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Conservative Approach of Fractured Tooth with 7-Years of Clinical and Radiographical Follow-Up: Case Report

Abordaje Conservador de Diente Fracturado con 7 Años de Seguimiento Clínico y Radiográfico: Reporte de Caso

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ABSTRACT: Clinical and radiographical diagnosis is crucial to treat a tooth with transverse root fracture (TRF) due to dental trauma (DT). This paper aimed to report a clinical case of TRF at the cervical third of tooth 21 injured by recurrent DT with 7 years of follow-up. A 7-years old female patient was referred to dental care after the first episode of DT in 2014. Based on the radiographical examination, splinting of teeth 11 and 21 was performed using resin composite. After 11 months, the splint was removed and the patient was discharged. In 2015, the patient suffered a second DT of the same tooth. The clinical approach was splinting the traumatized tooth using orthodontic wire and resin composite. In 2018, a third episode of DT occurred. Then, the dental staff chose to maintain the splint and evaluate the case in a long-term. In 2021, based on bone tissue condition, dental fragment stability and radiographical follow-up, the splint was removed. The patient remains under regular follow up evaluations. It can be concluded that a conservative approach in cases of TRF, when possible, can preserve biological tissues.

KEY WORDS: dental trauma. root fracture. dental pulp. esthetics.

INTRODUCTION

Dental trauma (DT) can trigger tooth, periodontal, and soft tissue injuries (Skaare & Jacobsen, 2003; Reis *et al*., 2004; Rechenberg, 2019). It may cause displacement; avulsion; enamel or enamel and dentin fracture, with or without pulp exposure; or root fracture depending on the period of development and the intensity and direction of the force (Andreasen *et al*, 1989, 2004). Moreover, individuals with a history of DT have a greater risk of DT recurrence. Thus, preventive and conservative approaches are crucial to avoid new occurrence of DT and their clinical implications (Magno *et al*., 2019).

Transverse root fractures (TRF) comprehend 0.5 to 7 % of all permanent teeth injuries (Andreasen, 2007), being more prevalent in the middle third of the root (Andreasen, 1967). Presence of clinical signs such as mobility, extrusion and displacement of coronal fragments are dependent on the fracture location and severity of the DT (Clark & Eleazer, 2000; Andreasen *et al*., 2004; Reis *et al*., 2004).

The diagnosis, treatment planning, clinical procedures, and prognosis depend on the degree of mobility of the TRF, palpation of coronal and alveolar regions, response to pulp sensibility tests, probing depth, and imaging examinations. Based on all these clinical findings, the clinician is able to propose the most adequate treatment (Andreasen *et al*., 2004; May *et al*., 2013; Rothom & Chuveera, 2017; Dogan *et al*., 2018; Rechenberg, 2019).

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The immediate therapy indicated for teeth with TRF is repositioning and temporary splinting teeth, followed by periodical reevaluation of the patient (Clark & Eleazer, 2000; Choi *et al*., 2014). Due to pulp necrosis, endodontic treatment of the coronal fragment is required in 25 % of teeth with TRF (Andreasen & Andreasen, 1990). The maintenance of pulp vitality is dependent on tissue repair, periapical changes, pulp calcification and/or resorption, that are evaluated during clinical and radiographical follow-up (Andreasen *et al*., 2012).

This study aims to report the conservative approach of tooth 21 with HRF and recurrent DTs. Clinical and radiographical outcomes after 7 years are presented.

CASE REPORT

PRICE guidelines were followed in this case report. Written in- formed consent was obtained from the patient.

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On September 12th 2018, a 12-year-old female patient was referred to the XXX. The patient's mother brought a referral letter signed by the general dentist of their Basic Health Unit, informing that the upper left central incisor (21) had suffered a root fracture, several episodes of DT and requesting evaluation and treatment.

To the readers better understand the case evolution, we reported this case in two phases, as follow: Phase 1 - Facts and dental care chronologically reported by the patient and legal guardian until the appointment on September 12th 2018, at COU/UEL. When any dental care performed at COU/UEL was mentioned, the patient's dental record was checked to survey the notes and better understand the evolution of the case; and Phase 2 – Dental care provided at COU/UEL from the appointment on September 12th 2018.

Phase 1

First DT. On January 21th 2014, the then 7-year-old patient sought the emergency dental care at COU/UEL immediately after DT that occurred while riding a scooter. After periapical radiographic and intraoral clinical examination, the dental clinician diagnosed TRF at the cervical third of tooth 21, with slight extrusion of the coronal fragment. The treatment performed was replacement of the fragment and splinting of teeth 11 and 21 with resin composite.

Thus, on February 18th 2014, during the follow up appointment, discoloration of the coronal fragment was not observed. Besides, the patient did not report any symptoms when tooth 21 was submitted to pulp sensibility tests using cold agent (Endo-Ice®, Maquira Dental, Maringá, PR, Brazil), applied on the cervico-vestibular surface. In the radiographic examination, abnormalities in the periapical region and in the lateral areas of HRF were not observed (Fig. 1.A). After the appointment, the patient was referred to the Endodontics division at UEL.

On April 11th 2014, at the Endodontic evaluation, no clinical or radiographic abnormalities were observed (Fig. 1.B). Thus, splinting repair was performed with resin composite to maintain the stabilization of the coronal fragment and preservation of the alveolar bone. The patient was instructed to return after 2 months for reassessment.

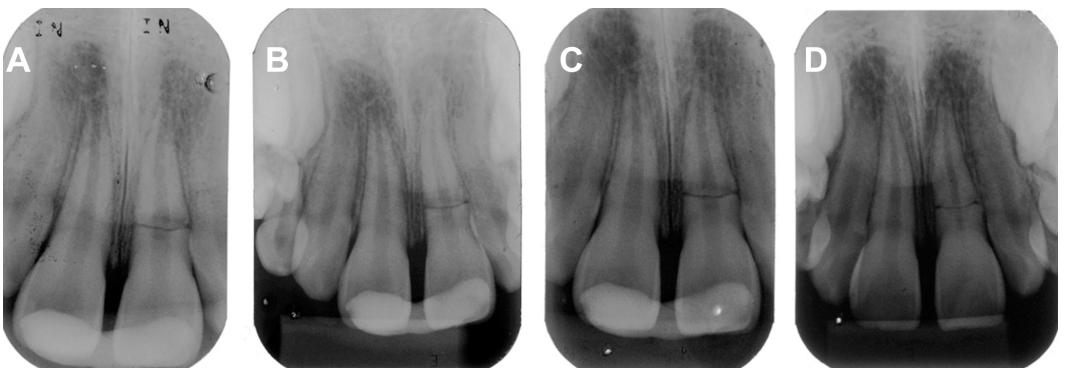

Fig. 1.A – Periapical radiograph of the upper central incisor region, date 02/18/2014 (children's periapical film). B – date 11/04/2014; C – date 13/06/2014; D – date 12/07/2014.

On June 13th 2014, the radiographic examination did not suggest periapical or periradicular pathology (Fig. 1.C). Cold sensibility test was negative. A computed tomography scan was requested to better visualize the dentoalveolar structures in the anterosuperior region.

On July 10th 2014, the patient brought a CT scan (not available in the chart), whose imaging report was transcribed in the chart: "presence of a line in the vestibule-palatal direction in the cervical third of the root of tooth 21, compatible with root fracture. The surrounding bone presents normal characteristics. Clinical and radiographic follow up and pulp vitality test of tooth 11 are indicated, without signs of fracture". A new follow up was scheduled for 5 months, and the patient's mother was told to return immediately in case of any symptoms.

On December 7th 2014, the tooth did not present discoloration, mobility or radiographic signs of periapical pathology and in the region of the HRF. Thus, it was decided to remove the splint and discharge the patient. The patient's mother was told to return in case of any symptoms (Fig. 1.D).

Second DT. In January 2015, the patient suffered the second DT on tooth 21 when ballet dancing. The patient and legal guardian sought dental care at a private practice. According to the mother, the dentist splinted teeth 21 and 11, using orthodontic wire and resin composite.

Phase 2

Third DT. On September 12th 2018, the patient was referred to COU/UEL by a dental clinician from a Basic Health Unit due to the third DT of tooth 21 when playing with her sister. The periapical radiographic examination revealed pulp calcification and a sight mesial movement of the coronal fragment in relation to the root (Fig. 2.A). Clinically, tooth 21 was not responsive to cold sensibility test and did not exhibit discoloration of the coronal fragment. The clinical approach was the follow-up of the case, with return after 4 months.

On January 30th 2019, no clinical and radiographic signs suggestive of alterations in the periapical and cervical-radicular regions were diagnosed (Fig. 2.B). The patient was instructed to return after 8 months.

On September 18th 2019, clinical and radiographic evaluation confirmed asymptomatic tooth 21 for cold sensibility test, with no color alteration of the coronal fragment, no periapical lesion and no lesion in the region of HRF (Fig. 2.C). Due to patient's esthetic complaining, splinting was replaced using orthodontic wire (0.5 mm; Morelli, Sorocaba, SP, Brazil) and resin composite (A2B and A1E color; Z350 XT Filtek, 3M, Sumaré, SP, Brazil). Thus, teeth prophylaxis with pumice paste and water using Robson brush (Ultra-soft, American Burrs, Palhoça, SC, Brazil) at low rotation; enamel etching of the middle third of the buccal face with 37 % phosphoric acid (Biodynamics, Ibiporã, PR, Brazil), for 30 seconds; rinsing water to remove the etching agent for 30 seconds; drying with air jet and application of the adhesive system (Adper Single Bond, 3M ESPE, Sumaré, SP, Brazil). The light-curing of the adhesive and resin composite was performed with a light-

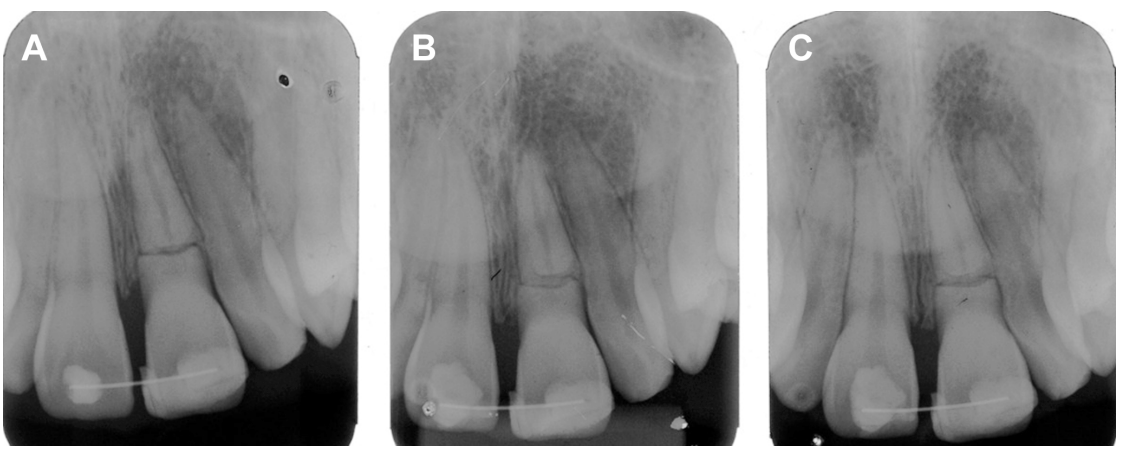

Fig. 2.A – Periapical radiograph of the upper central incisor region, date 12/09/2018; B – date 01/30/2019; C – date 09/18/2019.

emitting diode (LED) device (Emitter B Schuster, Santa Maria, RS, Brazil), with an irradiance of 1250 mW/cm^2, for 20 and 40 seconds, respectively (Fig. 3). The patient was discharged with a control appointment scheduled for 2020.

In 2020, due to the COVID-19 pandemic, non-emergency procedures were temporarily cancelled at COU/UEL. On March 17th 2021, 7 years, 1 month and 24 days after the first DT, the patient was scheduled for reassessment. During the appointment, the splinting was removed and the clinical palpation test showed no impairment of the supporting bone tissue and stability of the coronal fragment (Fig. 4). The images of digital radiographs, using the Clark method, suggested diffuse pulp mineralization, absence of radiographic signs of inflammatory periapical lesions and inflammatory processes in the lateral areas of TRF (Fig. 5). After the assessment, patient was temporarily discharged and the legal guardian was informed about the need to return for clinical and radiographic control after 6 months at first (Fig. 6) and then once a year.

Fig. 3. Intraoral image after splinting replacement, date 09/18/2019.

Fig. 4. Intraoral image after splinting removal, date 03/17/2021.

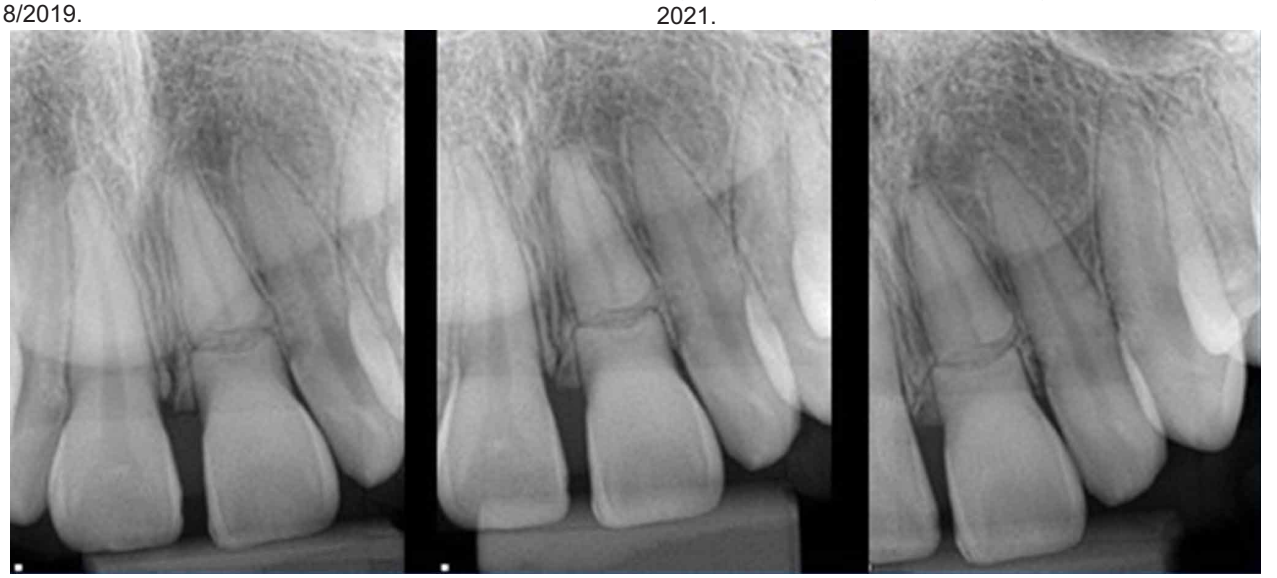

Fig. 5. Digital radiographies, date 03/17/2021.

DISCUSSION

This study reported the 7-year clinical and radiographic approach and follow up of a tooth with recurrent DT. The clinical outcomes showed that a conservative approach, whenever possible, is crucial to maintain natural dentition and periodontal structures.

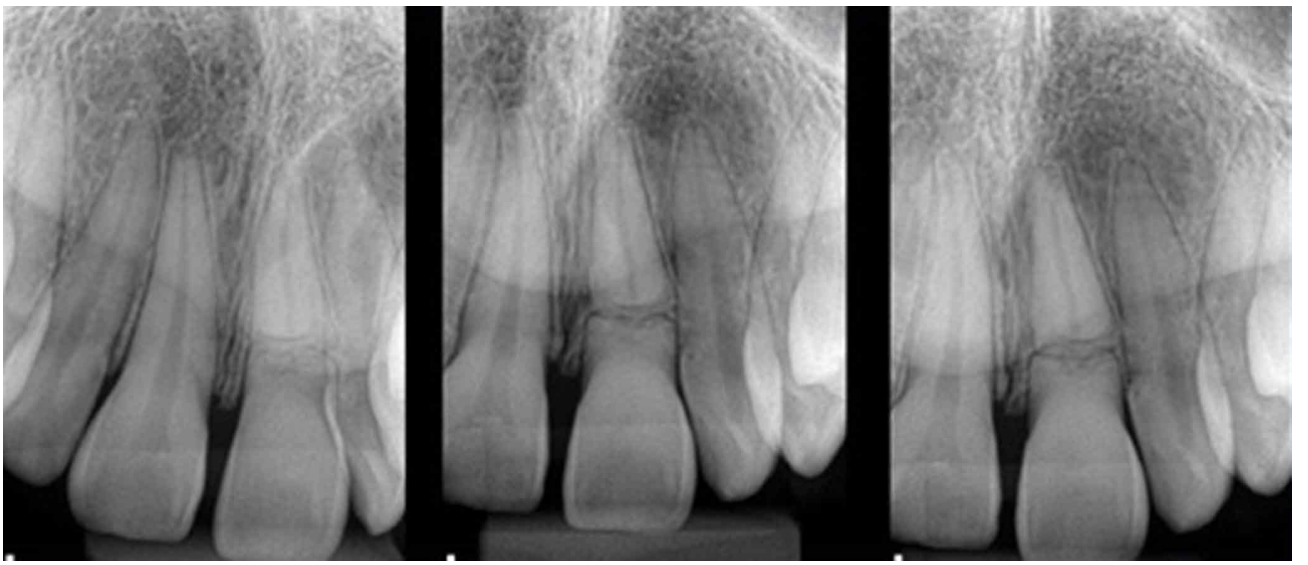

Fig. 6. Digital radiographies, date 06/16/2021.

Patient's characteristics and clinical condition of this case are in accordance with the DT-related literature: young patient (Eyuboglu *et al*., 2009); DT resulted from leisure activity (Huang *et al*., 2009); DT affecting the upper central incisor (Andreasen & Hjorting-Hansen, 1981; Calis¸kan & Pehlivan, 1996) and DT recurrence, frequent in 25 to 30 % of cases (Ravn, 1974).

.Although DT can cause different types of fractures, TRF represents 0.5 to 7 % of traumatic injuries in permanent teeth (Hovland, 1992) occurring frequently in the middle root third (57 %), followed by apical (34 %) and coronal/cervical (9 %) thirds (Gomes *et al*., 2001).

In the first appointment after DT, clinical and radiographic examinations are essential to evaluate the severity of the lesion and to plan the most appropriate treatment (Kositbowornchai *et al*., 2001). For better visualization of the fracture line, which is crucial to diagnose correctly, periapical radiographs must be acquired at different angles (Andreasen & Kahler, 2015). In our case report, although the dental clinician decision was based on the radiographic image, it is not attached in the dental record. There is also no radiography after the second DT, since dental care was provided in private practice. Only after the third DT, the radiographic images were acquired at different angles, showing absence of signs compatible with inflammatory periapical lesions and inflammatory processes in the lateral areas of the root fracture.

Combined with the radiographic examinations, the clinical approach must be supported by evaluating signs and symptoms, which include: integrity of the supporting bone tissue, degree of mobility, displacement of the coronal fragment in relation to the root remnant, pain to soft tissue palpation and pulp tissue condition (Zaleckiene *et al*., 2014; Andreasen & Kahler, 2015). In this case report, the patient's young age was alto taken into account. Thus, after DT recurrences (second and third DT), the decision-making was based on clinical and radiographic conditions, patient age, and the favorable prognosis after first DT. Therefore, replacement of the coronal fragment immediately after the first DT, the partial splinting with resin composite, the absence of color change, and the normal conditions founded in radiographic and tomography images throughout the follow-up are crucial factors to treat the case effectively.

Immediate splinting of teeth with TRF must be versatile, easy to apply and atraumatic to dental tissues, allowing mobility of fractured tooth to provide conditions for periodontal and pulp tissues repair. In addition, the splinting should not negatively interfere with daily oral hygiene, occlusion, and aesthetics of the upper anterior teeth (Kahler *et al*., 2016). For economic reasons and technical convenience, the splinting after the first DT was carried out only with resin composite. Considered a rigid retention, this type of splinting is not recommended since it may negatively affect the pulp and periodontal healing process and the root development in teeth with incomplete rhizogenesis

(Bauss *et al*., 2005; Cengiz *et al*., 2006). In our case, these adverse effects were not relevant to the tissue healing and repair process, since the splinting was restricted only to the two upper central incisors. The same rationale can be applied to splinting using orthodontic wire and resin composite, after the second DT.

Regarding the time of splinting, long periods can result in tooth resorption and ankylosis (Kinirons *et al*., 1999). Therefore, a period of four weeks is recommended for root fractures in the middle and cervical thirds (Sobczak-Zagalska & Emerich, 2020). In this case, the splinting after the first DT was kept in mouth for 11 months, and 6 years after the second DT. However, the absence of radiographic images compatible with inflammatory processes suggest that the splinting time did not affect the healing process (Kahler & Heithersay, 2008; Hinckfuss & Messer, 2009).

In root fractures, the guidelines of the International Association of Dental Traumatology (AITD) recommend to follow-up pulp conditions for at least one year (Diangelis *et al*., 2012). During this period, pulp vitality should be assessed through pulp tests and the symptoms reported by the patient, since pulp vitality after DT is uncertain. Decreased, temporary or permanent response to vitality test may indicate false positive or false negative, up to 3 months after DT (Mehlman *et al*., 2003; Diangelis *et al*., 2012).

In this case, pulp vitality was assessed 28 days after the first DT, obtaining asymptomatic response to thermal tests. This response can be interpreted as subjective with limited value regarding the real pulp condition, since sensibility tests assessed the response of pulp nerves and not the pulp blood flow (Mejàre *et al*., 2012). An injured tooth may have lost sensibility, temporarily or permanently, which justifies the negative response, even with tooth vascularization preserved (Gopikrishna *et al*., 2007). Subsequently, the asymptomatic response to thermal tests was verified in the further three appointments (on September 12, 2018, January 30, and September 18, 2019).

After the first DT, the decision to follow up the case without endodontic treatment, was based on no displacement of the root fragment from the fracture line (Clark & Eleazer, 2000). This approach was sustained after DT recurrence since no suggestive images of injuries in the control periapical radiographs were observed. However, displacement of the coronal fragment in relation to the remaining root was verified in radiographic examination after the third DT. The absence of radiographic image in the dental record after the second DT does not allow us to affirm the moment of displacement.

In TRF, there are four possible types of healing (Andreasen, 1967): 1) healing with interposition of hard tissue, slightly visible fracture line, with intimate contact of the coronal fragment and root portion; 2) healing with interposition of soft tissue, where the coronal fragment and the root portion are close together, but separated by a radiolucent line; 3) healing by interposition of hard and soft tissue, with a coronal fragment and root portion separated by growth of hard tissue and surrounded by a space similar to periodontal ligament; and 4) no healing, with space between the coronal fragment and the root portion, interposition of granulation tissue and presence of a radiolucent area in the alveolar bone adjacent to fracture. The periapical radiographs attached in the patient's dental record after the first DT suggest healing with interposition of soft tissue, with the coronal fragment and root portion separated by radiolucent imaging. Thus, we assume that the radiographic and computed tomography images may have contributed to removal of splinting in the clinical follow-up session after the first DT, on December 7th 2014.

After the third DT, periapical radiographs suggest increase in the space between the coronal fragment and the remaining root, and mesialization of the coronal fragment. These facts lead us to maintain the splinting as a preventive measure, even in the absence of tooth mobility.

Regarding the imaging exams performed, although periapical radiography has limitations and less accuracy when compared to cone beam computed tomography (CBCT) (Cohenca & Shemesh, 2015), it was sufficient for the control and follow-up of the clinical case. CBCT exposes the patient to higher radiation doses (Cohnen *et al*., 2002; Kalra *et al*., 2004; Bernardes *et al*., 2009; Lorenzoni *et al*., 2012), in addition to presenting a higher cost for the patient assisted in public health services (Scaf *et al*., 1997).

CONCLUSION

Clinical and radiographic outcomes after 7 years of tooth with TRF and two other episodes of DT highlighted that the conservative approach performed was an effective alternative to maintain tooth and periodontal structures, as well as the aesthetics and psychosocial requirements of the patient.

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RESUMEN: El diagnóstico clínico y radiográfico es fundamental para tratar un diente con fractura radicular transversa (FRT) por traumatismo dentario (DT). Este trabajo tuvo como objetivo reportar un caso clínico de FRT en el tercio cervical del diente 21 lesionado por DT recurrente con 7 años de seguimiento. Una paciente de 7 años de edad fue remitida a atención odontológica luego del primer episodio de DT en 2014. Con base en el examen radiográfico, se realizó la ferulización de los dientes 11 y 21 con resina compuesta. A los 11 meses se retiró la férula y se dio de alta al paciente. En 2015, el paciente sufrió un segundo DT del mismo diente. El abordaje clínico fue la ferulización del diente traumatizado utilizando alambre de ortodoncia y composite de resina. En 2018 ocurrió un tercer episodio de DT. Luego, el personal dental optó por mantener la férula y evaluar el caso a largo plazo. En 2021, en base al estado del tejido óseo, estabilidad de los fragmentos dentarios y seguimiento radiográfico, se procedió a la retirada de la férula. El paciente permanece bajo evaluaciones regulares de seguimiento. Se puede concluir que un abordaje conservador en casos de TRF, cuando sea posible, puede preservar los tejidos biológicos.

PALABRAS CLAVE: trauma dental, fractura de raíz, pulpa dental, estética.

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