Case report

Combined Periodontal, Endodontic, and Restorative Management of a Pediatric Maxillary Crown-Root Fracture

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Abstract

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| **Aims:** This case study illustrates the successful preservation and functional restoration of a traumatised maxillary central incisor via a multidisciplinary, conservative approach, providing further evidence in favour of integrated treatment strategies for young patients.  **Presentation of Case:** An 11-year-old female patient presented with a history of dental trauma affecting her upper right central incisor (tooth #11). An intraoral examination revealed a complex crown-root fracture involving the vestibular, palatal, mesial, distal and incisal surfaces, with a subgingival extension that compromised the biological width. The diagnosis was a complicated crown-root fracture with pulpal involvement. Treatment consisted of endodontic therapy and surgical crown lengthening to re-establish the supracrestal tissue attachment. A definitive restoration was achieved using a glassfiber post and a stratified composite build-up with a silicone guide. Despite the inability to conduct long-term follow-up due to socioeconomic limitations, the immediate outcome was aesthetically and functionally successful.  **Discussion:** This case study illustrates how a well-planned, interdisciplinary approach can effectively restore severely traumatised anterior teeth in paediatric patients, thereby avoiding extraction and maintaining aesthetics and function. Although, the lack of follow-up due to poor financial status and unavailability of the patient’s family presented itself as the main shotcoming of this case.  **Conclusion:** It emphasises the importance of individualised, conservative strategies and highlights the challenges in ensuring follow-up care for vulnerable populations. |

*Keywords: Dental trauma, Crown-root fracture, Pediatric dentistry, Multidisciplinary treatment, Case report.*

1. Introduction

Dental trauma is a prevalent public health issue, particularly among children and adolescents, with the maxillary central incisors most frequently affected due to their anterior position [1,2]. Crown-root fractures, though less common than uncomplicated crown fractures, present greater clinical challenges by compromising function, aesthetics, and periodontal attachment [3,4]. Their severity depends on trauma mechanism, impact intensity, and patient age [1].

Management often requires multidisciplinary intervention combining periodontal, endodontic, and restorative approaches to re-establish function and aesthetics [5,6]. Treatment may include orthodontic or surgical extrusion, crown lengthening, fragment reattachment, or direct/indirect restorations [7]. In children, conservative strategies are essential to preserve natural teeth, ensure proper growth, and minimise psychological impact [2,8].

Decisions must consider root development, pulp vitality, and long-term survival. While conservative management is preferred, deep subgingival fractures may require invasive endodontic procedures [9]. Thus, integrated treatment is crucial for functional and aesthetic success in paediatric cases.

This report describes the conservative, interdisciplinary management of a complicated crown-root fracture with biological width invasion, combining periodontal, endodontic, and restorative approaches.

2. Presentation of Case

This case forms part of a prospective project conducted by the Restorative Dentistry Study Group (GED) at the Federal University of Ceará, approved under protocol 4.750.328. The patient’s guardian signed informed consent for clinical management and use of anonymised data and images.

An 11-year-old female presented to the dental clinic after an accidental fall with trauma to the upper right central incisor (#11). She had no relevant medical history and no prior dental trauma. Clinical and radiographic examinations revealed a complicated crown-root fracture involving buccal, palatal, mesial, distal, and incisal surfaces, with subgingival extension compromising the supracrestal tissue attachment (Figures 1a, 1b). The patient’s parents reported that dental trauma had occurred around 21 days before seeking care, which likely contributed to pulpal compromise and the need for endodontic therapy. The tooth had been previously accessed but required complete endodontic therapy. Pulp sensibility testing was conducted whereas the results presented as negative, while clinical and radiographic findings were consistent with pulpal necrosis. Adjacent teeth were unaffected, and there was no pathological mobility or soft tissue injury.  


Figure 1: Vestibular (a) and palatal (b) view of fracture in tooth 11 involving the vestibular, palatal, mesial, distal and incisal surfaces.

Given the extension of the fracture and the patient’s age, an interdisciplinary plan was established over two sessions, combining endodontic, periodontal, and restorative procedures.



Figure 2: Case timeline.

During the first session, local anaesthesia was administered, and endodontic access and pulpectomy were performed. Surgical crown lengthening followed to allow isolation and restorative planning. A sulcular incision and flap elevation exposed the fracture margin, and osteotomy was performed on the palatal surface to re-establish the biological width (Figure 3a). Once periodontal space was restored, deep cervical margin elevation (DCME) was carried out to relocate the margin to a more favourable position (Figure 3b), enabling rubber dam isolation. Endodontic treatment was then completed with mechanical instrumentation, sodium hypochlorite/EDTA irrigation, and obturation using the roll-cone technique with sealer 26, chosen due to the wide apical foramen.



Figure 3: Periodontal surgical procedure to increase the clinical crown, with detachment of gingival tissue using a simple Molt detacher (a). under absolute isolation, with a vaselined gutta-percha cone positioned inside the canal, to begin the reconstruction of the cervical portion (b).

In the second session, shade selection was confirmed, and the post space was prepared, leaving a 4 mm apical seal. A glass fiber post was cemented with dual-cure resin cement, providing reinforcement without compromising the root structure. For coronal reconstruction, a diagnostic wax-up was performed, and a silicone index was fabricated to guide the restoration. Incremental layering of composite resin reproduced the palatal wall, dentin mamelons, and enamel stratification, ensuring natural integration with adjacent teeth (Figure 4).



Figure 4: Plaster model with waxing of tooth 11 and silicone guide to perform the wall technique.

Final finishing and polishing were performed using sequential abrasives, rubbers, and polishing paste. Occlusal adjustment was carried out to achieve proper force distribution and prevent interferences. The restoration provided satisfactory function and aesthetics, and the patient and guardian were instructed on the importance of follow-up visits for monitoring and maintenance (Figures 5a-f).



Figure 5: Demarcation of transitional line angles (a), reflective and deflective zones (b). Measurements of width and length using a dry point compass (c-d). Initial (e) and final (f) photograph of the case, after finishing and polishing.

3. Discussion and Conclusion

Crown-root fractures in paediatric patients are challenging due to subgingival extension and involvement of multiple tissues. According to IADT guidelines, preserving biological width, considering root development, and meeting aesthetic demands are essential [7,9]. Early multidisciplinary care helps prevent periodontal breakdown and functional or psychological sequelae [3,6].

In this case, crown lengthening enabled exposure of the fracture margin and adequate isolation, while endodontic therapy provided a sound foundation for restoration [11]. A 4 mm apical gutta-percha plug ensured sealing, and a glass fiber post offered reinforcement with dentin-like elasticity, reducing fracture risk [14,15,16]. Additionally, the Callahan-Johnston roll-cone obturation technique was chosen to address the challenge of the wide apical foramen, allowing for better adaptation and sealing since thin dentinal walls exceed the incidence of root fractures in teeth after apexification [17,18,19].

In pediatric patients, careful management of the periodontal tissues is particularly important due to the dynamic nature of gingival contours and the risk of future soft tissue changes. Children in developmental stages, additional factors—such as their physical and psychological development, time, and financial costs—add complexity to the treatment of complex crown-root fractures in anterior teeth, making prognosis less favorable [1,4]. Restorative procedures balanced biological preservation with aesthetic needs. Incremental stratification achieved optical integration and controlled polymerisation shrinkage [17,19]. Reducing chair time and employing preoperative planning improved predictability and patient cooperation.

A limitation was the absence of long-term follow-up due to socioeconomic barriers, preventing assessment of periodontal stability and restoration longevity [21]. Despite this, the immediate outcome demonstrated that coordinated endodontic, periodontal, and restorative management can effectively preserve severely traumatised anterior teeth in children. Also, although crown-lengthening surgery can provide immediate access for restorative procedures, its indication in pediatric patients must be weighed carefully due to ongoing dental and periodontal development. It has been recommended that orthodontic extrusion as a preferable alternative, as it preserves the periodontal ligament attachment and may provide more favorable long-term periodontal conditions [2,7]. In the present case, however, the surgical approach was selected because of the subgingival extension of the fracture, the urgent need to restore function and aesthetics, and the limited feasibility of orthodontic traction given the clinical and socioeconomic context.

Consent

All authors declare that ‘written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

Ethical approval

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

**Disclaimer (Artificial intelligence)**

During the preparation of this work the author(s) used ChatGPT 5o (Open AI) in order to review text fluency and language, spelling, and grammar errors. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

References

1. Petti S, Glendor U, Andersson L. (2018). World traumatic dental injury prevalence and incidence, a meta-analysis—One billion living people have had traumatic dental injuries. Dent. Traumatol, 34, 71–86.
2. Molina JR, Vann WF Jr, McIntyre JD, Trope M, Lee JY. (2008). Root fractures in children and adolescents: diagnostic considerations. Dent Traumatol, 24(5):503-9.
3. Mokhtari S, Hajian S, Sanati I. (2019) Complicated Crown-root Fracture Management Using the 180-degree Rotation Method. Int J Clin Pediatr Dent,12:247–250. doi: 10.5005/jp-journals-10005-1625.
4. Sobczak-Zagalska H, Ogonowska-Paul D, Bartmański M, Adamska P. (2024). Management of Complex Root Fractures in Young Patients—Case Series and a Literature Review. J. Clin. Med, 13, 6753.
5. Levin L, Peter F Day, Lamar Hicks, Anne O’Connell, Ashraf F Fouad, Cecilia Bourguignon. (2020). International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. DOI:  [10.1111/edt.12574](https://doi.org/10.1111/edt.12574)
6. Zhou ZL, Gao L, Sun SK, Li HS, Zhang CD, Kou WW et al. (2022). Spontaneous healing of complicated crown-root fractures in children: Two case reports. World J Clin Cases,10(18):6298-6306. doi: 10.12998/wjcc.v10.i18.6298. PMID: 35949815; PMCID: PMC9254207.
7. Antipovienė A, Narbutaitė J, Virtanen JI. (2021). Traumatic Dental Injuries, Treatment and Complications in Children and Adolescents: A Register Based Study. European Journal of Dentistry.
8. Selvaraj N, Mamat N, Taib H. (2024). Navigating Crown-Root Fracture Complexities in an Adolescent . Cureus, 16(10): e71406.
9. Krastl G, Weiger R, Filippi A, Van Waes H, Ebeleseder K, Ree M et al. (2021). Endodontic management of traumatized permanent teeth: a comprehensive review. Int Endod J, 54(8):1221-1245. doi: 10.1111/iej.13508.
10. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF et al. (2020). International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. Dent Traumatol, 36(4):314-330. doi: 10.1111/edt.12578.
11. Radwanski M, Caporossi C, Lukomska-Szymanska M, Luzi A, Sauro S. (2022). Complicated Crown Fracture of Permanent Incisors: A Conservative Treatment Case Report and a Narrative Review. Bioengineering (Basel), 18;9(9):481. doi: 10.3390/bioengineering9090481.
12. Corazza PH, Di Domênico MB, Facenda JC, Merlo EG, Borba M, Ozcan M. (2022). Fiberglass versus cast metal posts: a practical review based on mechanical properties. Brazilian Dental Science, 25(4).
13. Silva FM, Aguiar PHS, Assis HC, Lopes-Olhê FC, Mazzi-Chaves JF, Silva RG et al. (2024). Evaluation of the bonding strength of conventional, anatomized, adjustable, and CAD/CAM milled fiberglass posts in weakened endodontically treated roots. Braz Dent J, 35:e246103.
14. B. Sunil Rao, Siddhesh Bandekar, Shirin Kshirsagar & Shah Naman. (2017). Endocrown-A Unique Way of Retention-Case Report. Journal of Advances in Medicine and Medical Research, 22(3), 1–5. https://doi.org/10.9734/JAMMR/2017/32747
15. Fráter M, Lassila L, Braunitzer G, Vallittu PK, Garoushi S. (2020). Fracture resistance and marginal gap formation of post-core restorations: Influence of different fiber-reinforced composites. Clin. Oral Investig, 24:265–276.
16. Samiei M, Aghazade M, Farhadi F, Shahveghar N, Torab A, Vahid Pakdel SM. Sealing Efficacy of Single-cone Obturation Technique with MTA and CEM Cement: An in Vitro Bacterial Leakage Study. J Dent Res Dent Clin Dent Prospects. 2014 Spring;8(2):77-83.
17. Mohammadi Z. (2020). Strategies to manage permanent non-vital teeth with open apices: a clinical update. Int Dent J, 61(1):25-30.
18. Yu H, Zhu H. (2021). The management of a complicated crown-root fracture incorporating modified crown-lengthening surgery. British Dental Journal, 230(4):217-222.
19. Rech A, Olberttz M, Paiva DJ, Ribeiro AN, Gimenez T, Imparato JC. (2022). Aesthetic-functional rehabilitation of deciduous anterior teeth without removal of carious tissue: series of clinical cases. RGO-Revista Gaúcha de Odontologia, 70:e20220059.
20. Elfadil S, Nassar HI, Elbeshbeishy RA, Annamma LM. (2023). Esthetic Rehabilitation of Pediatric Patients Using Direct Bonding Technique—A Case Series Report. Children, 10(3):546.
21. Di T, Zhang X, Yu H, Yang Y, Wang L, Chen Y. (2024). Multidisciplinary treatment approach for complex crown-root fractures in child with periodontal health as the guiding principle: a case report with 8-year follow-up. BMC Oral Health, 24(1):1491.