

A multidisciplinary direct restorative approach for recovering crown-root fractures in young patients: a case report

Tratamento multidisciplinar restaurador direto para reabilitação de fraturas corono-radiculares em pacientes jovens: relato de caso

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RESUMO

O objetivo deste artigo é descrever passo a passo, um protocolo para tratamento de emergência de pacientes jovens, com abordagem multidisciplinar e restauração direta em resina composta para a reabilitação de fraturas corono-radiculares. Fraturas de incisivos superiores são uma consequência frequente de traumas em crianças e adolescentes. Pinos de fibra de vidro associados às restaurações em resina composta representam abordagem conservadora para este tipo de situação. Este artigo apresenta caso clínico de um paciente do sexo masculino de 14 anos de idade, com fratura co-

rono-radicular em incisivo lateral superior esquerdo. Inicialmente, o paciente foi submetido à cirurgia periodontal para aumento de coroa clínica. Depois, foi realizada cimentação do pino de fibra de vidro, seguido de restauração direta em resina composta. Por fim, um protetor bucal foi confeccionado para prevenir novo trauma. O tratamento multidisciplinar descrito para reabilitação de fraturas corono-radiculares é simples, proporcionando estética e função com uma abordagem conservadora em pacientes jovens.

PALAVRAS-CHAVES: Estética; Tratamento endodôntico; Cirurgia periodontal; Traumatismo dento-alveolar.

INTRODUCTION

Dental trauma is commonly associated with damage in periodontal and tooth structures¹⁻³. Fractures in maxillary central and lateral incisors are the most frequent consequence of oral trauma in children and teenagers^{4,5}, since the majority of dental injuries involve the anterior-superior teeth because of their position in dental arch⁶. When trauma affects the anterior teeth, aesthetics, psychosocial, functional and therapeutic problems also adversely affect the quality of life⁷.

The fracture can affect teeth in different levels and the treatment depends on the fracture complexity and amount of remaining tooth structure¹. Fractures exceeding the middle third of the crown can be associated with periodontal and endodontic injuries, such as invasion of the periodontal biological space and pulp exposure¹. In these cases, a multidisciplinary evaluation is a key approach to make diagnosis, treatment plan and more accurate prognosis. From the therapeutic view, this is achieved by an interdisciplinary approach combining periodontal surgery and direct restorations associated to fiber posts.

Children and teenager patients require a conservative restorative approach in cases of extensive tooth fractures. In such cases, the use of fiber glass posts associated to resin-based com-

posite restoration consists of an approach that meets the biomechanical and biological principles⁸⁻¹⁰. This case report describes the rehabilitation of a maxillary lateral incisor with crown-root fracture in a teenager patient with the state-of-the-art materials and techniques of the complex rehabilitation using multidisciplinary strategy.

CASE REPORT

Patient and Clinical Assessment

A 14 year-old male patient presented at the Dental Traumatized Patient's Assistance Program of the School of Dentistry of the Federal University of Uberlandia reporting a tooth fracture of the maxillary left lateral incisor following sport practice. The patient sought assistance 7 days after the accident occurred. The clinical examination revealed a complicated crown-root fracture in the maxillary left lateral incisor (Figure 1A and 1B). Radiographic examination demonstrated no pulp exposure and an oblique fracture involving the cemento-enamel junction extending to the biological space (Figure 2). The periodontal and occlusal conditions were found favorable and after the clinical and radiographic assessments, the treatment plan was defined



Figure 1 - (A) Crown-root fracture in the maxillary left lateral incisor; (B) Palatal view.



Figura 2 - Radiographic image of the fractured tooth before the treatment.

by the association of integrated and multidisciplinary procedures: crown lengthening surgery, endodontic therapy, fiber glass post cemented with self-adhesive cement and direct resin-based composite restoration.

Technique Report

Crown lengthening surgery

Firstly, a provisional restoration was made at the palatal surface using glass ionomer (Vidrion R, SS White, Rio de Janeiro, RJ, Brazil). As the subgingival extension of the fracture line in the palatal region extended to the biological space, a crown lengthening surgery was then required. A split-thickness conventional flap was performed and elevated to provide visibility and access to the bone and to the fractured root surface. During the elevation, the flap was totally dissected in the vestibular and palatal areas. A resective therapy at the palatal bone was necessary in order to reshape the alveolar margin (Figure 3A). The reshaping process was performed with diamond burs (3018, KG Sorensen, Barueri, SP, Brazil) copiously rinsed with physiological saline, basically as an attempt to modify the bone contour and to allow soft tissues to follow the new bone position, restoring the biological space. Once the surgery was completed and a good hemostasis was achieved, the flap was sutured in an apically displaced position (Figure 3B) and protected with surgical cement (Coe Pack, GC America Inc., Alsip, Ill, USA).

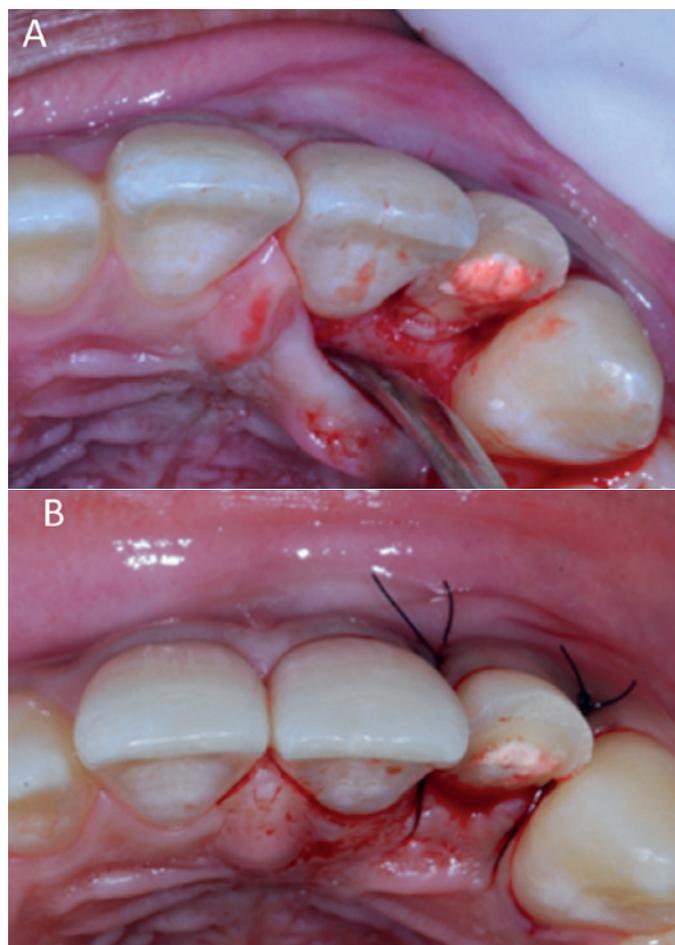


Figure 3 - (A) Crown lengthening periodontal surgery; (B) Palatal view.

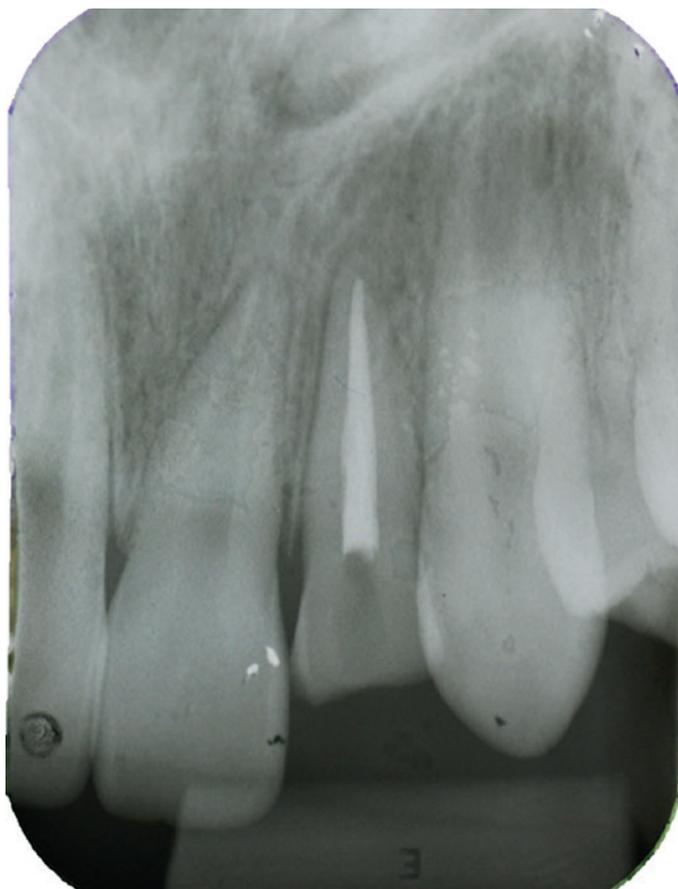


Figure 4 - Radiographic image of the endodontic treatment.



Figure 5 - Tooth color selection.

Endodontic treatment, post luting procedure and composite resin restoration

After twenty one days, the endodontic therapy was carried out in a single session using step-down instrumentation associated to 1.0% sodium hypochlorite. The root canal was filled with gutta-percha and calcium hydroxide-based cement (Sealer 26; Dentsply, Petrópolis, RJ, Brazil)¹¹ using the step-back technique with lateral and vertical condensation (Figure 4). In the same session, the color selection was performed with a VITA Shade Guide (VITA Zahnfabrik, Sackingen, Germany) and the color

was defined as A2 (Figure 5). Rubber-dam isolation was made (Figure 6A) and the post space was created initially with a heated instrument and the coronal gutta-percha was then removed with 2 and 3 Gates-Glidden drills (Dentsply Maillefer, Ballaigues, Switzerland) preserving 4 mm of endodontic filling at the apex¹². The post space was prepared with the drill supplied in the post system (White-Post n°2, FGM Produtos Odontológicos, Joinville, PR, Brazil) (Figure 6B and 6C). Once adequate post insertion had been verified in the canal, the root dentin was prepared for the luting procedure. The root dentin was rinsed with 24% EDTA followed by 0.9% saline solution¹³. Moisture excess was removed from the post space using paper points. The surface treatment of the glass fiber post was carried out by immersing it in 24% hydrogen peroxide solution for 3 min, and a silane agent was actively applied and left to react for 1 min (Prosil, FGM Produtos Odontológicos) (Figure 6D)¹⁴. Self-adhesive resin cement (RelyX Unicem; 3M-ESPE, St. Paul, MN, USA) was manipulated according to manufacturer's instructions and applied to the root canal using a #35 K-file (Dentsply Maillefer). The resin cement was applied to the post and it was set in position (Figure 6E). Excess material was removed and after 5 minutes the resin cement was light-cured with a LED-curing unit (RadiiCal; SDI, Victoria, Australia) for 40 s in each surface (Buccal, Incisal and Palatal).

After post luting procedure, the resin-based composite restoration was immediately performed. Firstly, a 45° angle bevel was made at the buccal enamel surface to improve aesthetics (Figure 7)¹⁵. The enamel and dentine surfaces were etched with 35% phosphoric acid for 30 s and 15 s (Scotchbond Etchant, 3M-ESPE), respectively, rinsed with water spray and gently air-dried. An etch-and-rinse 2-step adhesive system (Adper Single Bond Plus; 3M-ESPE) was applied to the etched surfaces according to manufacturer's instructions and photoactivated with a LED-curing unit for 20 s (Figure 8).

In this case dentin and enamel shades of nanofill resin-based composite were selected: (Filtek Z350 XT; 3M-ESPE, A2E, A2D, A2B, CT) and used to build the restoration by the incremental technique. Increments of the nanofill composite, Filtek Z350 A2E (3M ESPE) shade were applied and light polymerized for 20 seconds to create the restoration body, that is, to restore the palatal surface (Figure 9A). To mask the fracture line between the composite and tooth structure, dentin shades A2D and A2B composite resin was applied over this union line (Figure 9B). This composite resin (A2D) was also applied to create the basic facial tooth anatomy represented by dentin development lobes in younger patients. Finally, enamel shades of Filtek A2E and CT nanofill composite (3M ESPE) were selected reproducing the enamel structure and light-cured for 20 s until accomplish the final restoration using a ramped polymerization (Figure 9C). Occlusion and anterior guidance were checked to ensure that there were no premature contacts, and the restoration was finished with fine and extra fine diamond burs (2134 FF, Kg Sorensen) and polished with aluminum oxide discs (SofLex Pop-on, 3M-ESPE) (Figure 10).

Finally, an impression was taken from the upper arch (Express XT, 3M-ESPE) and full arch stone cast was poured (Durone IV, Dentsply). A custom-fitted EVA mouthguard 3.0 mm in thickness was then formed in a vacuum machine and adjusted

to patient's soft tissues in order to preventing new dental trauma (Figure 11). After 1 year, the tooth restoration remained clinically acceptable, with good aesthetics and periodontal health (Figure 12). No color change, mobility, or periodontal and radicular pathology was observed during the evaluation.

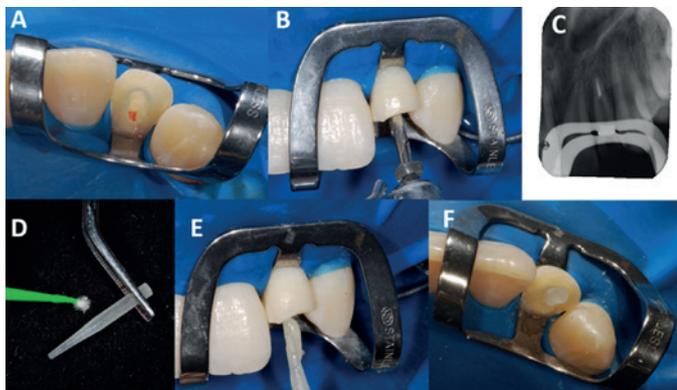


Figure 6 - Post luting procedure. (A) Rubber dam isolation; (B) Post space preparation; (C) Radiographic image of the root filling remaining at the apex (4.0 mm); (D) Surface treatment of the post; (E) Post luting; (F) Post luting procedure finalized.



Figure 7 - Beveling of the buccal enamel.



Figure 8 - Hybridization procedure. (A) Etching of the tooth structures with 35% phosphoric acid; (B) Water spray rinsing; (C) Application of the adhesive system.



Figure 9 - Incremental restorative technique. (A) Palatal surface reconstruction; (B) Increments of dentin layers; (C) Enamel surface reconstruction.



Figure 10 - Final resin-based composite restoration at the maxillary left lateral incisor.



Figure 11 - Custom-fitted Mouthguard.



Figure 12 - Aspect of the resin-based composite restoration at the maxillary left lateral incisor after 1-year.

DISCUSSION

Enamel and dentin fractures are the most common type of dental trauma occurring mostly in children and teenagers^{4, 5, 7}. Crown-root fractures represent a type of fracture that involves invasion of the periodontal tissues by fracture line and pulpal exposure in some cases. In this case, the resin-based composite restoration associated to intraradicular retention using a fiber glass post assured a suitable option for the rehabilitation¹⁶. This strategy is indicated for crown-root fractures with minor invasion of the biological space¹⁷, restoring function and aesthetics of the affected tooth as in this case report, and resulting in adequate stress-strain recovering similarly to intact teeth.

The loss of tooth structure by dental trauma with periodontal involvement and the endodontic treatment creates a condition unfavorable for the prognosis of the case. Thus, the correct diagnosis indicating a post with mechanical properties similar to root dentin, such as fiber glass posts contributes to a better

prognosis⁸. This is because these posts are able to properly distribute the stresses and strains generated by occlusal loading on the remaining tooth structure, preventing the occurrence of new failures¹⁸⁻²⁰. However, studies have shown that endodontically treated teeth are more susceptible to failures^{9, 19-21}. On this way, fiber glass posts associated with composite resin restoration can be a very appropriate restorative alternative²², since the similar mechanical properties of the restorative materials to the dental structures lead to a decrease in the occurrence of catastrophic fractures, also facilitating the repair when required^{9, 10}.

In this case report, the multidisciplinary and conservative treatment used was the best option because the patient is still in growing. Choices of materials and treatments directly influence the success or failure of rehabilitation. Initially, the endodontic filling and post luting procedure made in the same session requires the attention of the clinician about the type of sealer used. In such cases, calcium hydroxide-based sealers are indicated because the chemical components and cement cure do not influence the polymerization of the resin cements¹¹. On the other hand, eugenol-based sealers are contraindicated for luting posts with resin cements at the same session of the endodontic treatment¹¹. These endodontic sealers can contaminate dentin, impairing bonding to the root canal walls and affecting the resin cement polymerization^{11, 23}.

Following the sealer choice, the surface treatment of the post and dentin also influence the bond strength to root canal dentin. The surface treatment of the post with hydrogen peroxide promotes partial removal of the epoxy resin matrix, not damaging the post, besides increasing the bonding strength among dentin, resin cement and fiber post¹⁴. The observation of these parameters during post setting contributes to decreased adhesive failures. Lastly, the choice for a resin-based composite restoration requires no extensive preparations prior to its execution, which favors the preservation of healthy tooth structure²⁴. Also, the treatment approach used is a modality that allows full rehabilitation of tooth in a single clinical session, besides presenting low costs.

At last, the contact sports practice has increased among children and teenagers, presenting itself as the main cause of injuries and dental trauma^{25, 26}. Mouthguards reduce the likelihood of crown fracture and brain damage caused by impact forces^{25, 27}. In this clinical report, a custom-fitted EVA mouthguard (3 mm thickness) was made for patient use in sports practice. Custom-fitted mouthguards are more acceptable for teenagers because they have advantages in terms of comfort, fit, stability, respiratory capacity, phonetics and provide better protection for dental structures²⁵.

CONCLUSION

It was concluded that the multidisciplinary direct restorative treatment described for crown-root fracture rehabilitation is technically simple to execute, providing esthetics and function with a conservative approach, being suitable for young patients. The follow-up of these cases, as well as the prevention of future accidents with the use of mouthguards is essential for successful rehabilitation of these patients.

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ABSTRACT

The aim of this article is to describe a step-by-step protocol for emergency care of a young patient with multidisciplinary direct restorative approach for recovering crown-root fractures. Fractures of maxillary incisors are a frequent consequence of trauma in children and teenagers. Glass fiber post associated with composite resin restoration represents a conservative approach for this rehabilitation. This paper presents a case of a 14-year-old male patient with a crown-root fracture in a left maxillary lateral

incisor. The patient was submitted to a periodontal surgery for coronal lengthening. After that, the post luting and restoration technique was performed. Finally, a mouthguard was made for preventing new trauma. The multidisciplinary treatment described for crown-root fracture rehabilitation is simple, providing esthetics and function with a conservative approach in younger patients.

KEY WORDS: Aesthetics; Root Canal Treatment; Flap Surgery; Dental Trauma.

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