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Conservative Approach for Management of Complicated Crown Facture using Tooth Fragment Reattachment Technique

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Abstract

The restoration of a fractured anterior tooth by fragment reattachment is biological, conservative, and the most currently acceptable treatment option. In addition, the advancements in adhesive dentistry, tooth fragment reattachment procedure has become simpler and clinically reliable. This article presents management of two cases of complicated crown fracture of maxillary incisors by reattachment of the fractured tooth segment.

Keywords: Complicated crown fracture • Tooth reattachment • Partial pulpotomy • Dental trauma • Dental restoration

Introduction

Fracture of anterior teeth by direct or indirect trauma is a common problem in permanent dentition. Crown fracture has been registered to account for up to 92% of all traumatic injuries [1]. The most affected teeth are maxillary incisors due to their anterior position. Dental trauma are associated with different factors as gender, physical features (age, protrusion, anterior open bite...), environment, road traffic accidents, psychological and behavioural factors. Some fractures are minors limited in hard tissues; others are complicated with pulp exposure. The number and extent of the tissues involved in traumatic injury determine the therapeutic approach [2,3]. Various therapies has been described for the management of fractured tooth, Recently with the improvements in the field of adhesive dentistry, the re-attachment of tooth fragment as conservative treatment should be the first choice to restore fractured tooth for many reasons as satisfying long-lasting esthetic result, functional restoration [4] efficacious and cost-effective intervention. This article reports presents two clinical cases of complicated crown fracture treated by tooth fragment reattachment using the direct bonding technique and preserving pulp vitality by partial pylpotomy [5].

Case Presentation

Case 1

A 24-year-old patient presented at the emergency of conservative dentistry and endodontistc's department complaining of crown fracture of the right central incisor due to sport injury (Punch) dating from yesterday night. The tooth fragment was stored in the saliva of the patient. The patient has no interested medical history. After clinical examination the fracture was classified as an enamel-dentin fracture with pulp exposure (Figure 1). Extra oral and intraoral examination revealed ecchymosis, inflamed and edematous gingiva. The absence of mobility of the fractured tooth was recorded. The fracture line was subgingival on the buccale side. The adaptation of the tooth fragment was clinically verified. Periapical radiograph of maxillary central incisors showed intact roots, closed apices, and absence of periapical pathosis (Figure 2). Several factors influence the treatment approach of a dentist when encountering a complicated fractured tooth [6]. Many factors influencing treatment planning like evaluating the fracture line, tooth fragment retrieval, degree of infection and inflammation in the pulp space and the time elapsed between the accident and the emergency treatment [7]. After discussing different treatment options with the patient and informed consent was obtained, reattachment of tooth fragment and preservation of pulpal vitality was planned. The treatment planning strategy was carried out in one session. In the first, partial pulpotomy with mineral tri aggregate cement placements, then bonding procedure were performed. Local anesthesia using 2 percent lidocaine with 1: 100 000 adrenaline was administrated and rubber dam (Dental Dam Hygenic, Coltène/Whaledent GmbH, Langenau, Germany) was placed to avoid bacterial and moisture contamination.

Figure 1. Clinical pre-operative view.

Figure 2. Pre-operative periapical radiograph.

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The superficial layer of the exposed pulp and the surrounding dentin are excised to a depth of about 2 mm using a high-speed turbine tunguestene carbide bur with abundant water- spray cooling (Figure 3). The surface of the remaining pulp is irrigated gently with physiological serum [6]. Hemostasis was done with dry and sterilized cotton pellet applied with a moderate pressure. The bleeding had ceased 2 minutes later (Figure 4). After partial pulpotomy the pulp was covered with white mineral trioxide aggregate (White MTA-Angelus, Londrina, Brazil) prepared according to the manufacturer's instructions and recovered by glass ionomer cement. The fragments were cleaned with chlorhexidine solution for 1 min. The orthophosphoric acid gel (37%) was applied specifically on the enamel of the fractured component and remaining tooth of the central right incisor for 15 seconds (Figures 5 and 6). After thorough rinsing and drying, self-etch adhesive was placed and light cured for 10 seconds on both tooth fragment and tooth structure. A low-viscosity flowable resin cement and light cured (Polofil NHT flow light-curing nano-hybrid filling material) used to re-attach fractured tooth segment to the remaining tooth structure. After photo-polymerization for 20 s in the buccal and palatal side using polymerizing halogen light with an intensity of 1400 mW/cm^2 (Radii LED Curing Light, SDI, Australia). Finishing and polishing were performed with disk (flexi-snap KIT 1295SO AU\SG-switzerland). Finally a satisfied esthetic and functional result was achieved (Figure 7). The teeth were followed clinically and radiographically at 1 week, and 3, 6, and 9months (Figures 6 and 7). There were absence of clinical failure symptoms such as spontaneous pain, discomfort or coronal discoloration; normal response to pulp vitality test was noticed, and no signs of resorption, or periapical lesion. After 12 months, a radiographic control showed coronal dentinal barrier formation (Figure 8), and clinical examinations showed good esthetics and periodontal integration [8-10].

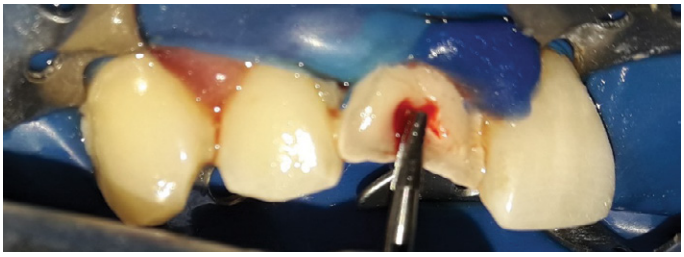

Figure 3. Clinical view during partial pulpotomy.

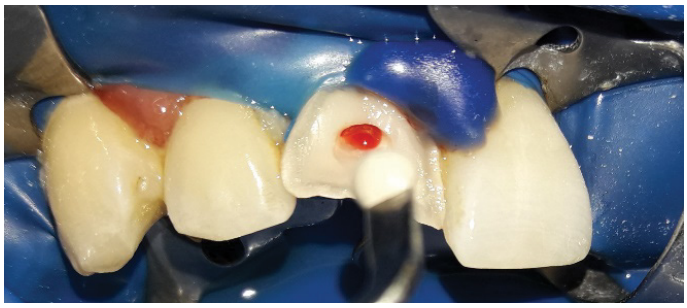

Figure 4. Mineral tri-aggregate cement placement.

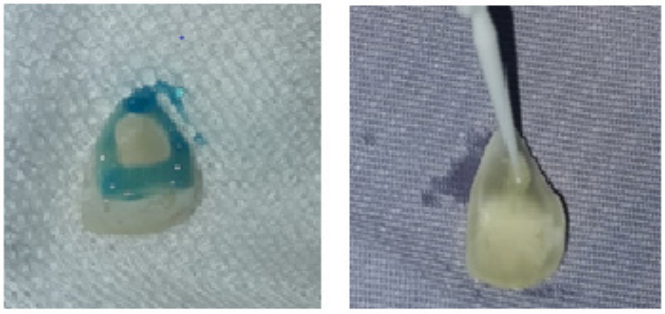

Figure 5. Etching (A) and adhesive application (B).

Figure 6. Clinical immediate post-operative view.

Figure 7. Clinical view on the 9-month recall visit.

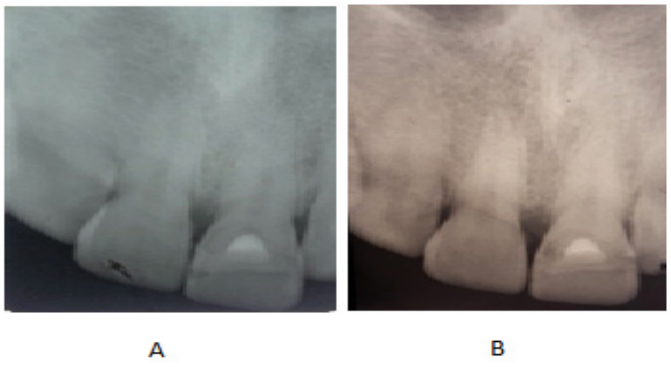

Figure 8. 3-month (A) and 12-month (B) follow-up radiographs.

Figure 9. Buccal clinical pre-operative view.

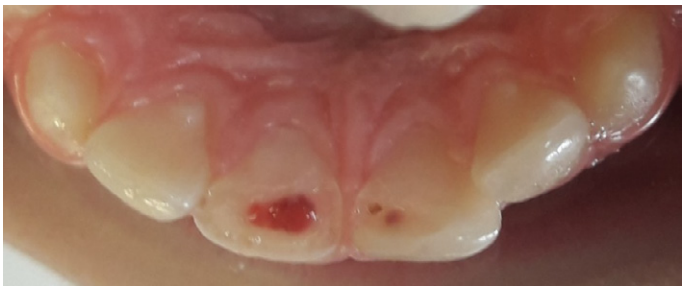

Figure 10. Palatal clinical pre-operative view.

Case 2

A 14-year-old boy who did not have any problems in her medical history presented to the emergency department at the dental clinic of Monastir. The patient was hit accidentally by a schoolmate and his two maxillary central

incisors were fractured. Clinical examination revealed that the two central incisors presented undergone Ellis class III fracture. No significant soft tissue injury was noticed and there was no history of loss of consciousness and vomiting. The patient brought only one broken crown fragment in a water filled container, which was properly adapted to the fractured left central incisor. Tooth fragment for maxillary left central incisor was not available. Periapical radiograph of fractured teeth showed intact roots, absence of alveolar bone fracture and closed apices with no periapical pathosis. The adhesive reattachment of the coronal fractured fragment to the remaining tooth structure was planned for the right central incisor, to be followed by composite restoration and direct pulp cupping with calcium hydroxide cement, of the left central incisor. The treatment was carried out in the similar way as that for Case 1. Follow-up visit of the patient after 9 months revealed successful reattachment of the tooth (Figures 9 and 10).

Discussion

The treatment of complicated coronal fracture of anterior teeth is a great defiance for the dentist, because it has to achieve a successful conservative, biological and esthetic restoration (Figures 11 and 12). Treatment options should be discussed attentively depending on patient's age; systemic health condition, localization of fracture line, the pulp vitality and the time elapsed between the accident and the emergency treatment [11]. Partial pulpotomy implies the excision of exposed pulp only 1 to 2 mm because Cvek affirms that it is the only part of the pulp tissue affected by inflammation and bacteria contamination. Partial pulpotomy followed by MTA dressing is an immediate and ultra-conservative procedure (Figures 13 and 14). Various benefits of this technique has been described such us; better retention of the dressing material, the preservation of cell-rich coronal pulp tissue, necessary element for the hard tissue barrier formation [9], regardless of the size of exposure, the maturity of the root, or the interval between pulp exposure and emergency treatment [8]. Opposed to cervical pulpotomy, removing all the coronal pulp leaving only radicular pulp, which is fibrous and uncellular, causing the absence of the dentin on the coronal area and can increase the risk of cervical fracture [9]. Partial pulpotomy is a promising treatment for complicated crown fracture to maintain pulp vitality, it permits continued root formation in immature tooth; prevents pulp necrosis and consequently the need for root canal treatment [8]. However, the failure of the treatment can be the result of many causes such a severe luxation of the tooth causing the rupture of the pulpal vascularization, microleakage producing bacterial contamination leading to pulp necrosis (Figures 15 and 16). The development of adhesive dentistry allows the fragment reattachment as a definitely and successful treatment of complicated crown fracture when the tooth fragment is available and there is no or, minimal violation of the biological space. This technique provide numerous advantages such immediate restoration with optimal esthetic quality, restore function, less time-consuming and provides predictable long-term wear particularly by preservation of the original color, contour, dimension, characterizations, opacity, fluorescence, incisal translucency and texture of the surface as well as the preservation and strengthening of the tooth structure [10]. The uses of the natural tooth fragment avoid various problems related to aging and degradation of the composite material, color difference, and difficulties in reproducing the original form and surface texture [11]. It is relatively cheap and simple restorative technique, but it requires proper diagnosis of pulp vitality, accurate repositioning of the dental fragment, good occlusion condition and proper handling of bonding technique faraway from moisture and bacterial contamination.

One of the important element of biological and esthetic success of the tooth fragment re-attachment is the intact retrieval and propitiate hydration of the dental fragment following the traumatic accident, so the duration and the type of storage environment plays a determining factors that influence the bond strength of the reattached fragment and the final result (Figure 17). Different types of environments like water, milk, patient saliva, or physiologic serum, can be used to keep the fractured part of teeth providing dentin hydration, an important factor to improve the bond strength between the fragments and composite resin, related to the hydrophilic characteristic of adhesive systems [12]. An appropriate storage media, which have high percentage of calcium and phosphate, is a necessary element to maintain the vitality and original esthetic translucence, ensure adequate bond strength, and minimize the risk of debonding [13]. In order to boost reattachment strength, a 24-hour rehydration of the tooth fragment before treatment seems necessary to restore favorable dentin humidity [14-19]. Unfortunately the amount of strength recovery needed to avoid debonding and keep the reattached fragment in function for long term still unknown [14]. Several materials have been used in pulpal procedures. Clinicians should evaluate several elements when choosing a material to be

Figure 11. Intact tooth fragment of maxillary left central incisor.

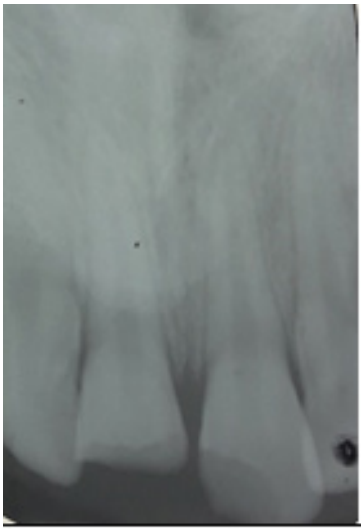

Figure 12. Pre-operative periapical radiograph of the two maxillary central incisors.

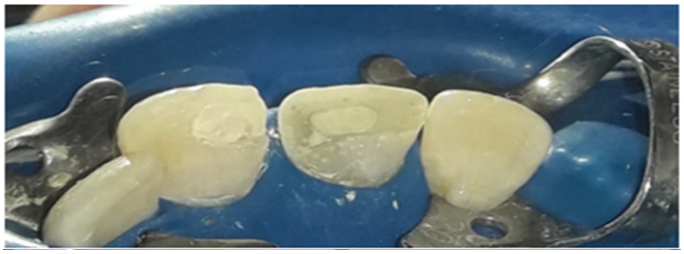

Figure 13. After partial pulpotomy, MTA placement, and direct pulp cupping with calcium hydroxide cement.

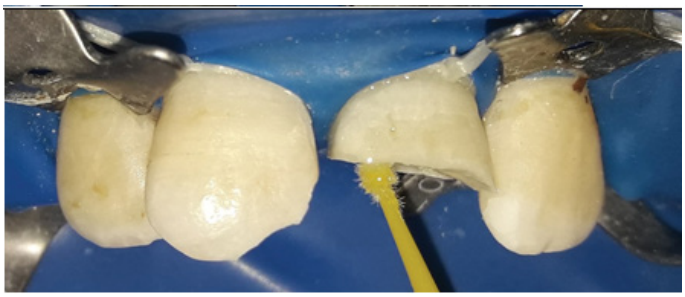

Figure 14. Bonding procedure.

Figure 15. Immediate clinical post-operative view.

Figure 16. 1-month (A), 3-month (B) and 9-month (C) follow-up radiographs.

Figure 17. Clinical view after 9 months follow-up.

used in vital pulp treatment. These elements include the ability of the material to kill bacteria, induce mineralization and establish a bacteria tight seal [15]. In recent years, Mineral Trioxide Aggregate (MTA) has been introduced for pulpotomy in permanent teeth. MTA is a powder consisting of tricalcium silicate, dicalcium silicate, tricalcium aluminate, calcium sulfate dehydrate, and bismuth oxide [15]. When the material is hydrated it becomes a colloidal gel that solidifies in approximately 3 hours. Compared with the traditional material of calcium hydroxide, it has superior long-term sealing ability and stimulates a higher quality and greater amount of reparative dentin [17]. The setting ability of MTA is uninhibited by blood or water. In fact, Arens and Torabinejad have recommended covering MTA with a wet cotton pellet and IRM to gain a better setting of the material [19]. MTA has demonstrated the ability to induce hard-tissue formation in pulpal tissues, and it promotes rapid cell growth *in-vitro* [18]. Compared with calcium hydroxide, MTA has demonstrated a greater ability to maintain the integrity of pulp tissue.

Conclusion

The re-attachment of the fragment tooth properly in the right position presents a challenge to the dentist because it require the proper diagnosis, treatment planning, and regularly controls to assure a satisfying results.

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