 seconds. Bonding agent was also applied to the light transmitting post. Dual curing resin cement [RELYX ARC, 3M ESPE] was then applied to the canal walls and the fiber post. The post was seated into the canal and the excess cement was removed. Polymerization was done for 40 seconds through the post. The fragment

was adapted to the tooth and fit was verified. Once the tooth fit was confirmed the tooth fragment was attached with a flowable composite.

Finishing and polishing of the tooth was done. All instructions regarding precaution of treated tooth, diet and oral hygiene maintenance were given. The patient was kept under observation and initial follow-up at weekly intervals.

DISCUSSION

Aesthetic rehabilitation of crown fractures of the maxillary anterior is one of the greatest challenges to the dentist. Reattachment of a fractured fragment to the remaining tooth can provide better and long-lasting aesthetics, improved function, a positive psychological response and is a faster and less-complicated procedure. With all the recent advancements in dental adhesives and bonding technology, it is now possible to achieve excellent results with reattachment of dislocated tooth fragments. However the biologic factors, materials and techniques are to be logically assessed and managed. The use of natural tooth substance clearly eliminates the problems of differential wear of restorative material, unmatched shades and difficulty of contour and texture reproduction associated with other techniques [15]. Treatment plan can be made after evaluation of the periodontal, endodontic, coronal and occlusal status [16]. Other factors that might influence the choice of technique include the need for endodontic therapy, extension of fracture, quality of fit between fragments and the fracture pattern [17]

Factors which influence the management of coronal tooth fractures can be summarised as follows, [18,19,20]

- Extent of fracture (biological width, endodontic involvement, alveolar bone fracture).
- Pattern of fracture and restorability of fractured tooth (associated root fracture).
- Soft tissue status.
- Presence/absence of fractured tooth fragment and its condition for use (fit between fragment and the remaining tooth structure).
- Occlusion, aesthetics, finances and prognosis.

During the clinical assessment, detailed Periodontal assessment, endodontic assessment and coronal assessment should be done.

Gentle probing around the periodontal tissues of the fractured tooth under local anaesthesia will help determine the level of the tooth fracture as well as the presence of vertical root fracture [21]. If the fracture line is supragingival, the procedure for reattachment will be straightforward. However, when the fracture site is subgingival or intraosseous, surgical or orthodontic extrusion of the apical portion for restoration with a postretained crown, instead of reattachment, may be necessary.

In the Endodontic assessment, apart from clinical examination for pulpal exposure, the vitality of the pulp and status of apex maturation should be analysed by vitality tests and periapical radiographs. Coronal assessment should be done to assess the number and status of fracture segments. If multiple fragments are present, it may be necessary to assemble the pieces with resin composite prior to trial in the mouth.

However, when endodontic therapy is required, the space provided by pulp chamber may be used as an inner reinforcement, thus avoiding any excess preparation of teeth. The direction of fracture line is an important aspect in restorability and it has a direct bearing on the prognosis of teeth [22]

Cavalleri and Zerman-reported that the long-term prognosis for reattached crown fragments appears to be better than for composite resin restorations [23]

When the tooth is completely unrestorable, extraction is the only option available, leading to the loss of bone in the area compromising future treatment with implants [24]

If the fracture line is supragingival, the procedure for reattachment will be straight forward. However when the fracture site is sub gingival or intraosseous, orthodontic extrusion with a post retained crown may be necessary [25]. Alternatively, surgical techniques such as electrosurgery, elevation of tissue flap, clinical crown lengthening surgery with removal of alveolar bone and removal of gingival overgrowth for access

to the fractured site are all viable methods for bonding fractured component [26]. It has been suggested that whenever the fracture site invades the biologic width, surgery should be performed with minimum osteotomy and osteoplasty [27]. However, in cases with minimal biologic width invasion the organism is able to restore the biologic width by itself provided assiduous plaque control is done. The prognosis of the reattached teeth would also depend on the fitness, contour and surface finishing of the subgingival restoration [28]. If the invasion of biologic width is minimal, satisfactory esthetics and function can be achieved, without conventional flap surgery, however requiring long term follow up [29]. The cases which required crown lengthening were in order to keep the restorations on definite margins. The success rates of reattached fragments has been seen to be upto 90 % for the parameters of periodontal, pulpal and colour harmony for a follow up of upto 24 months[30,31]

One more factor into consideration is the Dehydration of the fragment, which may result in a change in dental color and a decrease in the fracture strength of the tooth. Proper rehydration of the fragment has the capability of restoring both color and strength [32,33]. Farik and others evaluated the fracture resistance of dehydrated and rehydrated teeth over different periods of time. When the fragment remains dehydrated for more than one hour, the fracture resistance decreases significantly [34].

In the case presented, the fragment was well adapted, and for this reason there was not any additional preparation done and the retention of the fragment was achieved only through hybridization of the dental tissue. We opted for the use of resin cement and not composite resin, considering that the shade, viscosity, and dual-cure mechanism of these cements facilitate the insertion and polymerization, while the innermost portions of the luting interface may not be light cured [35,36]. If the fragment does not exhibit good adaptability and if there is a loss of continuity, composite resin is indicated for filling any volume loss.

It is the dentist's responsibility to undertake periodic follow-up consultations and to perform clinical, radiographic, and periodontal examinations

as well as pulp vitality tests in order to ensure the integrity, the esthetics, and the functional health of the fractured element [37,38].

CONCLUSION

Complex coronary fractures require a specialized interdisciplinary treatment and must be carefully assessed by the dental clinician to achieve the best possible outcome.

Bearing in mind that it is a simple, fast, affordable, and esthetically predictable technique, tooth fragment reattachment should always be the treatment method of choice when the fragment is present and is in good condition, even if a perfect adaptation is not observable.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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