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Integrative management of complicated crown fracture

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ABSTRACT

This case study explains and investigates a tooth fragment reattachment procedure used to repair crown fracture in anterior teeth. Such therapy provides for a more traditional approach towards traumatic coronal lesions while yet retaining aesthetics & function. The authors presented a clinical case scenario of a complicated crown fracture of a lateral incisor. This case is marked by trauma caused by a sports injury, which necessitated a variety of therapeutic options. We used a simple and conservative approach that did not require any tooth preparation. Adhesive reattachment is an uncomplicated technique for achieving greater aesthetic and functional results. According to our clinical experience, when both the tooth and the fractured fragment are intact, performing the technique of reattachment without tooth preparation is a predictable and a very efficient process. Reattachments techniques have outweighed resin composite restorations by resulting in better short as well as medium term outcome.

Keywords: Crown fracture, Dental trauma, Reattachment, Tooth fragment.

1. INTRODUCTION

With the emergence of resin composites & bonding systems, reattachment of fractured tooth fragments has been proved to be a beneficial substitute for restoration. Reattachments techniques have outweighed resin composite restorations by resulting in better short as well as medium-term outcomes. The good esthetic & functional results can be achieved in relatively simple cases as well as in more multifaceted situations in which there is the involvement of pulp & biological width (Bhat et al., 2019). The advancement in adhesive materials formed a new vision towards the reconstruction of fractured teeth. If materials, techniques & biological factors are assessed & managed locally, excellent results could be obtained by reattaching the dislocated fragment of the tooth (Andreasen, 1970). Whenever a fragment is obtainable, reattachment should be always the first go-to option. Reattachment offers various advantages, including recovering the colour as well as size of the natural tooth, being worn out in every fraction as the next tooth, and providing an optimistic conditioned response to the patient (Andreasen et al., 2018). It remains one of the most conservative & appealing choice for managing frontal teeth, as it provides a quick return to that of natural tooth upon reattaching the fragment of the tooth. Several treatment

options have been suggested for coronal fracture of the tooth which depends on situations like reattachment of the fragment immediately, surgical exposure, re-contouring of crown & root along with reattachment of fracture, use of splints, & without radicular anchorage, each having its advantages & disadvantages (Macedo et al., 2008).

Benefits and limitations of reattachment

Benefits of reattachment

· Conservative
· Wear on adjacent/opposed teeth is comparable.
· Colour matching to the leftover part of the crown.
· To keep the incisor translucency intact/ aesthetic.
· Preservation of original tooth contours.
· More long-lasting restoration as compared to a "Class IV resin restoration alone".
· Safeguarding of "identical occlusal contacts".
· Colour permanence of the enamel.
· Patients' emotional and social responses were positive.

The limitations of reattachment

· Dehydration of the fragment leads to an unesthetic appearance.
· Alteration in the shade of the bonded fragment.
· Requirement of uninterrupted monitoring.
· Unpredictable longevity.
· Progressive breakdown of the bonded junctions leads to predictable separation of the repaired fragment.

It is approximated that a part of the population suffers at least 1 of dental traumatic injury concerning coronal fractures of the front teeth before 18 years of age, falls being the major attributing factor, sports having a high impact, road traffic accidents (Tay et al., 2007). Because of the position which the maxillary incisors hold in the arch, fractures of the crown in these teeth are the usual sequelae of traumatic injuries, while the mandibular central incisors are less commonly involved (Kumari et al., 2012). Fracture Reattachment of a fragment of a tooth is one of the best options for management of coronal fracture of tooth whenever there is the availability of the fragment & minimum or no invasion of the biological width. This provides superior & enduring aesthetics as the tooth's anatomical form, colour, contour & surface texture areguarded.

Restoration of function, providing a positive physiological response, & being an extremely simple procedure, these advantages offered by reattachment makes it one of the best options to opt for. The co-operation of the patient &better understanding of the restrictions related to the treatment is very important for better outcome of the treatment. In cases of fractured anterior teeth, immediate clinical attention is necessary since untreated fractures can cause dentition damage and have a psychological impact on the patient. The treatment of such complex coronal fractures is a multifaceted development that is influenced by the scope and prototype of the fracture (violation of biological width, endodontic procedure involvement, alveolar bone fracture), condition of the fractured teeth to be restored (any allied tooth fracture), any derived injuries like checking the status of soft tissue, occurrence or lack of fractured fragment of the tooth, & clause for using it (by checking the fitting among fragment & residual tooth structure), esthetics, occlusion, finances, & prognosis (Işeri et al., 2011). Fractured segment reattachment preceded by RCT along with fibre post strengthening is a viable alternative, for treating the case of complicated crown fracture where the segment of fracture can be approximated closely.

According to literature, when resin cement is used for luting the fibre post, it leads to an increase in withholding of the segment providing a monoblock effect. This case report shows a case of complex crown fracture effectively treated by reattaching the fractured tooth fragment.

2. CASE HISTORY

A 17 -year-old boy arrived for treatment 1 day after fracturing his maxillary right lateral incisor in a sports injury. Though the fragment of the tooth was mobile, it was still attached palatally & was in place. No change in color was observed in the crown structure. A radiograph was taken, which showed a complicated crown fracture in the cervical third area of the tooth, fracture line was appreciated running from mesial to distal side at the cementoenamel junction (Figure 1). Mesial drift of coronal portion of the

tooth, which was only attached palatally was also appreciated. Pulp exposure was appreciated, which indicated the need of endodontic treatment. An intact periodontal ligament space, entire formation of the root, & without having any visible fracture of the root, was appreciated in the periapical radiograph. On clinically examination of the tooth only a mobile coronal portion was seen (Figure 2). The depth of the fracture could not be appreciated clearly by radiograph & hence the fragment was removed (Figure 3). The patient's parents were well-versed about the risk associated with tooth loss. After explaining the entire procedure, with age of the patient being the major factor, the option of reattachment was chosen by accepting the pros and cons of the procedure. After administration of local anaesthesia ("1.0 cc of lidocaine 2% with 1: 80,000 epinephrine, Lignocaine hydrochloride & adrenaline by Bitartrate Injection i.p, Neon Laboratory limited, Mumbai, India"), the fractured segment was atraumatically removed with 12 (Figure 4). 2% chlorhexidine solution (Neelkanth, Safe Plus, Chlorhexidine Gluconate, Rajasthan, India) was used for disinfection of fractured segment & was then preserved in isotonic saline solution (Figure 5). Vents were created in the crown & also internal groove in the dentin was given (Figure 6).

RCT was completed with 12 (Figure 7) & post space preparation was done with the help of GG drills (Kerr Dental, USA) & Peesoreamers (Mani, Japan) (Figure 8). Post fit was checked (Figure 9). A 1.1 mm diameter esthetic post ("Angelus, REFORPOST, Londrina, Brazil") was selected. 37% phosphoric acid (Prime, Thane, India) was used for 15 minutes for etching of the prepared post. Rinsing with water was done thoroughly & a cotton pellet was used for the removal of excess water. The adhesive was then applied both on the post & etched surface, & further air-thinning and light-curing were done for 10 seconds. Calibra Universal cement (Dentsply Sirona, North Carolina) was used for luting of post leaving 2mm of the coronal portion of post extension into the chamber (Figure 10). 15 BP blade was used for elevation of buccal & palatal full-thickness mucoperiosteal flap, for gaining access up to the gingival extent of fracture line as well as for better evaluation of its connection to crestal bone (Figure 11A, 11B). After achieving hemostasis, the dual-cure resin was used for luting the post & resin cement for reattaching the fractured segment (Figure. 12A, 12B). The flap was then placed in position followed by suturing (Figure 13). Immediate post-op radiograph was taken (Figure 14). After 7 days follow up it was seen that endodontic as well as restorative management was acceptable clinically (Figure 15). Favourable healing was appreciated clinically as well as radiographically after 3, 6 months (Figure 16, 17) & 1 year follow up (Figure 18).

After 3 months of follow up, the patient further underwent orthodontic treatment for proclination & generalised spacing of teeth. The patient was bonded with a 0.022MBT bracket system & light wire forces were applied with round NiTi wire. Gradually the wire was progressed every month till round stainless steel wire. Follow up radiograph was taken every 3 months for inspection of mobility or root resorption. Since no mobility or peri-apical changes could be appreciated, hence the orthodontic treatment was further continued with complete space closure & progressive correction in proclination.

Figure 1 Pre-Operative Radiograph

Figure 2 Clinical Preoperative Picture

Figure 3 After Removal Of The Fragment

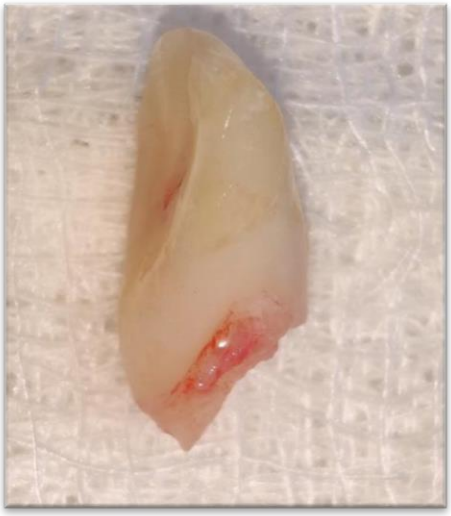

Figure 4 Fractured Segment

Figure 5 Storage in Isotonic Saline

Figure 6 Venting in Crown

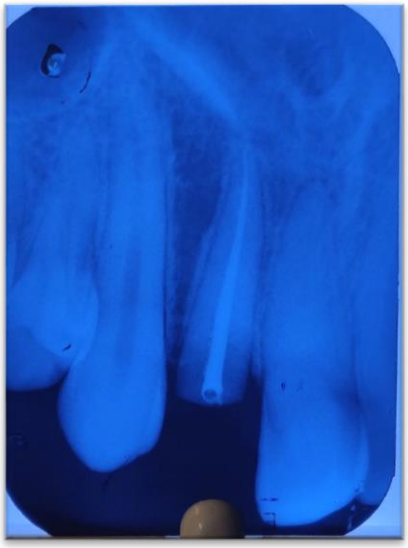

Figure 7 Obturation

Figure 8 Post Space Preparation

Figure 9 Post Fit Check

Figure 10 Fibre Post Placement

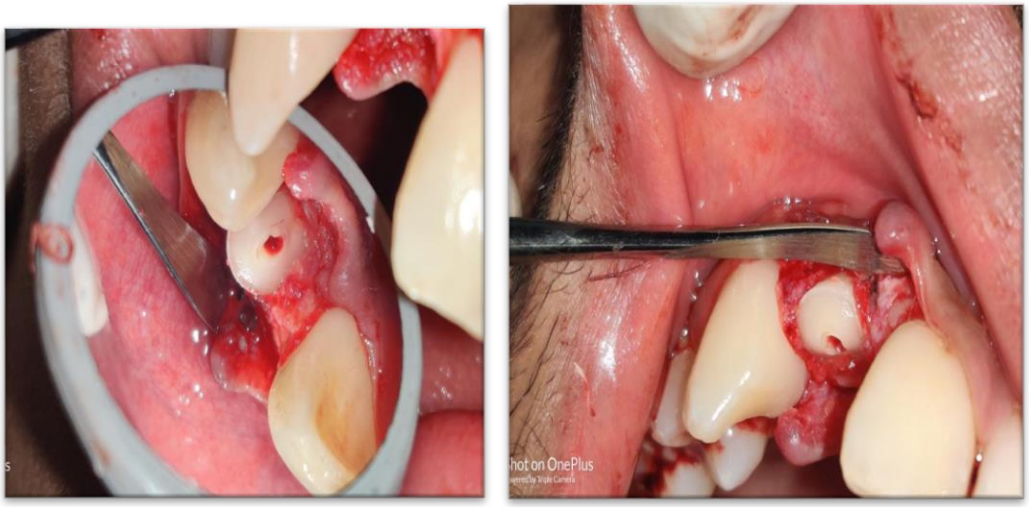

Figure 11A, 11B Mucoperiosteal Flap Raisement

Figure12 A, 12B Reattachment of Fragment (Figure 12A) Buccal aspect (Figure 12 B) Palatal view

Figure 13 Suturing

Figure 14 and 15 Suture Removal after 7 Days Immediate Post Operative Radiograph

Figure 16 Follow up after 3 Months

Figure 17 Follow up after 6 months

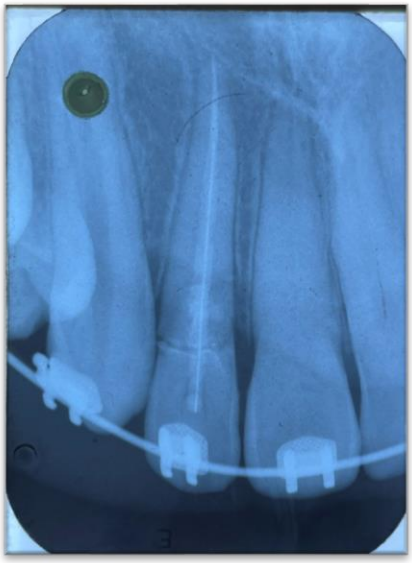

Figure 18 Follow up after 1 year

3. DISCUSSION

Full & partial coverage crowns, "laminate veneers" & composite resins are some of the traditional methods used in restoring fractured teeth. But these come with several disadvantages like it being time-consuming, expensive, & not much conservative. In 1964, Chosack & Eidelman were the first one to give in a detailed description of the restorating of fractured teeth with the help of tooth fragments which could offer a perfect way to re-establish the natural contour, shape, occlusal alignment, surface texture & colour of the fragment (Sathe et al., 2019). Also, it allows restoring of teeth without destructing much residual tooth structure. In literature, the mounting numbers of case reports have suggested that reattaching the fractured tooth fragment proved to be a doable route for the management of coronal fracture of frontal teeth if there is the availability of a fractured segment. Among several factors influencing the success of reattachment, the most important being is “hydration of fractured segment outside the oral cavity”. This is obligatory for maintaining the vitality & natural aesthetic look of the tooth and ensuring ample bond strength. Hence, after separation of the fractured fragment, hydration was clinched by storing it in, "sterile isotonic saline". Whenever a significant associated periodontal injury has occurred or the biological width is invaded, the restorative management of coronal fracture should also be considering rehabilitation of the associated tissue.

In the present case, fracture line extension was subgingival in the mesio-palatal area without disturbing the biological width. Upon examining clinically, the biological width was seen to be invaded minimally, indicating no need of necessitating osteotomy procedure. In addition, the margins of restoration can be positioned right over the cementoenamel junction. For smooth and ideal attachment of the fragments along with margin finishing, a mucoperiosteal flap of full-thickness was raised on buccal as well as palatal aspects. After surgery, the healing period remains monotonous. Use of post for strengthening of reattached fragments has been extensively reported in the literature. Of all the available techniques with different materials which have been recommended, the best option is "resin-based restorative materials" with tooth coloured fibre post because of having various advantages like appropriate elastic modulus, good aesthetics, better bonding between post & cement, lesser chairside time, & minimum removal of tissue.

Literature also reports making use of fibre post for fractured teeth because it interconnects the two fragments, minimizing the stresses on the tooth fragment which is reattached. A vent was shaped in the coronal aspect of the detached fragment along with post space preparation which served as a leeway that aided excessive flow of cement devoid of any hydrostatic pressure build-up. Literature recommended an analogous technique for reattachment using a Ribbond material. Although having various problems, extrusion of teeth is a substitute for treating a subgingival fracture. Firstly, impairing a superior esthetics resolution the diameter of the cervical area is smaller than that of the neighbouring teeth. Secondly, a longer time is needed for achieving final results, keeping in mind the time for stabilization & extrusion. Subgingival fractures are difficult to treat having a low incidence of the healing process. “The biological width is the sum of epithelial & connective tissue attachment lengths.”

According to previous studies, if the fracture invades the biological width flap, the surgical option should have opted with minimum osteotomy & osteoplasty (Reddy et al., 2019). On the other hand, others reported that in cases where biological width was minimally invaded, the organism itself restores the biological width, on a condition that plaque is properly controlled. For

providing strength to the restoration & preventing microleakage an external chamber was prepared on the labial surface of enamel. According to few authors, reattachment of coronal fragments with that of residual tooth structure, by making use of an "over contour / internal groove technique" provided increased fracture strength to teeth which is restored. In this case, “a dual-curing luting adhesive composite system, glass fibre reinforced composite” was used to adhere the canal post with an original fragment of the crown. This technique helps in fortification to the restored segments & also leads to amplifying the longevity as well as survival. In this case, for increasing the retention of the fragment, grooves were made in the dentin surrounding the pulp chamber & were packed with hybrid composite while reattaching. For inhibiting microleakage which will occur due to enamel cracks & for having more retention, micro filled composite was veneered on the labial surface of the teeth.

Fitness, contour, & surface finishing of subgingival restoration are several factors on which the prognosis of the reattached tooth will depend, which may lead to an increase in plaque retention. Providing helpful plaque & diet control, the restoration will maintain its presentation. It has been suggested for creating vents on the remnant structure of the teeth, leading to greater bonding between resin & remaining tooth structure. During orthodontic movement, light, short-acting forces (<70gms) were used. The use of heat-activated & super elastic wires & a smaller rectangular stainless steel wire during incisor retraction & finishing played a role in this finding. Aesthetics is a boon for professional progress, communal interaction, & establishing a relationship with likewise attractive people (Pisulkar et al., 2019).

5. CONCLUSION

Various aspects govern the selection of technique or the alliance of materials for reattaching the fragment. Reattaching the fractured fragment has been proved to be a booming technique in this case scenario for restoration of aesthetic form & function. Because there are few long-term published studies on the prognosis of reattachment procedures, the patient should be well versed of the potential intervening effectiveness of interventions. In patients with fragmented teeth as a result of trauma, alleviating discomfort with immediate aesthetic repair fragment reattachment meets the therapeutic goal.

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Informed Consent

Written & Oral informed consent was obtained from the patient included in the study.

Author Contributions

AJ and AI – Initiated the publication concept and contributed to the manuscript's development
PC - Data collection
AJ- Identified the condition
AJ, AI, PC, MC- Revaluated and updated the manuscript.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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