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The power of reattachment: Conservative restoration of fractured anterior teeth

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Abstract
Coronal fractures of anterior teeth are amongst the most common dental trauma related condition which significantly hamper effective treatment plan. Among various therapeutic options, reattachment of a fractured crown fragment is a conservative approach that merits consideration for cases of crown fractures involving anterior teeth. This case illustrates a complex treatment sequence involving gutta percha removal, root canal debridement, and obturation. The success rate of endodontic treatment can be maximized by meticulously adhering to standard clinical practices and using advanced techniques. The advantages of direct composite veneers include minimal tooth preparation requirements, reversibility of treatment, absence of the need for an extra adhesive cementing system, and economical cost in comparison to indirect procedures and alternative restoration systems.

Keywords: Direct composite, discolouration, fragment reattachment, veneer

Introduction
Coronal fractures of anterior teeth are a frequent dental trauma related condition, often posing challenges to the development and execution of an effective treatment strategy. Among various therapeutic options reattachment of fractured crown fragment is a conservative approach that merits consideration for cases of crown fractures involving the incisors. This method preserves the tooth's natural surface texture and translucence, which are critical for aesthetics. Coronal fractures of anterior teeth can be treated specially well by reattaching fractured portion of the crown to a broken tooth [1].

In order to avoid re-infection, endodontic therapy aims to remove the diseased pulp tissue, thorough debridement and disinfection of root canal system, and prepare and obturate the canal with a biocompatible material. Failure of endodontic treatment occurs when the procedure does not adhere to standard clinical practices. Persistent microbial bacteria, inadequate filling of the root canal (underfilling), over extension of root canal obturating materials (Over-obturation), inadequate apical seal, untreated canals, procedural errors, and complications due to instrumentation are the factors that contribute to endodontic treatment failure [2].

Endodontic re-treatment involves re-treating a tooth that has previously undergone endodontic treatment and requires further intervention to achieve a successful outcome. The success rate of endodontic retreatment can be governed by variable factors, including the skill and experience of the endodontist, complexity of the initial treatment, presence of persistent infection, and condition of the surrounding dental tissue. Studies suggest that up to 50% of a clinician's work may be represented by endodontic re-treatments, highlighting the importance of this procedure in clinical practice.

Several biological and technical factors contribute to the persistence of infection and failure of endodontic treatment. These include presence of an intra-radicular infection in the apical root canal anatomy, inadequate debridement of the root canal, lack of an effective disinfectant, and inability to achieve a proper apical seal. Understanding these factors play a pivotal role for development of enhanced treatment strategies and optimization of favourable patient outcomes. Reattachment of a coronal fragment to a fractured tooth is a technique which preserves the natural surface texture and translucency of the tooth,

which are essential for aesthetics. This approach is particularly effective for treatment of coronal fractures of anterior teeth and is considered the first choice for these cases [3].

Endodontic treatment failure may occur due to a variety of factors, including persistent bacterial microorganisms, inadequate filling of the canal (Underfilling), overextension of root canal filling material (Over-obturation), inadequate apical seal, untreated canals, procedural errors, and complications due to instrumentation. By meticulously adhering to standard clinical practices and using advanced techniques, the success rate of endodontic treatment can be maximized.

Case Report

A 34-year-old male, presented with a complex dental issue involving an oblique fracture of the maxillary right central incisor (#21). Patient's history included previous episodes of swelling and pus discharge from the affected tooth, indicating presence of a periapical abscess. Upon clinical examination, a healed sinus tract was evident on attached gingiva in the region of #21, suggesting a history of chronic infection. Radiographic examination showed widening of periodontal space in the apical region.

Fig 1: Pre-operative periapical radiographs taken in different angulations.

Fig 2: Pre-operative images showing fractured tooth #21 with exposed oturation material.

Fractured coronal portion of the tooth was extracted to address the immediate issue of pain and infection. The root canal space was then thoroughly debrided and cleaned. The exposed gutta percha obturation was removed using H-file #30 and #35, with reaming movements and thorough irrigation with 2.5% sodium hypochlorite (NaOCl) and saline. Periapical radiographs were taken to assess the cleanliness of root canal walls and presence of any residual debris. Working length of the root canal was determined radiographically with the help of periapical radiographs. Root canal treatment was initiated using K-files, beginning with #35 and progressing to #70. With each file change, thorough irrigation was done with normal saline. Calcium hydroxide intracanal medicament (Metapex) was placed, and the patient was scheduled for recall in one week.

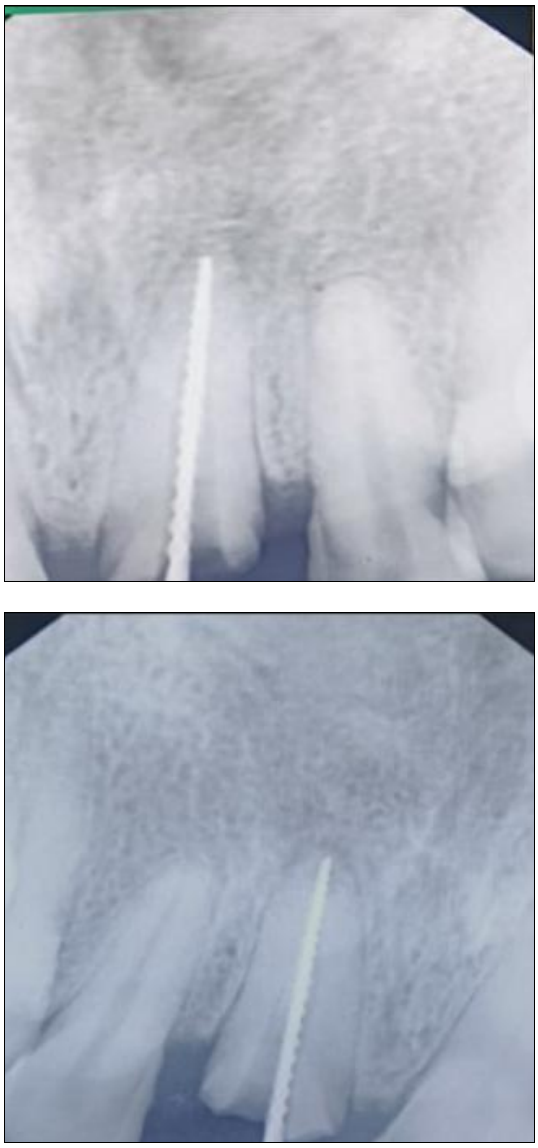

Fig 3: Radiographic evaluation of the working length after removal of previous obturation.

At the second visit, patient reported no symptoms and appeared to be asymptomatic. Root canal was obturated using sectional obturation technique, with the working length of gutta percha #70 at 21mm. Gutta percha was cut with a heat plugger to achieve a final working length of 16mm, leaving a 5mm gutta percha plug in apical root canal. The radiograph demonstrated a hermetic filling of the root canal space.

This case illustrates a complex treatment sequence involving gutta percha removal, root canal debridement, and obturation. Periapical radiographs were employed for working length determination and confirmation of root canal cleanliness in this case. Patient's history of previous infection and the presence of a pus discharge highlight the importance of thorough debridement and the potential for successful endodontic treatment in the presence of a periapical pathology.

Following completion of obturation, radicular post space preparation was done using no. 3 Peeso reamer (Mani, Japan) followed by which the fiber post (Waldent Radiopaque Composite Fibre Post) was tried in the canal and the radiograph was taken. Fiber post outside the root canal is left up to 2/3 of the length of the clinical crown to support the core. Pre-fabricated fibre post was cemented into the tooth using flowable composite resin (NanoFlow Bulk Fill,Waldent). The fractured coronal fragment was cautiously stored in saline solution. After completion of root canal treatment and post placement, fractured fragment was rinsed and cleaned thoroughly and access cavity was prepared to roughly correspond to the fibre post. Tooth fragment was placed into the post space to check the alignment with corresponding teeth. The fractured fragment was etched with 37% phosphoric acid and bonding agent was applied followed by light curing for 20 seconds. Radicular post portion of the tooth was also etched and bonded. The fiber post and tooth fragment was carefully positioned and secured in place using flowable composite resin. The restoration was then finished and polished to ensure optimal aesthetics and function.

Fig 4: Periapical radiograph showing radicular post space preparation

Fig 4: Post space preparation

Fig 5: Post cementation

Fig 6: Post-operative photograph after reattachment of fractured coronal structure

Patient was recalled after 1month for follow up to evaluate the restoration. At one-month follow-up appointment, the patient reported no discomfort or sensitivity, indicating successful root canal treatment and restoration. The radiograph demonstrated good healing and no signs of infection

Upon follow up, tooth #21 was discoloured when compared to other teeth, giving it an unaesthetic appearance. Since aim of this treatment plan was to offer a desired esthetic restoration and it was important to preserve the remaining healthy tooth structure, laminate veneers were used in this case as a conservative method of correcting the look of discolored teeth. Adoption of a more conservative treatment protocol incorporating a dependable and straightforward chair-side procedure for restoration of the teeth is made possible by advancements in current adhesive methods, improved handling qualities of resin-based composites, and preparatory designs.

To ensure a dry and moisture-free field of work prior to the placement of adhesive and composite resin, cotton rolls and gauze was placed in the buccal and labial sulcus with strong suction evacuation were used to successfully establish and maintain isolation.

The tooth was prepared for direct composite resin laminate veneer by 0.5 mm of facial reduction with high-speed, water-cooled diamond burs. The cervical border was positioned 0.5 mm above gingiva. There were no severe internal line angles in the tooth preparation, and the cervical edges were included with chamfer finish lines.

After isolation, placement of adhesive and composite resin was initiated. The labial surface of tooth #21 was etched with 37% phosphoric acid for 20 seconds and rinsed off thoroughly with water and air dried. A desensitizing agent was applied to the prepared tooth surfaces, and cotton pellets were used to gently dab the surfaces dry. A primer and bonding agent were then applied repeatedly with an applicator brush until an even, glossy surface was obtained. The tooth was air dried and light cured for 15 seconds. Direct composite veneering was initiated by layering A2 shade Nano-hybrid composite resin at the gingival margins and smoothing it and curing it with a light cure for 10 seconds. Shade A3 (IPS Empress direct™, Ivoclar Vivadent®) was added to the incisal one-third and extended to the middle one-third of the teeth surface, and then light cured for 15 seconds to blend over the shade A2 gingivally. Final layer of composite resin was smoothened over the entire labial surface from mesial to incisal and gingival to incisal one third, and then light-cured with multiple exposures to all surfaces for 10 seconds. This resulted in the tooth being slightly over-contoured with excessive composite resin, Finishing and polishing processes were done with a yellow-banded diamond bur (Mani, India), immediately followed by polishing discs (Mani, India). The polishing discs were employed in a low-speed handpiece.

Fig 7: Etching of prepared tooth surface

Fig 8: Application of bonding agent

Fig 9: Light curing the prepared tooth surface

Fig: Post-operative photograph

Aesthetic and biologic restoration can be quite difficult to restore fractured incisors. For teeth with fractures, a number of therapeutic modalities have been suggested, such as fragment removal followed by restoration [4]. Despite several advancements in adhesive materials, no restorative material can replicate the flawless appearance and performance of natural dental structures as much as they can. Reattaching a broken coronal fragment to a fractured tooth is the primary option for coronal fractures in anterior teeth because it preserves the tooth's natural translucency and surface texture. Immediately upon reattaching the original tooth fragment, the natural esthetics will be enhanced.

Since the tooth needed to be retained due to a fractured crow root, post placement was necessary in this instance. Furthermore, this process is comparatively easy, atraumatic, and inexpensive.

Numerous case studies demonstrate that effective restorations are possible even for sub-gingival tooth fractures [5]. According to studies, the fracture line in 85% of damaged incisors proceeds apically and obliquely from the labial to lingual facets. As a result, this kind of unfavorable fracture healing could be more resistant to horizontal pressures which arise from slicing or ripping food than it would be to forces applied in labial directon, such as a traumatic force itself [6]. According to a study, teeth that have undergone endodontic treatment and have seen a significant loss of structure have to be strengthened. Prior to restoration, a post-and-core procedure is advised if a tooth has lost more than 50% of its coronal structure [7].

It has been noted that after application, fiber-reinforced posts may have less instances of root fracture. Researchers has shown that cemented custom post and cores offer higher resistance to failure than dentin-bonded resin post and core restorations. Moreover, fiber-reinforced posts utilise undercuts and surface imperfections to enhance surface area and improve bonding of the prepared post space. [8] In this case, the autogenous tooth fragment was reattached to the crown using a prefabricated fiber post. Prefabricated fiber posts aid in the preservation of the coronal restoration even if they do not mechanically strengthen endodontically treated teeth [9].

Direct composite veneering is the process of replacing teeth with tooth-colored material to restore normal shape and function with little to no extra dentition removal. An enamel and dentin substitute restorative material, which closely resembles the lost tooth structure in terms of optical qualities and mechanical properties is chosen for direct composite veneering. Depending on the patient's desired aesthetic and economic commitment, the composite resin can be layered simply using one or two tones. Establishing and enhancing the restored tooth's optical, mechanical, and esthetic properties is the sole purpose of composite direct veneering.[10] The advantages of direct dental composite veneers includes minimal tooth preparation, adaptability of treatment, absence of the necessity of an extra adhesive cementing system, and its economic viability in contrast to indirect procedures and alternative restorative systems.[11] The process of composite resin polishing is simple, any artifacts, craze lines or fractures in the restoration may be fixed right away, and marginal adaption is superior to indirect laminate veneer restorations. Composite resins are now more suitable for more aesthetically pleasing outcomes, including laminate veneers, courtesy to their improved physical qualities. With benefits including one-session treatment completion, reduced prices as compared to ceramics, and no requirement for elaborate laboratory processes, direct composite veneers are becoming more and more common in this modern era of esthetic and restorative dentistry.

Conclusion

Tooth fragment reattachment is a conservative approach to restore the teeth to its original form, function and esthetics and use of composite veneers is a recommended treatment modality to effectively manage such complex cases.

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