

## Autogenous Tooth Fragment Reattachment ; A 12 -Years Follow-Up

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**Abstract:** *The fractures of the anterior teeth are a common form of dental trauma that mainly affects children and adolescents. One of the therapeutic options for managing coronal tooth fractures when the tooth fragment is available and there is no or minimal violation of the biological width is the Autogenous reattachment of the dental fragment.. Reattachment of fractured fragment can provide good and long lasting esthetics. This is a report of a 12 -year follow-up of a coronal fracture case successfully treated using tooth fragment reattachment.*

**Keywords:** *Composite resins, coronal fracture, fragment reattachment*

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### I. Introduction

Traumatic injuries of teeth involve varying degrees of damage to the supporting soft tissues or the teeth itself. A very common injury to the permanent dentition affecting children and adolescents during their growing years is the anterior crown fracture.

Uncomplicated crown fractures are a frequent form of dental injuries encountered in a dental clinic requiring immediate management. Uncomplicated crown fractures are a frequent form of dental injuries encountered in a dental clinic requiring immediate management.[1,2]

Reattachment of fractured tooth provides the best esthetic results as natural tooth shape, contour, surface texture, occlusal alignment and color are maintained (5-10). Additionally, this approach provides positive psychological and social response from the patient.[3]

Numerous factors influence the management of coronal tooth fractures, including extent of fracture, pattern of fracture and restorability of fractured tooth (associated root fracture), secondary trauma injuries, presence/absence of fractured tooth fragment and its condition for use (fit between fragment and the remaining tooth structure), occlusion, esthetics, finances, and prognosis.[4–6]. Patient cooperation and understanding of the limitations of the treatment is of utmost importance for better treatment outcome. When there is a substantial associated periodontal injury or invasion of the biological width, the restorative management of the coronal fracture should follow the proper management of those associated issues. Coronal fractures must be approached in a systematic way to gain a successful restoration.

One of the options for managing coronal tooth fractures, especially when there is no or minimal violation of the biological width, is the reattachment of the dental fragment when it is available.[7]. Tooth fragment reattachment offers a conservative, esthetic, and cost effective restorative option that has been shown to be an acceptable alternative to the restoration of the fractured tooth with resin-based composite or full-coverage crown.[6,8–10]. Reattachment of a fragment to the fractured tooth can provide good and long-lasting esthetics (because the tooth's original anatomic form, colour, and surface texture are maintained),[9] can restore function, can result in a positive psychological response, and is a reasonably simple procedure. [11]. In addition, tooth fragment reattachment allows restoration of the tooth with minimal sacrifice of the remaining tooth structure. Furthermore, this technique is less time-consuming and provides a more predictable long-term wear than when direct composite is used.[12]. Clinical trials and long-term follow-up have reported that reattachment using modern dentin bonding agents or dual cure adhesive luting systems may achieve functional and esthetic success.[6,13]

Tennery was the first to report the reattachment of a fractured fragment using acid-etch technique[14]. Subsequently, Starkey [15] and Simonsen [16,17] have reported success with similar cases. The introduction of composite in combination with the use of acid-etch technique to bond composite to enamel, made restoration possible for the fractured incisor, with minimal preparation[16]. However, composite resin has the disadvantages of poor abrasion resistance in comparison to enamel [17], water absorption, and staining. Reattachment techniques for tooth fragments present several advantages over restorations obtained with composite resin systems: better and long-lasting esthetics, improved function, immediate results, a positive psychosocial response, and faster and less complicated procedures[5,6,10].

Tooth fragment reattachment offers a conservative esthetic and cost-effective restoration option that has been shown to be an acceptable alternative to the restoration of the fractured tooth with resin-based

composite as full coverage crown. Reattachment of a fragment to the fractured tooth can provide good and long-lasting esthetics (as the original tooth anatomic form, colour, and surface texture are maintained), can restore function, can result in a positive psychological response and is a reasonably simple procedure. [5,6] This article reports on coronal tooth fracture cases that were successfully treated using Autogenous tooth fragment reattachment of a 12 -year follow-up.

## II. Case Report

A 9-year-old female patient reported to my pediatric dental clinic , after sustaining an uncomplicated crown fracture to her maxillary left central incisor while playing about 6 hours ago.

The fractured tooth fragment was recovered by the patient at the site of the injury and she had kept it in an empty box. Clinical examination revealed that the teeth had fracture of the incisal angle involving the enamel and dentin . The fractured part of the tooth was intact, with some crack and craze lines . No abnormal mobility of the injured tooth was recorded and the surrounding tissues were healthy.A periapical radiograph showed that the root formation was complete and there were no other injuries. The tooth fragment was checked for the fit with the tooth and immediately maintained in normal saline. (Fig.1a,b)



Fig.1a; Fracture fragment

The treatment options were presented to the patient and her parents, which included a) no treatment; b) crown build up with composite; c) reattachment of the fractured fragments. After some deliberation about the advantages, disadvantages and prognosis, the patient opted to have tooth fragment reattached.



Fig.1b; Pre-operative view, labial

The tooth fragment was analyzed and tried intraorally to check for proper positioning and fit with the fractured coronal structure. The operating field was isolated with rubber dam; the fractured fragment and the tooth surface was treated with 37% phosphoric acid (Scotchbond etchant, 3M ESPE, St. Paul, USA) for 15 seconds and after, rinsed with water for 15 seconds.



Fig.2a; post-operative view, labial

The excess water was removed with absorbent paper, Primer (Adper Scotchbond multi-purpose primer, 3M ESPE, St. Paul, USA) was applied to the etched enamel and dentin and air-dried gently for 5 seconds. The adhesive (Adper Scotchbond multi-purpose adhesive, 3M ESPE, St. Paul, USA) was applied to the primed enamel and dentin, which penetrates in the tubules of the dentin in order to create a hybrid layer. The adhesive was light cured for 10 seconds with a QTH light-cure unit (Optilux 500, KEER, Orange, CA, EUA).



Fig.2b; post-operative view, occlusal

A small amount of resin composite universal dentin shade (Filtek Z250, 3M ESPE, St. Paul, USA) was placed on the tooth before the compound with the tooth fragment was indexed. The excess resin composite was removed with a plastic instrument prior to polymerization. The resin composite was polymerized for 20 seconds with a QTH light-cure unit (Optilux 500, KEER, Orange, CA, EUA), finished with serial finishing burs (KG SORSEN, Sao Paulo, Brazil) and polished with sandpaper disks (Diamond Pro, FGM, Joinville, Brazil) for the final fragment reattachment procedure (Figure 5). Each layer of resin composite was polymerized for 20 seconds with a QTH light-cure unit (Optilux 500, KEER, Orange, CA, EUA). The external surfaces were finished with serial finishing burs FG 2134, FG 2134 F, FG 2134FF (KG SORSEN, Sao Paulo, Brazil) and polished with sandpaper disks (Diamond Pro, FGM, Joinville, Brazil). (Fig.2a,b)



Fig.3; 12-years after fractured tooth fragment reattachment

Proximal contacts were verified for both restorations using floss (Colgate Total floss, Colgate, New York, USA) and occlusal contacts were marked with double-sided articulating film (AccuFilm II, Parkell, Edgewood, USA). All excursive movements were verified and postoperative instructions provided. The patient was placed on 6 and 12 months recall monitoring the direct pulp cap and too evaluating the stability of the reattached tooth fragment. The follow-up period showed positive tooth vitality on cold testing using ethyl Chloride Spray (Endo Ice, Coltene Whaledent, USA). Follow-up radiographs were normal without any evidence of periapical pathology. Clinical and radiographic examinations were carried out regularly over a period of 12 years. During this period, the reattached fragment was intact without any distortion. Occasionally, it required polishing to remove some mild stains. Nine years follow-up showed a predictable outcome of the reattached fragment.( Fig.3)

### **III. Discussion**

Fragment reattachment and root canal dental trauma is a situation that requires acute decision making by the dental provider for optimal treatment outcomes. Traumatic injuries to an immature permanent tooth may result in cessation of dentin deposition and root maturation and can also affect the tooth's prognosis.[19] Crown fractures comprise 26-76% in the permanent dentition. i f an intact tooth fragment is present after trauma, the reattachment procedure presents a conservative, simple and esthetic treatment option. The procedure is reasonably economical, while restoring function and esthetics with a very conservative approach.[4,5 ] Incisal fractures of anterior teeth have been successfully treated by reattachment. Complicated fractures involving pulp have been treated by reattachment with post and core . There are certain other factors to be considered during reattachment procedures. If endodontic therapy is required, the pulp chamber can be used as an internal reinforcement, avoiding excessive tooth preparation, but the disadvantage is that the esthetics is compromised as the pulpless teeth lose a part of their translucency and brightness. If the fracture extends close to the pulp, a direct pulp-capping agent is essential, and this would prevent placement of an internal groove in the fragment. If the fragments are very small, simple reattachment is done without any additional preparation.[19,20,21]

When a fractured tooth occurs due to an accident, the patient should follow some important steps:

1. Locate and bring the broken piece/s to the emergency room or dental office.
2. Transport the fragment in an appropriate solution: Hank's Balanced Solution (HBSS), milk, egg white, hypertonic dextrose solution or saliva, water [4,5]. If these solutions are not available, store the fragment in the patient's saliva [17]. Pulpal protection is paramount in these acute traumatic situations. An indirect pulp capping procedure is indicated if the fracture approaches the pulp, but no exposure occurs. A root canal treatment or a direct pulp cap is indicated if the pulp tissue is exposed. Direct pulp capping with calcium hydroxide or MTA has been shown to be controversial [22]. On the other hand, some authors believe that direct pulp capping has clinical merit and should be considered as a non-aggressive alternative to root canal treatment [22,23].

The remarkable advancement of adhesive systems and resin composites has made reattachment of tooth fragments a procedure that is no longer a provisional restoration but rather a restorative treatment, offering a favourable prognosis. Fabrication of a mouth guard and patient education about treatment limitations may enhance clinical success, as reattachment failures may occur with new trauma or parafunctional habits[4,57]. Despite these factors, case reports and multicentre studies have described functional and aesthetic successes for over `12 years now.

Fabrication of a mouth guard and patient education about treatment limitations may enhance clinical success as reattachment failures may occur with new trauma orparafunctional habits.[5,6] Clinic applications and long term follow-up has revealed that modern dentin bonding agents and adhesive bonding systems used in the reattachment technique increase the functional and aesthetic success.[4,5,24] Reis et al. reported on the fracture resistance of reattachment technique, and noted that without any preparation, the application fracture resistance was only 37.1%, while in the buccal chamfer application resistance was 60.6%, in bonding with an over contour it was 97.2%, and in the placement of an internal groove it was 90.5%.[9,25]Demarco et al. evaluated the different adhesive systems and the effects of the bevel preparation in regards to resistance against fracture. They reported that bevel applications in all groups increased the resistance against the fracture, whileadhesive bonding applications yielded poor results.[26] Eden et al. reported that the reattachment technique that more comply the fracture segments were better in complied with together, positively affected the stability of the natural tooth surface, as well as successful biocompatibility with periodontal tissue.[27]Kararia et al. and Saha SG et al. reported more successful short and long-term results in coronal fragment repairs with the reattachment technique.[28,29]Cavalleri and Zerman have reported longterm follow up studies of the reattachment technique, and confirmed that the reattachment technique yielded

more successful results than composite resin restorations.[30] Preeti Kore et al reported a successful one year follow up of esthetic reattachment of a coronal fragment in a complicated crown fragment of permanent right central incisor.[31]

Wadhvani et al reported a successful one year follow up of esthetic reattachment of a coronal fragment in a complicated crown fracture of permanent right central incisor.[32]

Macedo GV et al reported two coronal tooth fracture cases that were successfully treated using tooth fragment reattachment. Reattachment of fractured tooth fragment

offers a viable restorative option for the clinician because it restores tooth function and esthetics with the use of very conservative and cost effective approach.[33]

Badami and associates have shown neither the bevel nor the material used could obtain the original fracture resistance of the tooth. Specimens prepared with chamfer and bonded had a fracture resistance of 40 to 60%, with internal dentin groove and over contour it reached around 90%. A simple reattachment procedure as in the first case is indicated, since bevel with flowable composite improves fracture strength recovery. The resistance of the fracture segment can be directly proportional to the surface area of adhesion. Most of the 5th generation bonding agents increased the fracture resistance of reattached coronal fragments when used with conjunction with unfilled resin. Extensively fractured fragments have to be restored with conjunction with a resin. The highest fracture resistance was obtained by chemically cured composite followed by light cured and resin cement and least by only dentin bonding agent.[34]

In our case, retention technique used have found to be esthetically & functionally in good condition at the first year recall visit, suggesting fragment reattachment can be a choice of treatment in management of anterior traumatic teeth, if the original tooth fragment is retained following fracture.

With the materials available today, in conjunction with an appropriate technique, esthetic results can be achieved with predictable outcomes. Thus, the reattachment of a tooth fragment is a viable technique that restores function and esthetics with a very conservative approach, and it should be considered when treating patients with coronal fractures of the anterior teeth, especially younger patients.

#### **IV. Conclusion**

Recent development in restorative materials, placement techniques, preparation designs, adhesive protocols, allow clinicians to effortlessly complete this procedure in a single appointment. Thus, reattachment of the intact fractured segment can be considered as an ultraconservative biologic method for aesthetic rehabilitation and it is an excellent choice of treatment.

#### **Disclosure**

The authors do not have any financial interest in the companies whose products are included in this article.

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