



Case Report

Retrieval of multiple separated endodontic instruments using ultrasonic vibration: Case report



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المخلص

يهدف هذا التقرير لشرح تدبير حالة معقدة لثلاثة أدوات لبية مكسورة في سن واحدة. راجع مريض عمره ٣٢ عاماً، لديه ثلاثة أدوات لبية دوارة مكسورة في الرحي الثانية العلوية اليمنى. تم تحضير درجة الاستناد فوق الجزء العلوي من الأداة المكسورة. ثم تم إزالة العاج حول الجزء العلوي من الأداة المكسورة بواسطة رأس خاص لجهاز الأمواج فوق الصوتية، وذلك بمساعدة التكبير بالمجهر الجراحي السني. وبعد ١١ دقيقة أصبحت الأداة المكسورة مهترزة وتم استخراجها. وبتتابع نفس الطريقة تم إخراج الأداة المكسورة الثانية من نفس القناة الجذرية بعد ١٧ دقيقة. بعد ذلك فشلت المحاولة الأولى لاستخراج الأداة المكسورة الثالثة من القناة الجذرية الأخرى. لذلك تمت محاولة المرور بجانبها ولكن المحاولة فشلت. ونتج عن المحاولة الثانية للاستخراج كسر الجزء العلوي من الأداة المكسورة، وبعدها نجحت المحاولة الثالثة للاستخراج بعد ٧ دقائق. يمكن الاستنتاج من هذا التقرير أنه حالما يتم العبور بجانب الأدوات المكسورة يجب إنهاء تنظيف الأقفنية الجذرية بمبارد يدوية. كما يجب على الممارس أن يحدد إمكاناته ويأخذ بعين الاعتبار تحويل الحالات التي يصعب عليه التعامل معها. تساعد الخبرة الكافية وتوفر الأدوات المناسبة على تدبير الحالات المعقدة. ويسهم استعمال تقنية الأمواج فوق الصوتية والتكبير بالمجهر السني في الاستخراج الناجح للأدوات المكسورة.

الكلمات المفتاحية: الاهتزاز فوق الصوتي؛ شظايا سنية؛ قمة المجس فوق الصوتي؛ مبرد؛ قناة إنسية شذوية

Abstract

This report describes the management of a complicated clinical case with three instruments fractured in one

tooth. A 32-year-old patient presented with three Pro-Taper rotary files fractured in the upper right second molar (S2 and F2 in the disto-buccal canal and S1 in the mesio-buccal canal). A staging platform was prepared in the distal canal coronal to the fragments. Under dental microscope magnification, an Endo-4 ultrasonic tip was activated to dislodge the more coronal fragment (S2) by trephining dentine around the coronal aspect of the fragment. After 11 min, the fragment became loose and was removed. Following the same protocol and using an Endo-5 ultrasonic tip, the second fragment (F2) was removed in approximately 17 min. The first attempt to remove the S1 fragment from the mesio-buccal canal was not successful. An attempt to bypass this fragment using a K-file also failed. A second attempt using the ultrasonic technique resulted in a secondary fracture of the coronal aspect of the fragment. An Endo-5 ultrasonic tip was used to dislodge the fragment, which was successfully removed in 7 min. This report concludes that once a fractured file is bypassed, the instrumentation of a root canal is best completed with hand files. Clinicians should identify their limitations and consider referring cases that are beyond their abilities. Good experience and an appropriate armamentarium enable successful management of complicated cases. Ultrasonic vibration and dental microscope magnification contribute to successful removal of fractured instruments.

Keywords: Complications; Endodontics; Removal; Separated; Ultrasonics

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Introduction

Successful root canal treatments (RCTs) depend on a sequence of procedures. Sufficient cleaning and shaping of the root canal system is essential.¹ However, unpleasant accidents or mishaps, such as fracture of endodontic instruments, may occur during this step. Factors contributing to this unfortunate accident have been identified.^{2–5} One of the most important factors is root canal anatomy: the rate of file fractures increases as the radius of the root canal curvature decreases.⁶ It is generally accepted that the more endodontic files are used, the greater the likelihood of fracture. Therefore, a single use policy has been highly recommended to reduce files fracture.⁷ However, even with a single use, instruments still sometimes fracture.⁷ This has been explained by the fact that fracturing of endodontic files is greatly influenced by the way they are used,⁴ which, in turn, is affected by the experience and proficiency of the clinician using them. A previous clinical study showed that the most important factor influencing instruments' failure was the operator.⁸ This relationship was explained by clinicians' clinical skills or by their decision to use instruments either a specific number of times or until defects were evident.⁸ Another important factor is instrumentation procedures and techniques.^{3,4} For example, pre-flaring the root canal system by using hand files enables rotary files to be used a greater number of times.⁹ Other factors, such as the design and metal composition of instruments, sterilization, using irrigation during instrumentation, and manufacturing process have been found to influence instruments fracture.^{2,4} In addition, studies have suggested many kinds of instrument fractures, including fatigue and flexural fracture.^{2,4}

Management of fractured endodontic instruments can involve surgical or conservative approaches.^{2,10,11} The latter set of options includes attempting to bypass the fractured instrument, attempting to remove it, and instrumenting and obturating the root canal system to the level of the fragment. It is generally accepted that the optimum management strategy is removal of the fractured instrument to enable sufficient debridement of the root canal system. Such an approach is recommended when the clinician has good experience and is competent enough to address such cases,¹¹ when complications are less predictable and when the tooth is strategically important.¹¹ Additionally, this approach can be considered when the instrument fracture occurred during the early stages of instrumentation, when the root canal system is not cleaned.^{10,11} Nevertheless, before a clinician attempts removing a fractured instrument, the complete armamentarium required for such cases should be available.

Many techniques, devices, instruments and methods have been used in the last several decades. The ultrasonic technique involves generating ultrasonic vibrations that are transmitted to the fractured fragment to loosen it and then move it out of the canal.^{12,13} Hand files or spreaders were initially used to transmit the vibration to the fractured instrument.^{14–17} However, specially designed ultrasonic tips are currently used.^{18,19} Ultrasonic vibration is one of the most common techniques.²⁰ However, like any other technique, it may be associated with undesired

complications, particularly if it is not used carefully.^{21–24} Nevertheless, it has been an effective technique, and high success rates have been reported recently.^{25,26} Studies have shown that the combination of ultrasonics with magnification provided by a dental operating microscope has made the removal of fractured instruments more predictable.^{25,26} Cujè *et al* indicated that one important factor contributing to the high success rate of fragment removal was the use of magnification provided by a dental microscope.²⁵ Additionally, Nevares *et al* reported a higher removal success rate (85.3%) when the fragments were visualized with a dental microscope compared to when the fragments were not visible,²⁷ in which case the success rate was a low 47.7%.

Fracture of endodontic instruments may occur even in experienced hands.^{28,29} A previous study showed that the proportion of endodontists who had experienced instruments fracture (94.8%) was significantly greater than that of general dentists (85.1%).²⁹ Moreover, while the plurality of endodontists had experienced more than 10 fractured instruments, a plurality of general dentists had experienced just 1–5 fractured instruments. However, there are few reports in which more than one instrument fractured within one tooth or even one canal.^{17,30} Management of such cases can be more challenging and may entail greater difficulty compared to cases with a single fractured instrument.

The aim of this case report was to describe the management of a complicated clinical case in which three instruments fractured in one tooth using the ultrasonic vibration technique.

Materials and Methods

A 32-year-old healthy male Sudanese patient presented at the General Dentistry clinics at the College of Dentistry, Taibah University, with irreversible pulpitis of the upper left second molar (Figure 1A). Following diagnosis, administration of local anaesthesia and rubber dam isolation, the dentist (a demonstrator) started performing RCT. Following location of three canal orifices (palatal, mesio-buccal and disto-buccal), a size 10 K-file was used to obtain initial canal patency. Cleaning and shaping was performed using the ProTaper rotary system (Dentsply Maillefer, Ballaigues, Switzerland). The clinician started with the SX, S1 and S2 instruments. The root canal system was irrigated during instrumentation using 2.5% sodium hypochlorite after each file use. During instrumentation, the S2 file fractured in the disto-buccal (DB) canal (Figure 1B). The dentist successfully bypassed the fragment using K-files up to size 20 (Figure 1C & D). Then, he started cleaning and shaping the other two canals. While instrumenting the mesio-buccal (MB) canal, the S1 ProTaper file fractured in the apical one-third of the canal (Figure 1E). The dentist became stressed and went back to the DB to complete cleaning and shaping of the DB canal using rotary files. Subsequently, an F2 ProTaper fractured next to but slightly more apically than the previous fragment (Figure 2A). At that point, the dentist referred the patient to the endodontic specialty clinic to be managed by an endodontic specialist (the author).

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