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Garrocho-Rangel, Arturo; Sánchez-Reynoso, Aránzazu; Rosales-Berber,
Miguel Ángel; Ruiz-Rodríguez, Socorro; Pozos-Guillén, Amaury de Jesús

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Clinical Management of Intra-Pulp Canal Broken Endodontic Files in Primary Teeth: Literature Review

Manejo clínico de las limas endodónticas fracturadas dentro del conducto pulpar en dientes primarios: Revisión de la literatura

Arturo Garrocho-Rangel DDS,PhD[1]; Aránzazu Sánchez-Reynoso DDS[1];
Miguel Ángel Rosales-Berber DDS[1]; Socorro Ruiz-Rodríguez DDS, MS[1];
Amaury de Jesús Pozos-Guillén DDS, PhD[1]

1. Pediatric Dentistry Postgraduate Program. Faculty of Dentistry, University of San Luis Potosí, México.

Correspondence to: PhD Amaury de Jesús Pozos Guillén - apozos@uaslp.mx

ABSTRACT: Fracture of an endodontic file inside a primary root canal is a rare but critical complication during the pulpectomy treatment, because the mechanical obstruction impedes the optimal cleaning and obturation of the pulp canal, compromising seriously the clinical outcome. This accidental event is mainly associated with over-use and excessive torque of intracanal files. Most clinicians opt to proceed with the extraction of the affected tooth followed by a space maintainer placement. Other practitioners attempt the non-surgical retrieval of the separated fragment through available proven techniques in permanent teeth; however, these methods may involve significant damage to the tooth and surround tissues. On the other hand, preservation of the metallic fragment might affect the treatment prognosis and interfere with the physiological root resorption.

KEYWORDS: Primary teeth; Pulpectomy; Broken endodontic file; Clinical management.

RESUMEN: La fractura de una lima endodóntica dentro de un conducto radicular primario es una complicación rara aunque critica durante el tratamiento de pulpectomía, debido a que la obstrucción mecánica impide la limpieza y obturación óptimas del conducto pulpar, comprometiendo seriamente el resultado clínico. Este evento accidental está principalmente asociado con el sobreuso y torque excesivo de las limas dentro del conducto. La mayoría de los clínicos optan por realizar la extracción del diente afectado, seguido por la colocación de un mantenedor de espacio. Otros practicantes intentan la remoción no quirúrgica del fragmento separado a través de técnicas disponibles probadas en dientes permanentes; sin embargo, estos métodos pueden causar daños significativos al diente y tejidos circundantes. Por otra parte, la preservación del fragmento metálico puede afectar el pronóstico del tratamiento e interferir con el proceso de reabsorción radicular fisiológico.

PALABRAS CLAVE: Dientes primarios; Pulpectomía; Instrumento endodóntico fracturado; Manejo clínico.

Conservation of primary tooth structure in functional status is the main purpose of the pediatric dental practice, contributing thus to the child's overall health and development. The fundamental objectives of pulp therapies in the primary dentition are the removal of infection and chronic inflammation, and, in consequence, the relief of the associated pain. Thus, the affected tooth can be retained in a functional status up to its natural exfoliation (1). According to the American Association of Pediatric Dentistry (2), the pulpectomy procedure is indicated in irreversible inflamed/infected or necrotic primary teeth due to caries or trauma. In this therapy, the canals are instrumented and debrided with endodontic files ("K", Hedström, or NiTi files) together disinfection irrigants to significantly reduce the microbial population within the primary root canals (3). Then, a resorbable material is placed into the root canal –which permits the normal eruption process of the successor permanent tooth–, and finally, the tooth is sealed with a hermetical restoration (4). Usually, pulpectomy in children is a challenging procedure because of the anatomical complexity of the canal system, typical of primary molars. Diverse treatment protocols have been suggested and the prognosis is reasonably good (5).

During the root canal bio-mechanical debridement, the risk of endodontic file fracture or breakage always exists, particularly when stainless-steel (SS) operated-manually instruments are employed (6-8); however, other authors have mentioned that NiTi rotary instruments show a higher incidence of fracture, despite their favorable mechanic properties (9-10). In permanent teeth, the global separation rates of SS or NiTi instruments have been reported from 0.2 to 10% and 0.4 to 3.7%, respectively (11-12); in the primary dentition, there are only a few available data on these accidental events.

Fracture of an endodontic file is often the result of the incorrect instrumentation technique or an overuse associated with an excessive amount of torque of the instrument (7,11,13); another mentioned risk factors are the inadequate access to the canal system, the complex root canal anatomy (excessively curved canals, for instance), and manufacturing defects (10,14). The separated instrument produces a mechanical obstruction of the root canal, impeding further cleansing, which significantly compromises the treatment prognosis (8). When the fracture occurs in a permanent tooth, two treatment options should be considered:

(i) to attempt the removal of the broken segment, or (ii) to retain the segment within the canal and the placement of a sealing restoration (9). Diverse safe invasive, minimally invasive, or non-invasive methods have been suggested in the dental literature to remove broken instruments within the root canal, such as bypass, ultrasonic devices, microtubes, electrochemical dissolution, laser, operating co-axial light microscopes, pliers and forceps (13-16). The success rate of instrument retrieval in permanent dentition has been reported between 55-79% (17,18).

On the other hand, in primary teeth, extraction and the subsequent adaptation of a space maintainer is often the chosen strategy treatment to follow, as the instrument segment is a serious complication that may interfere with the physiological root resorption process (8,18). Additionally, it may lead to abscess formation, pathological root resorption, periapical lesions, and abnormal premature mobility (18).

The occurrence of dental treatment-related accidents such as the intracanal breakage of an endodontic instrument in a primary tooth may be the cause of considerable anxiety in pediatric dentists. According to Patel and colleagues (14), broken instruments should be considered as foreign objects, which may cause pain, infection, and swelling. In these cases, therefore, the clinician should be prepared to resolve the situation, carefully considering both the benefits and potential risks of each treatment option (19-20). The ideal management of fractured instruments is the prevention of the event through cautious handling (14). In permanent teeth, it has been stated that the retention of a fractured instrument usually does not compromise the treatment prognosis, so that it is an adequate option for preserving tooth structure, time and money; regardless of the preoperative status of the pulp tissue, the impacted segment should be left inside the root canal and treatment finished above the segment, before a period of review, as long as sterile conditions can be maintained (20). About this, Ungerechts and co-workers (10) carried out a study including 3874 endodontic treatments in permanent teeth with only hand instruments (SS and NiTi), over 10 years of follow-up, in which the incidence of instrument fracture was 1.0%. They reported that the success rate was 71.4% where the fragment was removed, and 56.5% when the fragment was left into the root canal; also, the healing was significantly lower when primary infection or apical disease were present, and also in cases of endodontic retreatment.

However, in cases of primary teeth, this therapeutic choice may not always be possible or even desirable and may carry several and serious inconveniences (20). Thus, the decision-making process is more complicated, particularly when it comes to young children. It is because of that diverse authors (8,14,18) have recommended trying to remove the trapped fragment, particularly in anterior teeth with more straight canals. Musale and co-workers (8) have mentioned that fragment retrieval in primary teeth must be intended, as long as it causes minimum damage to the tooth and surrounding soft tissues, and maintaining the original canal shape as much as possible. Further, the successful removal depends on some factors, including the operator's experience and ability, anatomical features of the canal system, position and depth of the instrument within the canal curvature, and type of endodontic file (14). On the other hand, most of these techniques are limited because they lead to unnecessary removal of thinner radicular dentine, characteristic of primary molars (21). However, in many cases, it is impossible the removal of the fragment because it is deeply impacted inside the pulp canal. In this regard and according to Patel and colleagues (14), the more apical is the position of the fragment, the poorer is the treatment prognosis.

Finally, diverse useful precautions and considerations have been provided to pediatric dentistry practitioners to prevent an endodontic instrument breakage into the root canal system of primary teeth (13,16,22,23): (i) carefully assess the instrument conditions before usage; if there is evidence of unwinding, deformation, or shiny marks, discard the instrument immediately; (ii) although some clinicians suggest employing endodontic instruments only once, files may be safely used at least four times; (iii) keep the instrument in a moist environment, using intra-canal disinfectant irrigants or special lubricant coatings (e.g. RC Prep®); (iv) create a straight-line access and a glide path to the canals to decrease the stress on the instrument; and (v) while working, be gentle with the instrument, avoiding leaning or forcing it.

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