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Removal of Two Canal Instruments from the Mesiobuccal Canal of a Mandibular Molar Tooth: A Case Report

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Abstract

One of the important factors that affect the success of root canal treatment is the complete removal of the pulp all the way to the root apex and disinfection of the canal. One factor that may impede this process is the existence of fractured canal instruments within the canal. In some cases, this problem can be eliminated by bypassing the broken instrument. However, this may not always be possible and the removal of the instrument is necessary. In this case report, we present the extraction of two fractured instruments inside the mesiobuccal canal of the lower left first molar of a 30-year-old female patient, performed under a microscope.

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Key words: Bypass, retreatment, broken file.

Introduction

The success of root canal treatment depends on the success of shaping and disinfection processes (1,2). To achieve effective disinfection, root canals must be shaped up to a certain width to accommodate the application of irrigation solutions and medication. However, there is a risk of fracture associated with the files used during the shaping process. The presence of broken instruments negatively affects the disinfection, forming and filling processes, hence the success of treatment (3). In a study, it was recorded that the fracture rate of hand files was 0.25%, and NiTi rotary instruments were 1.68%-2.4% (4).

Fracture of endodontic instruments in root canals is one of the most undesirable complications encountered during endodontic treatments (5). A study conducted by reviewing follow-up radiographs indicates that the prevalence of instrument fracture ranges from 0.4% to 5% (6). Broken instruments typically hinder reaching the apex and teeth with broken instruments in their canals have a worse prognosis compared to other teeth that have undergone root canal treatment. The prognosis of these cases depends mainly on the pre-treatment condition of the periapical tissues (7). However, an attempt should still be made to remove the broken instruments in all cases and leaving the instruments in the canal intentionally should only be considered in cases where the broken part cannot be removed and the periapical tissues are asymptomatic (8). In most cases, orthograde removal of broken instruments is very difficult and time-consuming (3). There are numerous reports regarding the methods for removing broken instruments from root canals. From the past to the present, methods involving chemical agents such as iodine trichloride, mechanical methods like hand instruments and ultrasonic devices, as well as surgical techniques, have been utilized (5). It is reported that the success rate in removing broken instruments varies between 55% and 79% (9).

The most common causes of file fractures are the complexity of the configuration of root canals, the use of files more than the recommended number of uses, the use of files without paying attention to their numbers and techniques, presence of excessively inclined channels, insufficient irrigation, fabrication errors in the production of files and insufficient experience of the practitioner (10).

The initial stage in the treatment of file fractures typically involves non-surgical approaches. Among these methods are the removal or bypassing of the fractured file, or cleaning and filling the root canal

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up to the level of the fragment (where the broken instrument is located) (11).

In a study, two significant issues related to retaining broken instruments in the apical region were highlighted, which could affect the long-term treatment outcomes (12). The first issue is the corrosion of the metal part located inside the root canals. A two-year follow-up study has shown that stainless steel (SS) files are inert and corrosion-resistant (12). The authors stated that this problem should be addressed in future studies on both stainless steel and Ni-Ti files (11).

The second issue is that the leftover fragments are most likely to endanger the effective irrigation of the apical part of the root canal, which can negatively affect the treatment outcome. This is particularly relevant for teeth with periapical pathology. Reports indicate lower success rates in cases where both broken files and periapical lesions are present (13).

Surgical approaches include apisectomy, root amputation, or intentional replantation, and these are treatment options used to save the tooth before extraction (14). But sometimes the surgical approach, especially apisectomy, may not be applied due to the difficulty of access to the area, lack of visibility of the surgical area, proximity to important anatomical regions such as the mandibular canal and neurovascular bundle. Additionally, surgical methods are both more invasive and prone to more complications compared to non-surgical methods (11). For addressing these issues, positive developments include the use of dental operating microscopes with better magnification and illumination, improved designs of ultrasonic tips, and the utilization of innovative instrument access systems.

Case Report

In the dental history obtained from a 30-year-old female patient without any systemic diseases who presented to our clinic, it was learned that she experiences pain on the lower left first molar tooth while biting. Informed consent was taken before any dental procedure conducted. Periapical radiography of the patient (Figure 1) showed that there were 2 broken instruments in the apical third of the mesiobuccal canal. During the first session, under the dental operating microscope, the old root canal filling was removed, and access to the broken instruments was achieved. Since the attempt to bypass the files was unsuccessful, a modified size 4 Gates Glidden drill (Figure 5) was used to create a platform up to the first broken instrument, and the broken piece was visually identified. The dentin was removed circularly from the periphery of the file using ultrasonic tips. Using ultrasonic tips without cutting features, movement were made counterclockwise around the file to free the broken piece within the canal.

With the help of irrigation, the first broken part was removed from the canal, and then periapical radiography was taken (Figure 2). Then the second broken piece was bypassed. During the preparation, the broken instrument found in the canal was removed. Subsequently, purulent exudate drainage was observed in the mesiobuccal canal. The root canals were irrigated with physiological serum, dried with microsuction and then checked with paper points. Since purulent exudate findings were encountered on the paper points used, the cavity was sealed using a loose cotton and temporary filling material (Figure 3). The patient was given an appointment for the second session two days later.

When the patient came to the second session, it was learned that the pain during chewing had decreased. After the cavity was reopened and the root canals were irrigated using physiological serum, they were checked with paper points and no signs of exudation were found. Subsequently, the root canals were irrigated with 20cc NaOCl per canal and irrigation solution was activated for 15 seconds with the help of ultrasonics(Endoart ultrasonic polymer tips, İnci Dental). After drying the canals, they were temporarily filled with $Ca(OH)_2$, and the cavity was sealed with sterile Teflon and temporary filling material. The patient was scheduled for a third appointment in two weeks.

During the third session, it was found that the symptoms had completely resolved. After opening the cavity, $Ca(OH)_2$ was removed with the help of NaOCl and ultrasonic polymer tips. The canals were dried, and then filled with bioceramic root canal sealer(Dia-Root Biosealer, DiaDent Group International) and gutta-percha cones. At the most apical point of the created platform, it was cut and condensed. The remaining part of the canal was filled using thermoplastic gutta techniques (Figure 4).

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Figure 1: Initial periapical radiograph.

Figure 2: Periapical radiograph taken after the removal of the first broken instrument

Figure 3: Radiograph taken after placement of $Ca(OH)_2$

Figure 4: Periapical radiograph taken after root canal filling and coronal restoration

Discussion

The use of ultrasonic devices with the help of a microscope is a more conservative method of removing broken instruments compared to other alternatives (15,16). Ultrasonic devices can conservatively remove dentin structure, and they have a lower likelihood of causing damage to root structure and periodontal tissue (17).

Another procedure for removing broken instruments is performed by Ward et al. (17). This technique is a small variation of the technique described by Ruddle (18). In brief summary, it relies on creating a flat platform in the canal using modified Gates-Glidden drills. The purpose of this technique is to create a funnel-shaped enlargement in the canal towards the broken instrument to facilitate its visualization under the operating microscope. The Gates-Glidden drills were modified by cutting them with a diamond bur at their maximum cross-sectional diameters (19).

Figure 5: Modified Gates Glidden Drill

Conclusion

The attempt to remove broken files is becoming increasingly popular among clinicians. In the past, attempts to remove broken canal instruments often resulted in significant failures. However, with the help of magnification and illumination devices such as a dental operating microscope and with the increasing prevalence and variety of ultrasonic instruments, many clinicians are now able to achieve higher success in removing broken endodontic instruments from the canal.

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