Tooth fragment re-attachment in fracture with biological width violation: Case

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ABSTRACT
Dento-alveolar traumas are one of the most frequent injuries to teeth, mainly affecting the upper incisors due to their exposed position in the dental arch. In such cases, esthetics, function and phonetics of anterior teeth may be compromised. Furthermore, when there is involvement of the biological width, there is often a poor prognosis. This case report describes the multidisciplinary approach to tooth fragment re-attachment in a fracture with biological width violation. The patient presented with an oblique crown fracture in the maxillary right lateral incisor, extending from the buccal to palatal side, as well as a biological width invasion. The re-establishment of the biological width was obtained by periodontal surgery to achieve clinical-crown lengthening and tooth fragment re-attachment with a glass fiber post to increase retention. After 3 years of follow-up, the rehabilitated lateral incisor remains in good condition, with satisfactory esthetic and periodontal health.

KEYWORDS
Crown fracture; Tooth fragment re-attachment; Biological width violation

CASE REPORT
A 24-year-old male patient was referred to the Department of dentistry of the Federal University of Rio Grande do Norte (UFRN), with the complaint of a crown fracture in the maxillary right lateral incisor (tooth 12), due to trauma during soccer training (Fig. 1). The patient signed a consent form authorizing the use of images and publication of the case in a manuscript.

Figure 1. Preoperative view of the maxillary right lateral incisor after trauma.

The clinical examination revealed that there was no fracture of the maxilla or any other facial bones. Intraorally, the crown fracture in tooth 12 was oblique and extended from the buccal to the palatal aspect, involving enamel and dentin (Fig. 2).

A few days after the completion of semi-rigid containment around the maxillary anterior teeth, the patient reported pain in the injured tooth. Thermal tests for assessing pulp vitality were performed and the tooth was diagnosed with irreversible pulpitis. Before the endodontic treatment, biological width invasion of 2mm in the palatal and mesial aspect was diagnosed with a periodontal probe. Thus, the semi-rigid containment and the fragment were removed and were stored in physiological saline.

INTRODUCTION
Dento-occlusal traumas are commonly caused by injuries such as contact sports, street fights and traffic accidents.¹ ² These manifestations can vary from an enamel-dentin simple fracture to pulp and root-involving fractures.¹ ² Due to their exposed position in the dental arch, maxillary incisors are the teeth that are most commonly involved in dental trauma² ³ ⁴ and these fractures subsequently lead to aesthetic, functional and phonetic problems.⁵ A study by Murchison, Burke and Worthington⁶ estimated that about one-fourth of the population under the age of 18 years has traumatic injury in anterior teeth and, of this total, 80% are central incisors and 16% are lateral incisors. However, fractures involving crown and root with pulpal exposure constitute only 5%–8% of all traumatic injuries.⁷ A review of published case reports indicate that 85% of traumatized incisors fracture in an oblique fashion from the labial to lingual aspect.⁸

After the appearance of the acid-etching technique by Buonocore in 1955, the treatment of fractured teeth has become more conservative, preserving the healthy tooth structure. Currently, two methods are being used to rehabilitate fractured teeth, including resin composite restorations and tooth fragment reattachment.²

Tooth fragment reattachment is a good alternative in the treatment of dental fractures, since the fragment is adequately preserved in physiological saline solution or saliva to prevent dehydration and discoloration.⁹ This procedure offers good aesthetic and functional results in the short-term and medium-term and also restores the patient’s emotional balance.² Other advantages of tooth fragment reattachment are improved enamel smoothness and hardness, dentin translucency, maintenance of original tooth contours, as well as preservation of occlusal contacts, color stability and procedure cost.¹ ⁷ In cases where the fracture extends to the biologic width, periodontal surgery associated with osteotomy and osteoplasty procedures is required.³ ² ³

In spite of the high success rates in tooth fragment reattachment reported in the literature,¹ ² ³ some dentists make decision for other less conservative procedures such as tooth extraction and rehabilitation with implant-supported prosthesis. This may be due to either lack of knowledge of such procedures or fear of failure.⁴ Therefore, this article describes the rehabilitation of a crown fracture in the maxillary lateral incisor using the tooth fragment reattachment technique and using a glass fiber post to increase retention, with a 3-year follow-up.
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solution for use at a later stage (Fig. 3). The reestablishment of the biologic width was obtained through periodontal surgery in order to increase the clinical crown, using the internal bevel incision, associated with osteotomy and osteoplasty (Fig. 4). Vestibular papilla aspect was preserved during palatal flap elevation. On that occasion, tooth fragment reattachment was performed with the aid of absolute isolation and a saliva ejector was placed in position. In another section, the endodontic access was obtained, pulpal curettage and placement of intra-canal medication were performed and the completion of endodontic treatment was postponed for one week.

Subsequently, for fragment reattachment, a small attrition in the remaining tooth and fragment was performed to enable a better fragment adaptation and promote enough space for placement of the adhesive system and composite. Thus, after acid etching of both the remaining tooth and fragment for 20s with 37% phosphoric acid (Alpha Etch, DFL, Rio de Janeiro, Rio de Janeiro, Brazil), an adhesive system (Adper Single Bond 2, 3M ESPE, Sumaré, São Paulo, Brazil) was applied and polymerized using a halogen light source (LD Max, Gnatus, Ribeirão Preto, São Paulo, Brazil) for 40 s. The composite (Filtek™ Z350 XT Universal Restorative; 3M ESPE, Sumaré, São Paulo, Brazil) was then applied, and the tooth fragment was positioned and polymerized for 40s. As the fracture line was visible on the buccal surface, a groove was made and then restored with composite (Fig. 5). Finishing and polishing was done using the Sof-Lex polishing system (Sof-Lex, 3M ESPE, Sumaré, São Paulo, Brazil). After restoration, the rubber dam was removed.

One week after the tooth fragment reattachment procedure, endodontic treatment was carried out under absolute isolation and the root canal was filled with gutta-percha using the vertical and lateral condensation technique. In order to provide higher resistance and increase the dental fragment retention, two-thirds of the root canal filling material were removed and a glass fiber post (Whitepost DC, FGM, Joinville, Santa Catarina, Brazil) was adapted in the canal and cut to the desired length (Fig. 6). After adequate post adjustment, acid etching of the root canal was performed with 37% phosphoric acid, and the adhesive system was applied according to the manufacturer’s instructions. The glass fiber post was then cemented with the help of dual-cure resin cement (RelyX ARC, 3M ESPE, Sumaré, São Paulo, Brazil) and then polymerized using a halogen light source for 40s (Fig. 7).

After 3 years of follow-up, the maxillary right lateral incisor (tooth 12) remains in good condition, with satisfactory esthetic and periodontal health. Clinical and radiographic features such as absence of periodontal pockets, bleeding on probing and tooth mobility; intact and radiopaque lamina dura around the tooth; no periapical radiolucency and satisfactory

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Figure 2. Right lateral incisor with oblique crown fracture extending from the buccal to palatal aspect and biological width invasion (2mm) in the palatal aspect.

Figure 3. Crown fragment removed.

Figure 4. Occlusal view after reestablishment of the biologic width through periodontal surgery.

Figure 5. Crown fragment reattached to remaining tooth.

Figure 6. Glass fiber post placed after root canal preparation.
treatment of root canal could show success of the procedure of tooth fragment reattachment, even in situations involving the biologic width (Figs. 8 and 9).

DISCUSSION

A variety of traumatic conditions can cause crown fractures, although the literature shows some predominant causes such as falling while playing and running, during sports activities, and blows received to the face. According Taiwo and Jalo, the maxillary central incisors are most vulnerable to injury, sustaining approximately 67% of all dental injuries followed by the maxillary lateral and the mandibular incisors. As also described by Goenka et al. the majority of dental injuries involving the anterior teeth occur due to their exposed position in the dental arch. In agreement with this information, this case report describes the multidisciplinary approach to tooth fragment reattachment in a fracture with biologic width violation of a maxillary lateral incisor using a glass fiber post to increase retention as an alternative method for restoring the esthetics and function of traumatized teeth.

Although the indication of tooth fragment reattachment is restricted to simple cases where the fracture line is clinically visible, this case report demonstrated, through clinical success at 3 years of follow-up, that this procedure can be performed even in complex fracture cases involving the biologic width and tooth root, corroborating Durkan et al. and Rajput et al. This case emphasizes the importance of long-term follow-up visits, where esthetics, function and periodontal health should be confirmed clinically and radiographically during 5 years. The avoidance of premature occlusal contacts and correction of relationships with adjacent teeth favors treatment success.

The dental reattachment technique has improved along with the development of acid-etching technique and dentin adhesives. Failure of the teeth restored with metal posts and cores occurs typically due to root fractures, which are often related to the stiffness and different mechanical properties of metal posts. Unlike the metal post, glass fiber posts are less stiff and result in a better stress distribution in the root, which may result in fewer severe fractures after failure. In addition to the similarity in the elasticity coefficient to that of dentin, the ability to cement glass fibers with adhesive system is very important, along with good esthetic results. Based on these aspects, a glass fiber post was used to increase retention of the reattached crown fragment and its choice took into account the amount of tooth remaining and the presence of enamel, which improve adhesion to the adhesive system.

The tooth fragment reattachment is considered the most conservative treatment for crown fractures of the anterior teeth, as it provides enhanced fragment adaptation to the remaining tooth in addition to good stability and biocompatibility of the natural tooth surface to the periodontium, as well as keeping original tooth contours, preservation of occlusal contacts. It also provides immediate esthetic and functional rehabilitation of the fractured tooth.

CONCLUSION

Currently, with the available materials, in conjunction with an appropriate technique, esthetic results can be achieved with predictable outcomes. Thus, the reattachment of a tooth fragment is a viable technique that restores function and esthetics with a very conservative approach.

ETHICAL DISCLOSURES

Protection of human and animal subjects
The authors declare that no experiments were performed on humans or animals for this investigation.

Confidentiality of data
The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent
The authors must have obtained the informed consent of the patients and/or subjects mentioned in the article. The author for correspondence must be in possession of this document.

CONFLICT OF INTEREST STATEMENT
None declared.
References