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Multidisciplinary treatment of complicated coronary root fracture: case report

Tratamento multidisciplinar de fratura coronorradicular complicada: relato de caso

Tratamiento multidisciplinario de fractura radicular coronaria complicada: reporte de caso

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Abstract
Treatment of trauma to anterior teeth should aim at preserving the affected teeth so as to restore function and esthetic appearance. The management of coronary root fracture is complex and requires a multidisciplinary approach in which various specialties must coordinate to achieve the desired result. This report describes the treatment of a deep crown–root fracture compromising the pulp and extended subgingivally on the buccal aspect. A 57-year-old man presented with pain and mobility in his left maxillary lateral incisor which experienced fall trauma. After using the fractured fragment as a provisional crown, the patient received conventional root canal treatment and a challenger orthodontic extrusion followed by rehabilitation with a postcore- supported prosthetic restoration. A 4-year follow up showed the absence of clinical symptoms and mobility and re-establishment of the periodontal space with satisfactory esthetic results.
Keywords: Tooth injuries; Tooth fractures; Endodontics.

Resumo
O tratamento do trauma em dentes anteriores deve visar a preservação dos dentes afetados, de modo a restaurar a função e a aparência estética. O manejo das fraturas coronorradiculares é complexo e requer uma abordagem multidisciplinar na qual várias especialidades devem se coordenar para alcançar o resultado desejado. Este relato descreve o tratamento de uma fratura coroa-raiz profunda comprometendo a polpa e estendida subgengivalmente na face vestibular. Um homem de 57 anos apresentou dor e mobilidade em seu incisivo lateral superior esquerdo que sofreu trauma por queda. Após usar o fragmento fraturado como coroa provisória, o paciente recebeu tratamento endodôntico convencional e uma extrusão ortodôntica desafiadora seguida de reabilitação com uma restauração protética suportada por núcleo. Um seguimento de 4 anos mostrou ausência de sintomas clínicos e mobilidade e restabelecimento do espaço periodontal com resultados estéticos satisfatórios.
Palavras-chave: Traumatismos dentários; Fraturas dentárias; Endodontia.

Resumen
El tratamiento de los traumatismos en los dientes anteriores debe tener como objetivo la preservación de los dientes afectados para restaurar la función y la apariencia estética. El manejo de las fracturas radiculares coronales es complejo y requiere un abordaje multidisciplinario en el que se deben coordinar varias especialidades para lograr el resultado

deseado. Este informe describe el tratamiento de una fractura coronaria profunda que compromete la pulpa y se extiende subgingivalmente en la cara bucal. Un hombre de 57 años se presentó con dolor y movilidad en el incisivo lateral superior izquierdo que sufrió un traumatismo por caída. Después de utilizar el fragmento fracturado como corona provisional, el paciente recibió un tratamiento de conducto convencional y una extrusión ortodóncica Challenger seguida de rehabilitación con una restauración protésica posnúcleo. Un seguimiento de 4 años mostró ausencia de síntomas clínicos y movilidad y restablecimiento del espacio periodontal con resultados estéticos satisfactorios.
Palabras clave: Lesiones dentales; Fracturas de dientes; Endodoncia.

1. Introduction

Traumatic dental injuries (TDI) are common and the treatment challenging. The management of traumatized teeth frequently requires a multidisciplinar squad for restoring the function and aesthetics (Andreasen & Andreasen, 2007; Prado et al., 2012; Bacelar et al., 2020; dos Santos et al., 2020; Teles et al., 2021; Carvalho et al., 2022; Santos et al. 2022). Crown-root fractures typically present a fracture line that originates in the crown and extends apically in an oblique direction, involving enamel, dentin and cementum; they are frequently associated with pulp exposure and correspond from 0,6 to 5% of all TDIs (Andreasen & Andreasen, 2007; Hecova et al., 2010; Atabek et al., 2014).

Treatment of fractured teeth involves crown reconstruction and depends on the level of the fracture line and the amount of remaining tooth. Adhesive reattachment of the coronal fragment can be a valuable therapeutic option for crown-root fractured teeth because of its potential in preserving the pulp and minimize treatment time and costs, however, the outcome of adhesive fragment reattachment may be compromised due to insufficient control of moisture in the operating field and if the fracture surfaces are located at or below the alveolar bone level (Soliman et al., 2020).

Traumatized teeth with fractures below the alveolar crest are often considered hopeless and can be uncomplicated (Without Pulp Exposure) or complicated (With Pulp Exposure) (Fidel et al., 2011; Singh et al., 2019; Teixeira et al., 2019; Bourguignon et al., 2020). In these cases, gingivectomy and surgical or orthodontic extrusion of the root is necessary to convert the subgingival fracture to a supragingival one, to allow restoration of the fragment (Singh et al., 2019; Bourguignon et al., 2020; de Castro et al., 2010; Martos et al., 2014).

In mature teeth with complete root formation, removal of the pulp is usually indicated followed by temporarily covering the exposed dentin with glass-ionomer cement or using a bonding agent and composite resin. Future treatment options include completion of root canal treatment and restoration, orthodontic extrusion, surgical extrusion, root submergence, intentional replantation with or without rotation of the root (Bourguignon et al., 2020; Faria et al., 2015; Klandelwal et al., 2021).

When the fracture extends subgingivally at buccal surfaces, periodontal surgery is not recommended for aesthetic reasons (Moura et al., 2012). Orthodontic extrusion can be successful in elevating the fracture line above the gingival margin, thereby preserving the traumatized tooth and enabling restoration with a definitive crown (Sharma & Mittal, 2017; Scholtes et al., 2018).

The purpose of this report is to present and discuss a case with 4-year follow-up of a crown-root fracture involving a maxillary permanent lateral incisor in which an endodontic treatment and orthodontic extrusion before rehabilitation by post-core-supported prosthetic restoration was performed.

2. Methodology

This is a case report with descriptive, exploratory purposes and with a qualitative approach, the in order to show its clinical relevance and facilitate research and new reports on the topic, using as a reference base Pereira et al. (2018). The work was approved by the Research Ethics Committee of the Faculty of Dentistry of the Federal University of Bahia under opinion 4.012.118 and CAAE 23120719.2.0000.5024. All ethical and legal principles were respected in the treatment of patients in

accordance with the precepts of the Declaration of Helsinki, Resolution 466/12 of the National Health Council (CNS). The clinical case was only conducted after signing the informed consent form (ICF).

A 57-year-old man patient was referred to the Trauma Centre of the Federal University of Bahia, Brazil, with the left maxillary lateral incisor crown fractured in a fall accident. After the patient's general dental trauma and medical history were recorded, extraoral investigation revealed no further damage to soft tissues and no pathologic findings were noted during investigation of the temporomandibular joint and potentially affected osseous structures.

Intraoral investigation revealed that the maxillary left lateral incisor had a crown-root fracture extending subgingivally on the buccal aspect. The tooth fragment was mobile but remained in place (Figure1a,b). Radiographic examination showed clear horizontal fracture lines at both proximal sites (Figure 1c). The neighboring teeth had no clinical or radiographic evidence of damage due to trauma.

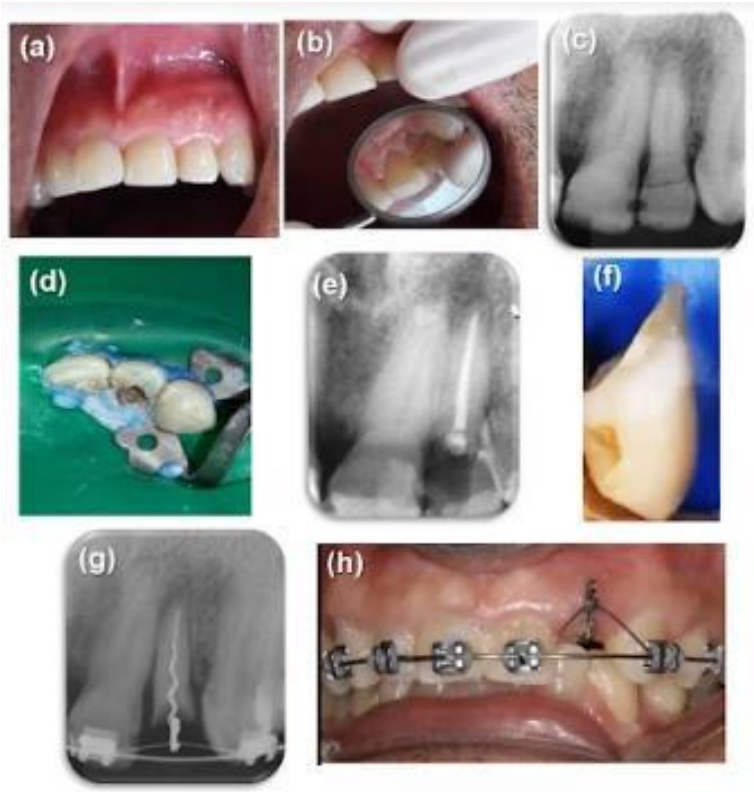
A clinical diagnosis of irreversible pulpitis was established and written informed consent was obtained. The treatment option chosen was planned root canal therapy and orthodontic extrusion for reestablishing the biologic width with posterior crown reconstruction once periodontal surgery was not recommended in the anterior region for aesthetic reasons.

It was decided to maintain the coronal fractured fragment to avoid bleeding and preserve the esthetic function. So, temporary stabilization of the coronal fragment with composite resin to the adjacent teeth was done. At the next appointment, local anesthetic was given, rubber dam placed in a group of adjacent teeth and the root canal treatment was performed using the clinical protocol for vital pulpectomy, coronal access, crowndown chemomechanical preparation using endodontic files to an ISO size 40 master apical file and irrigation with a 1% sodium hypochlorite solution. A calcium hydroxide dressing was placed into the canal and a temporary coronal seal was established fixing the fractured fragment. The patient was instructed on oral hygiene measures and to only consume liquid and soft foods.

One week later, the root was symptom-free and was obturated with gutta-percha and zinc oxide-eugenol sealer (Endofill, Dentsply-Mallefer, Rio de Janeiro, RJ, Brazil), using the lateral condensation method, and the patient was referred to the Orthodontic Clinic (Figure1d,e).

After removal of coronal fragment (Figure 1f), a custom-made wire hook was bent and cemented intra-canal with glass-ionomer cement into the partially unobstructed root canal. The extra-canal part of the hook was designed to extend above the gingival margin on the buccal side and promote the necessary space for a practical extrusion activation. Then, Niti .012 wire segment connected to the patients' orthodontic fixed appliance was attached to hook to obtain extrusion and buccal movement of the tooth fragment (Figure 1g,h).

Figure 1: (a) Buccal view of the maxillary left lateral incisor 1 day after the trauma; (b) Palatal view of the maxillary left lateral incisor 1 day after the trauma; (c) Initial periapical radiograph of the maxillary left lateral incisor; (d) tooth isolation with rubber dam maintaining the fractured fragment attached in group; (e) Periapical radiograph after root canal treatment; (f) Coronal fragment removed; (g) Periapical radiograph after intra-canal wire loop cemented; (h) Orthodontic fixed appliances.



Source: Authors.

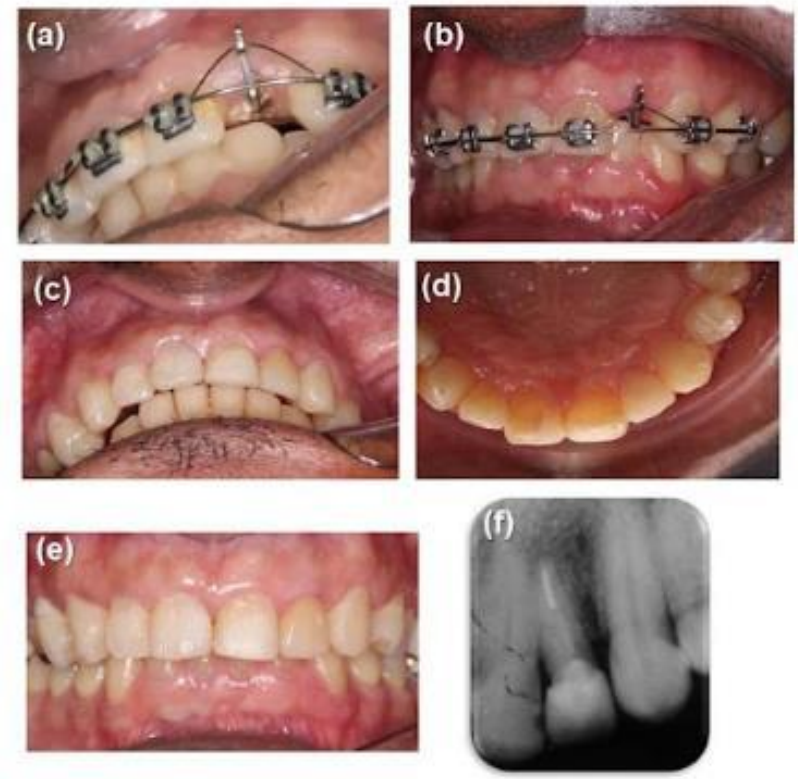
3. Results

In the next 6 months, the incisor was gradually extruded by the deflection action of the .012 NiTi wire segment. Because of the oblique fracture pattern, the crown height was gradually reduced by grinding the palatal edge with a bur for levelling the fragment edges. Palatal edge griding was also necessary to create space for the extrusion and prevent occlusal interferences, since the patient presented deep bite. Even so, temporary resin bite blocks were used to enable the extrusion (Figure 2a,b).

When the orthodontic extrusion was concluded an intra-radicular fiberglass retainer was cemented and impressions were taken for the posterior prosthetic rehabilitation. After placement of the ceramic crown, a harmonious smile was obtained, and the soft tissue esthetics were regarded as good by the patient and the dentists (Figure 2c,d).

Four years after the treatment, the periodontium appeared to be without pathology. On the periapical radiograph, no pathology of the dental and periodontal tissues was found (Figure 2e,f).

Figure 2: (a) and (b) Active extrusion of the maxillary right central incisor; (c) Buccal view after placement of the ceramic crown; (d) Palatal view after placement of the ceramic crown; (e) Clinical view 4 years after treatment; (f) Periapical radiograph 4 years after treatment.



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4. Discussion

Achieving and maintaining satisfactory treatment results for a crown-root fractured incisor is challenging for clinicians. It was found that 46% of dentists considered themselves unable to treat complicated crown-root fractures (de Castro et al., 2010). Esthetic and functional outcomes must be considered in the same way as the periodontal and pulp involvement when determining the proper treatment method (Soliman et al., 2020).

Factors to be analysed when determining the optimum treatment for crown-root fractures include fracture depth (subgingival depth), lesion morphology, root length and morphology, and the aesthetic requirements of each case (Elkhadem et al., 2014).

In Complicated crown-root fractures besides root canal therapy, gingivectomy and surgical or orthodontic extrusion of the root is necessary to convert the subgingival fracture to a supragingival one, to allow restoration of the fracture with prosthetic restorations (Bourguignon et al., 2020). In the present case, after root canal therapy, orthodontic extrusion was selected because of its conservative approach and the advantage of allowing the gingival papilla keep circling the teeth, besides biological stability (Faria et al., 2015; Mokhtari et al., 2017).

Extrusion is the easiest of all orthodontic movements, because it closely resembles natural tooth eruption providing a sound tissue margin for ultimate restoration and to create a periodontal environment that will be easy to maintain (Scholtes et al., 2018; Artieda-Estanga et al., 2018; Farmakis, 2018). However, it is frequently mentioned that orthodontic extrusion is considered time-consuming and requires commitment and motivation from the patient (Moura et al., 2012; Das & Muthu, 2013; Mokhtari et al., 2017).

Surgical extrusion or Intentional replantation have also been used to reestablish the biological width and expose the fractured subgingival margins with faster outcomes and the ability to directly assess fracture line, looking for other possible fractures (Moura et al., 2012; Das & Muthu, 2013; Mokhtari et al., 2017; Vignesh et al., 2019). However, there are more chances of periodontal ligament cell loss and root resorptions with this procedure (Prado et al., 2012; Scholtes et al., 2018; Enshaei & Ghasemi, 2018). Also, accidental fracturing of the root or crown was found as a complication (Scholtes et al., 2018).

The reattachment of the mobile tooth fragment was considered a temporary solution until a definitive treatment plan was made (Scholtes et al., 2018; Bourguignon et al., 2020). In our patient, we did reattachment of the fractured crown to the adjacent teeth until the beginning of orthodontic extrusion in order to maintain the aesthetic function. So the rubber dam was fixed in a group of teeth during the root canal therapy and when it was concluded a custom wire loop as an anchoring site was an easy-to-adopt-and-perform option for such cases (Farmakis, 2018). In patients with completely formed roots, the indication for postponing the root canal treatment is less, especially if root canal treatment is necessary because of the planned prosthetic restoration after orthodontic extrusion (Farmakis, 2018; Bourguignon et al., 2020).

For the present case, the oblique pattern of the fracture and the patient deep bite showed as challenging aspects for the extrusion mechanics. Griding of the palatal edge of the root was performed until the same level with the buccal edge was achieved, substantially reducing the remaining root fragment. In such cases, it is advised to evaluate previously if the amount of necessary extrusion will enable at least a final 1/1 crown/root ratio, as previously reported as the minimum proportion for supporting the masticatory and occlusal efforts (Levine, 1997; Emerich-Poplatek et al., 2005).

Moreover, it is important to highlight that the hook design employed made possible the extrusion activation under a condition of severe deep bite. It is also important to mention that the fragment was moved buccally by the end of the treatment to refine its final position. The authors of the present article did not find any previous report employing similar mechanics.

Finally, a good final outcome was considered challenging because the root length and its periodontal support were not strong. Nevertheless, esthetics, function, and patient expectations have been well established. Also, a 4-year follow-up revealed periapical and periodontal health and the patient is asymptomatic.

5. Final Considerations

This case demonstrates that root canal therapy associated to orthodontic extrusion and prosthetic reconstruction can be treatment options in the management of teeth with complicated crown-root fractures.

When considering the success obtained in this case, it is necessary that more studies are carried out for a greater scientific dissemination of the diagnosis and of more complex cases.

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