



Case Report

Ultraconservative reattachment for managing complete crown fracture in an endodontically treated tooth

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CLINICAL SIGNIFICANCE

This ultraconservative reattachment approach offers a cost-effective and aesthetically pleasing solution for managing complete crown fractures in older patients, preserving tooth structure and function while emphasizing the importance of conservative interventions in dental trauma cases.

ABSTRACT

This case report investigates an ultraconservative approach to managing a complete crown fracture in a 56-year-old patient with a previously endodontically treated tooth (tooth 21; treated ten years ago). The study contributes to the existing literature by illustrating a conservative and cost-effective intervention for preserving a traumatically injured tooth in elderly individuals. Radiographic examination not only confirmed the fracture but also highlighted the prior successful endodontic treatment, observing a normal periodontal ligament. The ultraconservative approach included meticulous post-preparation in two-thirds of the root canal space, insertion of a prefabricated post, and reattachment of the fragment using a resin composite. The primary outcome showcased the successful adhesive reattachment of the fractured crown, preserving function, aesthetics, and tooth structure. This approach underscores the viability of preserving traumatized teeth in older individuals with a history of endodontic treatment, emphasizing both clinical success and cost-effectiveness.

1. Introduction

Coronal fractures of anterior teeth resulting from traumatic injuries are widespread across diverse age groups. Maxillary central incisors, with their proclined angulation, are particularly prone to such fractures, leading to challenges in phonetics, function, and aesthetics. Swift attention is crucial to mitigate structural, functional, and psychological impacts. Achieving optimal therapeutic outcomes necessitates a multidisciplinary approach involving all dental specialties and utilizing available materials to preserve dental tissues—an essential objective in the conclusive stages of treatment.¹

However, recent advancements in acid-etching techniques and dentinal adhesives have spurred an increase in minimally invasive approaches among dentists, extending to tooth reattachment procedures.² While universal complex treatments such as tooth extraction and replacement, along with multidisciplinary approaches, may be time-consuming, expensive, and aesthetically unsatisfactory, simpler treatments offer a diverse array of options—from composite resin restoration to fragment reattachment. From a psycho-social perspective, the latter option presents advantages for the patient, providing immediate rehabilitation using their tissue.³ This technique ensures complete aesthetic restoration, preserving all macroscopic tooth characteristics, including shape, contour, alignment, translucency, surface texture, and positioning.^{4,5}

The success of the reattachment procedure is influenced by various factors, including the site and size of the fracture, root maturity, periodontal status, the choice of material, and pulpal involvement. Crown-root fractures are typically classified as complicated or uncomplicated based on pulp involvement. However, there are currently no such classifications for

endodontically treated teeth globally. Complicated crown fractures involve enamel and dentin damage with pulp exposure, with trauma incidence ranging between 2-13%.¹ Common causes include falls, traffic accidents, domestic violence, fights, and sports-related injuries.

In complicated coronal fractures, the reattachment of fractured tooth fragments emerges as a favorable and conservative treatment modality. This article outlines the successful treatment of a fractured maxillary central incisor through a straightforward reattachment procedure.

2. Case Description

A 56-year-old male was referred to our private dental clinic due to a complete crown fracture in tooth 21 following a fall in his home yard. The affected tooth had undergone endodontic treatment ten years ago (Fig. 1A). Extra-oral examination revealed no significant findings. Intra-oral assessment unveiled an oblique fracture extending subgingivally, with the palatal margin approximately 2 mm from the free gingival margins (Fig. 1B). The patient provided a fragment retrieved from the incident, which was maintained in a dry condition (Fig. 1C). Radiographic examination not only affirmed the clinical diagnosis of an endodontically treated tooth 21 with an oblique complicated crown-root fracture but also demonstrated the success of the prior endodontic treatment (Fig. 1D). As there were no wounds, tetanus prophylaxis was not deemed necessary. The final diagnosis was an endodontically treated tooth 21 exhibiting an oblique complicated crown-root fracture.

Various treatment options were presented, including tooth extraction and replacement with an implant, periodontal surgery followed by prosthetic post and crown replacement, orthodontic

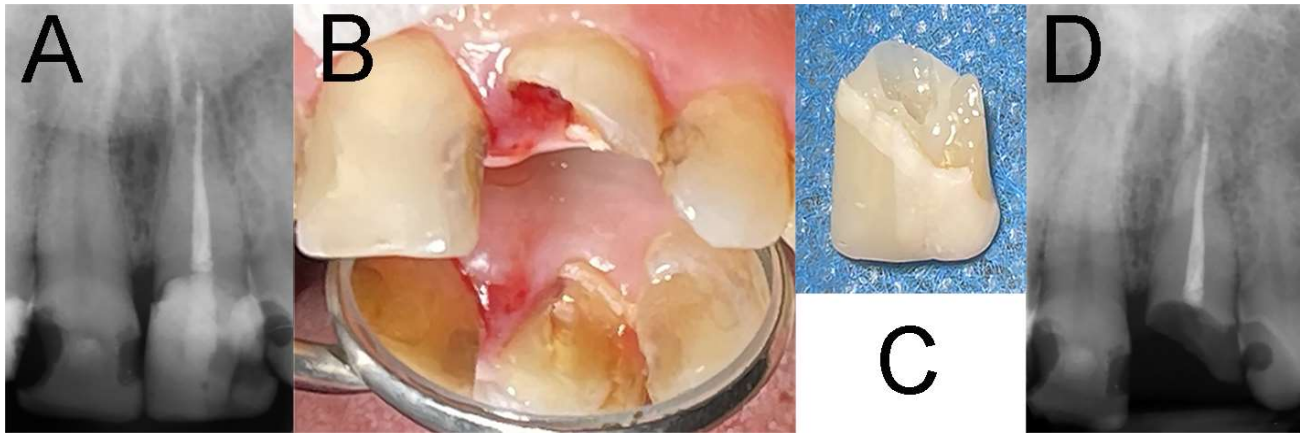


Fig. 1. Pre-operative radiographs and images illustrating the case of a 56-year-old male with a complete crown fracture in tooth 21: A) A periapical radiograph before the trauma showing the fractured tooth 21 had undergone endodontic treatment ten years ago. B) Intra-oral view revealing the oblique fracture of tooth 21, extending subgingivally, with the palatal margin ~2 mm from the free gingival margins. C) Fragment retrieved from the incident, maintained in a dry condition. D) Radiographic examination confirming the clinical diagnosis of an endodontically treated tooth 21 with an oblique complicated crown-root fracture, demonstrating the success of the prior endodontic treatment.

forced eruption followed by prosthetic post and crown replacement, or a straightforward immediate reattachment. After a meticulous evaluation of the fragment condition and fit, the decision was made in favor of reattachment. The patient opted for reattachment, and informed consent was obtained before initiating the procedure. No relevant medical or dental history was

identified.

The fractured segment, retrieved by the patient immediately after the trauma, was meticulously preserved in normal saline during the time between the clinical examination and reattachment, which took approximately 20 minutes. The treatment commenced with the cauterization of the free gingiva

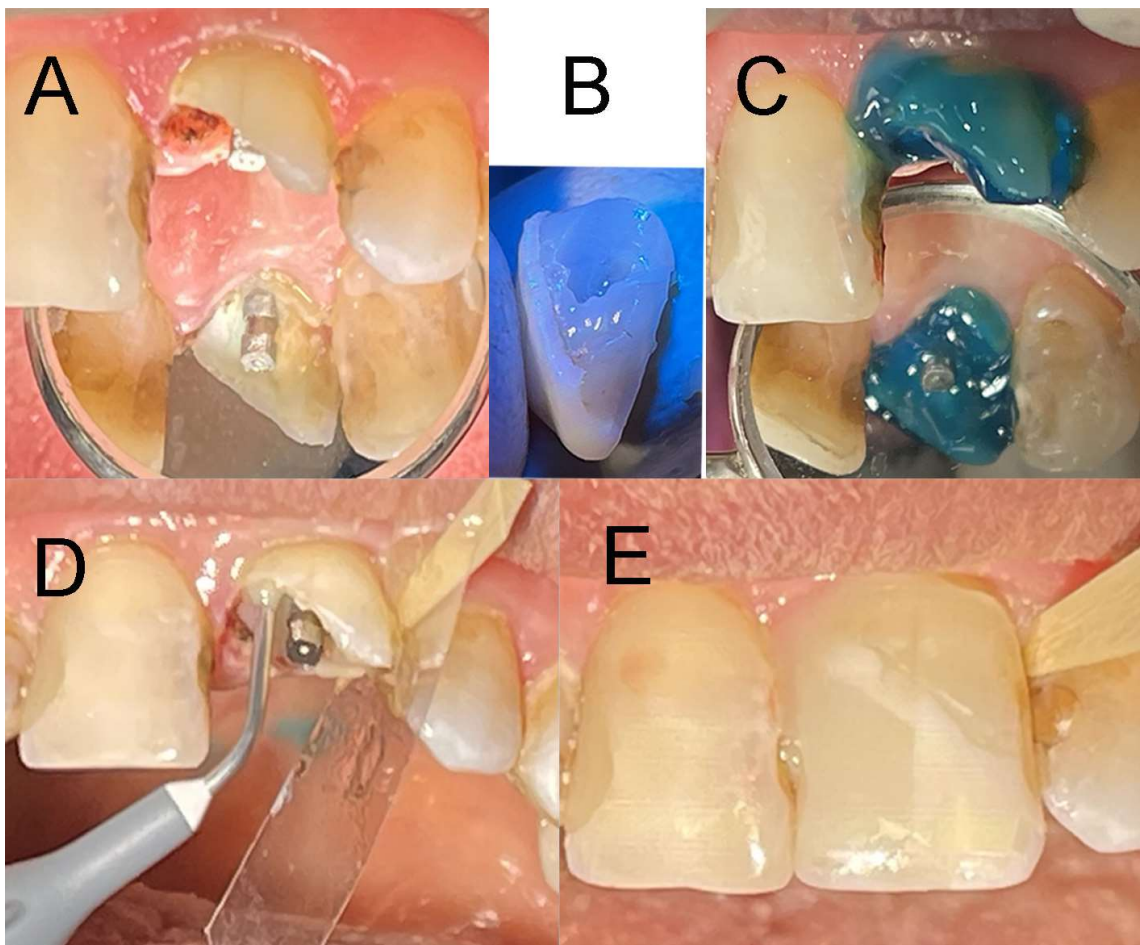


Fig. 2. Illustration of the treatment steps for the adhesive reattachment of the fractured crown in tooth 21: A) Meticulous post space preparation in two-thirds of the root canal space, ensuring proper fit and stability of the prefabricated post. B) Preparation of the fractured segment, including etching, rinsing, drying, and application of a light-curing bonding system in readiness for reattachment. C) Similar preparation steps repeated for the remaining tooth structure. D) Application of flowable resin-based dental composite restorative material for the reattachment of the fractured crown. E) Successful reattachment of the fractured crown without the need for surgical procedures, showcasing the effectiveness of the ultraconservative approach.

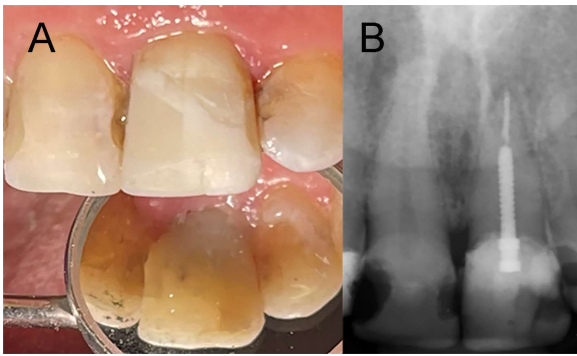


Fig. 3. Clinical follow-ups and radiographic evaluation after adhesive reattachment: A) clinical follow-ups with the patient expressing satisfaction regarding treatment. B) Radiographic evaluation after one year demonstrating successful results.

(under local anesthesia), followed by the detailed preparation of the post space in two-thirds of the root canal space using Gates Glidden burs #2-4 (DiaDent Group International, Korea), minimizing the removal of tooth structure. Given the subgingival nature of the fracture, the decision not to apply a rubber dam was made, considering that its use in this case might introduce further trauma to the gingiva. Subsequently, a prefabricated conical screw post (Long 2; Dental, Nordin, Swiss) was inserted and cemented using glass ionomer cement (Fuji II, GC Europe NV Leuven, Belgium), ensuring meticulous post space preparation for the proper fit and stability of the prefabricated post (Figure 2A). Despite the potential advantages of fiber posts, such as their ability to bond with tooth structure, it should be noted that in the present case, a metal post was preferred for its strength and stability.

The fractured segment underwent careful preparation to align with the remaining tooth structure and the inserted post. The prepared crown surfaces were then etched, rinsed, dried, and a light-curing bonding system (Scotchbond Multi-purpose; 3M, St. Paul, MN, USA) was applied in preparation for reattachment (Figure 2B). This process was replicated for the remaining tooth structure (Figure 2C). Utilizing flowable resin-based dental composite (3M ESPE, Seefeld, Germany) restorative material (Figure 2D), the crown was reattached without requiring surgical procedures (Figure 2E). The cauterization of the free gingiva played a pivotal role in maintaining a moisture-free environment during the procedure. Restorative margins were meticulously refined using diamond burs (KG Sorensen, Barueri, SP, Brazil), and occlusion adjustments were made to minimize occlusal interactions. The patient received explicit instructions to avoid exerting heavy pressure on the tooth and to adhere to proper oral hygiene practices.

Subsequent clinical follow-ups at regular intervals, conducted at three-month intervals, showcased positive patient feedback regarding the treatment and care received (Figure 3A). Throughout the follow-up period, there were no reported signs or symptoms, and radiographic evaluation after a year affirmed the success of the procedure (Figure 3B). Importantly, no adverse events were documented, solidifying the favorable outcome of the ultraconservative approach in managing the complete crown fracture.

3. Discussion

The ultraconservative reattachment approach demonstrated immediate treatment benefits, showcasing its efficacy in preserving traumatized teeth in older individuals with a history of previous endodontic treatment. Despite challenges posed by fractures extending subgingivally, satisfactory outcomes were achieved without resorting to surgery, thanks to the meticulous treatment protocol and the application of cauterization of the free

gingiva. The simplicity of the reattachment procedure, along with immediate restoration, supported the observed clinical success over time.

When a tooth fragment is available, reattachment is the preferred approach; in cases where the fragment is not available, covering the dentin with a glass ionomer or a bonding agent and composite resin is recommended.¹ If a post is needed to retain a crown in a mature tooth with complete root formation, root canal treatment remains the preferred method.⁶ The utilization of a prefabricated post, combined with meticulous post-space preparation, played a critical role in reattachment and achieving long-term success. Metal posts, though strong and stable, may pose challenges in terms of esthetics due to their opacity and potential for displaying a metallic hue. The decision not to apply a fiber post in this case was based on considerations of strength and stability. However, the choice of post material should be tailored to the specific clinical scenario, and in the context of this case, a metal post was preferred for its strength.

In comparison with conventional composite restoration, tooth fragment reattachment offers conservatism, a favorable wear mechanism, color matching with the remaining crown portion, preservation of incisal translucency, maintenance of the same occlusal contacts and natural tooth contours, color stability of the enamel, as well as ease of treatment and cost-effectiveness.^{4,6} This highlights the multifaceted advantages of tooth fragment reattachment, emphasizing its superiority over traditional composite restoration methods. The conservative nature of reattachment not only preserves tooth structure but also enhances aesthetic and functional outcomes, making it a valuable option in cases of crown fractures.

In treating anterior tooth trauma, especially common in children and young adults, the ultraconservative reattachment approach offers advantages. Young individuals benefit from higher tissue regenerative potential, predictable pulpal, and periodontal healing, and enhanced aesthetics with natural tooth structure preservation. Factors affecting the treatment approach differ between age groups. Young individuals may have ongoing tooth development and a more resilient periodontium, influencing treatment decisions. The psychological impact of trauma and the importance of immediate restoration for psychosocial well-being are significant considerations in this demographic.

In this case, no preparation on the tooth surface or fragment, such as beveling, was performed. This decision was based on the consideration that the ultraconservative reattachment approach aims to preserve the maximum amount of tooth structure.¹ Beveling, although a common technique in certain restorative procedures, was intentionally avoided in this case to minimize the removal of healthy dental tissues. The goal was to achieve a conservative restoration that maintains the natural tooth contour, alignment, and translucency without compromising structural integrity.

Regarding the choice of flowable resin composite for reattachment, we selected this material due to its specific properties aligning with the requirements of the ultraconservative approach.⁴ Flowable resin composites offer low viscosity, enabling easy adaptation to irregularities and ensuring a close fit between the fractured segment and the remaining tooth structure. The material's flowability allows for precise placement and minimizes the risk of voids, contributing to improved marginal integrity. Additionally, flowable resin composites exhibit good adhesive properties, promoting effective bonding between the tooth surfaces and the reattached fragment.⁴ The adhesive strength is essential for the long-term stability and durability of the

restoration. Moreover, the material's optical characteristics, such as translucency and color matching, contribute to achieving aesthetic outcomes by closely mimicking the natural tooth appearance.

Acknowledging limitations, the success of the ultraconservative reattachment approach is influenced by fracture extent, location, patient variables, and clinician expertise. Limitations include the decision not to use a rubber dam, potential esthetic concerns with metal posts, and other factors discussed in the case report.

4. Conclusion

Our study demonstrates the effectiveness of an ultraconservative reattachment approach in managing complete crown fractures, particularly in older individuals with a history of endodontic treatment. The meticulous treatment protocol, including cauterization of the free gingiva, and the utilization of a prefabricated post with a precise post space preparation, achieved immediate and sustained clinical outcomes. In addition, this ultraconservative method not only preserves tooth structure but also provides favorable aesthetic and functional results, underscoring its superiority over traditional composite restoration methods or other complex treatments for replacing the fractured tooth i.e. implant. The multifaceted advantages, including conservatism, color matching, and ease of treatment, make tooth fragment reattachment a valuable option for cases of crown fractures. Our findings support the importance of immediate restoration in successfully managing complicated crown-root fractures.

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CRedit Author Statement

S. A. : Conceptualization, Methodology, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision, Project administration, Funding acquisition

Conflict of Interest

The authors declare no conflict of interest.

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