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Management of Complicated Crown Root Fracture By Adhesive Fragment Reattachment (AFR) Using Fibre Post in A Paediatric Patient

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Abstract

This case report documents the multifaceted approach to managing the horizontal complicated crown root fracture in the permanent right and left maxillary central incisors of a young female patient. The trauma, resulting from a fall during outdoor activity, led to pain and mobility in the fractured teeth. The fractured segments were immediately detached and then placed in normal saline, followed by a calcium hydroxide dressing. Endodontic intervention is comprised of apexification, post-space preparation, and post-insertion. An mucoperiosteal flap was elevated to facilitate reattachment of the fractured segments using dual-cure resin supported by the fiber post. Long-term follow-up revealed successful healing, with both function and aesthetics restored. Here, we provide a case study highlighting the significance of a comprehensive treatment approach for the successful management of complex dental trauma in pediatric patients.

Keywords: Dental trauma, fragment, reattachment, Apexification

Introduction

Dental trauma accounts for 5% of all the traumatic injuries requiring emergency care. Complicated crown-root fractures, encompassing damage to the enamel,

dentin, cementum, and pulp, constitute 0.3% - 5% of all the dental injuries in permanent teeth[1–2]. These injuries are categorized based on pulp involvement as uncomplicated (without pulp exposure) or complicated (with pulp exposure).[1] Traumatic dental injuries primarily affect the maxillary anterior teeth and often lead to functional, psychological, aesthetic, and phonetic concerns. [3–4]Treatment in such patients is dependent on a thorough assessment of periodontal, endodontic, and restorative aspects along with addressing the substantial biological challenges necessary for successful outcomes Literature states, that compression zones are considered to be created after a tooth is subjected to horizontal force and are located apically on the labial aspect and cervically on the palatal aspect. The crown-root fractures are caused by shearing stresses that exist between these compression zones.[5] A complex crown-root fracture (CRF) usually manifests clinically as a fracture line that begins labially in the crown region, extends obliquely in the apical and palatal directions, and is frequently accompanied by pulp exposure. These fractures can consist of a completely detached or partially attached coronal fragment. The management of complicated crown fractures is a multifaceted process influenced by various factors such as the severity and pattern of the fracture (including involvement of the biological width, endodontic issues, and alveolar bone damage), the possibility of restoring the fractured tooth (including any associated root fractures), additional injuries (such as damage to soft tissues), the presence or absence of fractured tooth fragments, and their suitability for reattachment. The following case report describes the management of horizontal crown root fractures in permanent maxillary central incisors by endodontic intervention, followed by the adhesive reattachment of displaced fragments using a glass fiber post.

Case Report

A girl in her early adolescence presented to the Department of Paediatric and Preventive Dentistry with the chief complaint of discomfort and mobility in the upper front teeth region for one week , and a desire to have the affected teeth restored to achieve an aesthetic smile. A patient's dental history reveals an accidental injury during an outdoor activity 6-7 days ago. Following trauma, a general practitioner provided appropriate medical care, covering tetanus toxoid, prescribing painkillers, and advising extraction. Medical history was not a contributing factor, and further extraoral examination revealed there were no affected lymph nodes, no lacerations, or noticeable asymmetry of the face. On intraoral clinical examination, it was seen that the patient was in her mixed dentition stage with grade II mobility in 11 and grade III mobility in 21. Fractured fragments were attached to the junctional epithelium and the adjacent connective tissue **(Figure. 1A).** Both teeth were non-tender on percussion, and no associated mobility was observed in the remaining segment of the injured tooth. Fracture involved enamel, dentin, pulp, and a minor part of the cementum palatally. The fracture line in 11 was equigingival buccally and extended in an oblique direction in both tooth. In 21, the pattern of fracture was similar to that in 11, but the extent of the fracture line was coronal to the gingival margin with an associated incisal fracture. The palatal extension of the fracture line for both teeth was extending below the level of the alveolar bone crest. Radiographic examination revealed a horizontal radiolucent line separating the apical and coronal segments. An additional finding of missing bilateral permanent mandibular lateral incisors was noted in OPG **(Figure.1 B and C**). Consequently, a definitive diagnosis of a complicated crown-root fracture in the

permanent maxillary left and right central incisors was made. Thus, a non-surgical orthograde endodontic treatment was planned with a single-step apexification using MTA and the fractured segments were reattached with the fiber post.

Investigations

An intraoral periapical (IOPA) radiograph was advised at the first visit for tooth regions 11 and 21. To assess the actual size, extent, nature, and position of the periapical lesion, cone beam computed tomography (CBCT) was done preoperatively. Intraoral periapical radiographs were taken at subsequent visits for diagnosis and later to assess healing.

Differential diagnosis

Clinically, the fractured segments were mobile and attached by the gingival tissue. The fracture line was extending longitudinally towards the subgingival area, compromising the biologic width. Radiographically, the fracture involved the enamel, dentin, pulp, and cementum. There was an oblique extension of fracture line bucco-lingually, and below the level of the alveolar bone crest palatally. Thus, we teased out to the final diagnosis of a complicated crown root fracture classified as Ellis (class VIII) and WHO (873.62) fracture.

Treatment

During the first visit, the teeth were anesthetized with local anesthesia (LA) using 1.0 cc of lidocaine 2% with 1:80,000 epinephrine. The fractured fragments related to teeth 11 and 21 were then gently removed until the adhesive procedure. Following removal, the segments were cleaned with 2% chlorhexidine and stored in an isotonic saline solution **(Figure.2)**. After discussing the treatment plan with the patient, endodontic treatment was initiated on the maxillary right and left central incisors. Due to the patient's delayed presentation post-trauma and the necessity for intra-radicular retention, preserving tooth vitality posed challenges. Therefore, root canal treatment was planned for the affected tooth. After isolation, access to the root apex was obtained. Shaping and cleaning of the canal were performed using endodontic K-files and H-files (MANI, Inc., Utsunomiya, Tochigi, Japan) following determination of the working length **(Figure. 3A)**. Root canal irrigation was done during instrumentation using sodium hypochlorite (5.2% NaOCl) and normal saline. The canal was then flushed with normal saline and dried using absorbent paper points. Subsequently, the root canal was filled with a paste comprising calcium hydroxide powder mixed with saline, and the patient was recalled after 1 week. During the second appointment, the apexification procedure was done**.** After one week, when the tooth appeared asymptomatic, an apexification procedure was conducted. Following rubber dam placement, copious irrigation of the canals were done and dried with paper points. This was followed by the formation of an apical MTA plug; the mix was prepared according to the manufacturer's instructions. The material was compacted into the apical 4 to 5 mm of the canal, leaving about 1 mm short of the radiographic apex. Hand pluggers were utilized to introduce and compact the material into the apical area and coronally secured with the temporary dressing (Cavit G). An intraoral periapical radiograph was taken to confirm the adequacy of the barrier formed **(Figure. 3B)**

At the third appointment, an intersulcular incision was given from the maxillary right lateral incisor to the left lateral incisor **(Figure. 4A)**. The mucoperiosteal flap was elevated to expose the intraosseous fractured margin and facilitate restorative treatment under clean and dry conditions. Glass fiber posts (Angelus Reforpost Fiber Glass) were employed to retain the fractured root fragments. These posts were adjusted to the desired

length and passively placed into the canals. Simultaneously, etching of the root canals, fiber post, and fragment was done with 37% phosphoric acid gel. After drying, the dual-cure resin cement (Coltene Paracore) was applied in the root canals and in the prepared postspace in the fractured fragment **(Figure. 4B)**. The fragment segment was approximated in such a manner that the fiber post passed through the prepared post-space in the fragment. After assurance of approximation of the fractured coronal segment to the apical segment, the excess cement material was wiped and light-cured for 40 seconds **(Figure. 4C).** Finally, the exposed fiber post was trimmed at the level of the cingulum. The gingival flap was repositioned, and the papillae were sutured with 4.0 silk braided non-absorbable suture material (SMI, Belgium) **(Figure. 4D).** Analgesics and antibiotics were prescribed to the patient with supportive, proper oral hygiene maintenance instructions. After 1 week, suture removal was done along with the minor composite restoration correction. The supragingival fracture line was masked with appropriate composite shade along with incisal edge buildup. On the palatal aspect, there was an exposed metal thread of fiber post that was masked with packable composite.

Outcome and follow-up

The patient was evaluated periodically for clinical and radiographic evaluation **(Figure. 5)**. The intraoral presentation revealed acceptable aesthetics and function**.** The restorations were well-adapted with no discoloration, and the teeth were asymptomatic. The radiographic evaluation showed complete formation of root apex and intact periodontal ligament. There was no associated root resorption. However, the clinical and radiographic evaluation at 1-year follow-up has indicated mild gingival inflammation was noticed on the buccal aspect **(Figure. 6B)** and minimal interdental bone loss between treated central incisors **(Figure. 6B).** Patient's inadequate dental hygiene habits, which facilitate plaque accumulation, may be one of the possible cause of this observation. Further periodontal assessment and corresponding treatment are planned in collaboration with the institute's Department of Periodontology.

Discussion

Epidemiology

It is estimated that over 25% of individuals under the age of 18 experience traumatic injuries that result in fractures to their anterior teeth.[6] About 80% of these cases involve the central incisors, and the remaining 16% include the lateral incisors. This prevalence is attributed to their anterior positioning and protrusion during the eruptive phase. The most common type of injury is an uncomplicated fracture involving only the enamel and dentin. Fractures extending to both the crown and root with pulpal exposure constitute a smaller percentage, ranging from 0.3–5% of all traumatic injuries. According to a review of published case reports, oblique fractures from the labial to lingual aspect are observed in around 85% of traumatized incisors, with the fracture line usually advancing apically.[7]

Management and complications

The current IADT 2020 guidelines include coronal fragment reattachment as a treatment option for uncomplicated crown fractures but not for complicated crown root fractures (CRF). [8-9] However, recent advancements in adhesive dentistry and numerous other case reports have suggested adhesive reattachment to be a successful procedure. The reattachment procedure is now being considered as an immediate, simple, and cost-effective approach when compared to other treatment strategies. [10]

The preservation of mechanical and functional integrity stands as a paramount consideration in the restoration of traumatized anterior teeth. This case report underscores a successful aesthetic management approach for a complicated crown-root fracture. Preferably, when the fractured fragment remains intact, reattachment emerges as the optimal treatment modality. Preserving natural tooth structure not only facilitates functional and aesthetic rehabilitation but also presents a financially viable alternative for patients while minimizing the loss of remaining tooth structure.[11] However, the location of the fracture within the tooth significantly influences both treatment modalities and prognostic outcomes.

Various therapeutic interventions have been proposed for subgingival fractures of anterior teeth, including orthodontic extrusion, surgical extrusion, and extraction followed by implant placement. One viable strategy involves converting subgingival fractures into supragingival fractures through gingivectomy and osteotomy procedures. Notably, the literature lacks consensus regarding the ideal technique for tooth fragment reattachment. Consequently, a systematic review was conducted to furnish dentists with evidence-based insights to inform their decision-making processes, in which they concluded that simple reattachment can be considered the currently preferred technique when there is complete fragment adaptation.[12] In another study done by Bona and Boscato, four cases of tooth fragment reattachment utilized the adhesive system and dual-cure resin cement without additional preparation, maintaining the hydration of the fragments until reattachment. Satisfactory outcomes were observed in all cases over a 3-year follow-up period, supporting the justification for reattachment without additional preparation.[13] However, the success of fragment reattachment still depends on enamel bonding for retention, with phosphoric acid-based adhesive systems remaining the gold standard despite the advantages of self-etching systems.

The reattachment cases have also shown a success rate of 78% on one-year follow-up, comparable to other treatment options like orthodontics and surgical extrusion.[14] Therefore, reattachment emerges as a cost-effective treatment option for managing complicated crown-root fractures. Fragment reattachment is effective as a long-term temporary treatment option, particularly in young patients where alternatives like fixed partial dentures or dental implants are not possible or are contraindicated, allowing for the postponement of more invasive procedures. It has been noted that fragment reattachment in crown-root fracture cases has been occasionally associated with mild gingival inflammation, so it is important to maintain periodic periodontal examinations to monitor for potential bone loss that could compromise future implant placement.

Previous studies by Nevins and Skurow[15] and Flores-de-Jacoby et al.[16] suggested a 3 mm space between the bone crest and the restoration's apical limit to maintain periodontal health. Ramfjord initially recommended placing restoration margins as far as possible from the bone crest but later acknowledged the challenge of justifying surgical bone removal solely to create a biologic width apical to the restoration margin. Instead, he proposed removing bone to the minimal extent necessary to ensure proper access for restoration placement and finishing in subgingival areas. As in the present case, a fracture involved 3mm of cementum palatally; surgical bone removal was not considered in view of the patient's young age and the apical segment being very close, which could have undermined the final fragment approximation. The literature extensively

discusses reinforcing reattached fragments using posts. Among many techniques and materials proposed, resin-based restorative materials combined with tooth-colored fiber posts emerge as a preferred option due to several advantages.[17-18] These include a suitable elastic modulus, enhanced aesthetics, robust bonding between the post and cement, reduced chair time, and minimal tissue removal.

Additionally, hydration of the fractured fragment outside the oral cavity is vital for the success of fragment reattachment. This is crucial for preserving the vitality and original aesthetic appearance of the tooth, as well as ensuring sufficient bond strength. In the reported cases, the coronal segment was separated and then stored in sterile isotonic saline to maintain hydration. This method not only provides color matching to the remnant crown and preserves incisal translucency and tooth contours.[19] but also delays the need for prosthetic restoration, especially in young patients. Hydration of the fractured fragment has an influence on the fracture resistance and is essential for moisturizing the collapsed collagen fibers.[20] During the reattachment procedure, the hydration of the fractured fragment, coupled with the hydrophilic characteristics of adhesive systems, ensures adequate bond strength.[21-22]

References

1. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries A clinical study of 1,298 cases. European journal of oral sciences. 1970 Aug;78(1-4):329-42.
2. Turgut MD, Gönül N, Altay N. Multiple complicated crown–root fracture of a permanent incisor. Dental Traumatology. 2004 Oct;20(5):288-92.
3. Castro JC, Poi WR, Manfrin TM, Zina LG. Analysis of the crown fractures and crown-root fractures due to dental trauma assisted by the Integrated Clinic from 1992 to 2002. Dental traumatology. 2005 Jun;21(3):121-6.
4. Öz İA, Haytaç MC, Toroğlu MS. Multidisciplinary approach to the rehabilitation of a crown-root fracture with original fragment for immediate esthetics: a case report with 4-year follow-up. Dental Traumatology. 2006 Feb;22(1):48-52.
5. Andreasen JO, Andreasen FM, Andersson L, editors. Textbook and color atlas of traumatic injuries to the teeth. John Wiley & Sons; 2018 Dec 17.
6. Murchison DF, Burke FJ, Worthington RB. Incisal edge reattachment: indications for use and clinical technique. British dental journal. 1999 Jun;186(12):614-9.
7. Murchison DF, Burke FJ, Worthington RB. Incisal edge reattachment: indications for use and clinical technique. British dental journal. 1999 Jun;186(12):614-9.
8. Khandelwal P, Srinivasan S, Arul B, Natanasabapathy V. Fragment reattachment after complicated crown-root fractures of anterior teeth: a systematic review. Dental Traumatology. 2021 Feb;37(1):37-52.
9. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF, Tsilingaridis G, Abbott PV, Flores MT. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent Traumatol. 2020 Aug;36(4):314-330.
10. Soliman S, Lang LM, Hahn B, Reich S, Schlagenhauf U, Krastl G, Krug R. Long-term outcome of adhesive fragment reattachment in crown-root fractured teeth. Dental Traumatology. 2020 Aug;36(4):417-26.
11. Walker M. Fractured-tooth fragment reattachment.

General dentistry. 1996 Sep 1;44(5):434-6.

12. Garcia FC, Poubel DL, Almeida JC, Toledo IP, Poi WR, Guerra EN, Rezende LV. Tooth fragment reattachment techniques—a systematic review. Dental Traumatology. 2018 Jun;34(3):135-43.
13. Della Bona A, Boscato N, of Dentistry C. Clinical evaluation of allografts and homografts for restoration of missing tooth structure. The Journal of Prosthetic Dentistry. 2000 Aug 1;84(2):163-8.
14. Faria LP, Almeida MM, Amaral MF, Pellizzer EP, Okamoto R, Mendonça MR. Orthodontic Extrusion as Treatment Option for Crown-Root Fracture: Literature Review with Systematic Criteria. The journal of contemporary dental practice. 2015 Sep 1;16(9):758-62.
15. Nevins M, Skurow HM. The intracrevicular restorative margin, the biologic width, and the maintenance of the gingival margin. International Journal of Periodontics & Restorative Dentistry. 1984 Jun 1;4(3).
16. Flores-de-Jacoby L, Zafiropoulos GG, Ciancio S. The Effect of Crown Margin Location on Plaque and Periodontal Health. International Journal of Periodontics & Restorative Dentistry. 1989 Jun 1;9(3).
17. Akyuz SN, Erdemir A. Restoration of tooth fractures using fiber post and fragment reattachment: three case reports. European Journal of General Dentistry. 2012 May;1(02):94-8.
18. Torabi K, Fattahi F. Fracture resistance of endodontically treated teeth restored by different FRC posts: An: in vitro: study. Indian Journal of Dental Research. 2009 Jul 1;20(3):282-7.
19. Shirani F, Malekipour MR, Tahririan D, Manesh VS. Effect of storage environment on the bond strength of reattachment of crown fragments to fractured teeth. Journal of Conservative Dentistry and Endodontics. 2011 Jul 1;14(3):269-72.
20. Farik B, Munksgaard EC, Kreiborg S, Andreasen JO. Adhesive bonding of fragmented anterior teeth. Dental Traumatology. 1998 Jun;14(3):119-23.
21. Capp CI, Roda MI, Tamaki R, Castanho GM, Camargo MA, De Cara AA. Reattachment of rehydrated dental fragment using two techniques. Dental Traumatology. 2009 Feb;25(1):95-9.
22. Singhal R, Pathak A. Comparison of the fracture resistance of reattached incisor tooth fragments using 4 different materials. Journal of Indian Society of Pedodontics and Preventive Dentistry. 2012 Oct 1;30(4):310-6.

Legend Figures

Figure 1 (A): Pre-operative clinical view showing fractured line in the maxillary left central incisor

Figure 1 (B): Initial orthopantomogram (OPG)

Figure 1 (C): Pre-operative intraoral periapical radiograph showing horizontal fracture line at the level of coronal third in 11 and 21

Figure 2: Disinfected fractured segment stored in saline solution

Figure 3 (A): Working length determination

Figure 3 (B): Fabrication of a 3–4-mm thick MTA apical plug in a maxillary central incisors treated with apexification

Figure 4: (A) Intraoral view during mucoperiosteal flap elevated and post space prepared in the root canals

Figure 4 (B): Post space created in the fractured tooth segments

Figure 4 (C): Reattached tooth fragment with the cemented fiber post in position

Figure 4 (D): Interrupted suture were placed

Figure 5: Post and core treatment done in maxillary central incisors

Figure 6: (A): Post-operative clinical view at 1 year follow-up

Figure 6 (B): Post-operative intra-oral periapical radiograph at 1-year follow-up

Figure 7 (A): Extra oral pre-operative photograph

Figure 7 (B): Extra oral post-operative photograph