International Journal of Research and Review
Vol. 10; Issue: 12; December 2023
Website: www.ijrrjournal.com
Case Report *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

An Alternative Method of Management of a Separated Endodontic File Beyond the Apex - A Case Report

Ekaterina Karteva[1], Stefan Nyagolov[1]

[1]Department of Operative Dentistry and Endodontics, Faculty of Dental Medicine, Medical University – Plovdiv, Bulgaria,

Corresponding Author: Ekaterina Karteva

DOI: https://doi.org/10.52403/ijrr.20231269

ABSTRACT

Endodontic instrument fracture is a prevalent challenge in root canal therapy, often leading to treatment complications and increased procedural difficulty. This case report presents an alternative way of treating an endodontic file separated in the apical third of the mesio-buccal canal of a lower molar. Due to the strategic importance of the tooth, the considerable apical curvature and patient's requirements, the clinicians opted for deliberate extrusion of the broken fragment into the periodical tissues, thus hermetically sealing the endodontic space. This approach has the potential to offer a less traumatic treatment option under certain conditions.

Keywords: separated, file, fracture, management, alternative

INTRODUCTION

The field of endodontics continually evolves with the integration of advanced technologies and innovative techniques aimed at enhancing the precision and success rates of root canal procedures. Among the challenges encountered during endodontic treatments, the separation of instruments within the root canal system stands as a recurrent and formidable complication. The inadvertent detachment of files during instrumentation poses clinical dilemmas, necessitating efficient and predictable retrieval strategies to mitigate the impact on treatment outcomes. Separated endodontic instruments not only impede the progression of treatment but also present the risk of procedural errors, root canal irregularities, and potential post-operative complications. As endodontic therapy increasingly becomes a cornerstone in preserving natural dentition, the imperative to develop and refine techniques for the retrieval of separated instruments has never been more crucial. By understanding the factors contributing to instrument separation and implementing evidence-based practices, clinicians can proactively manage and minimize the occurrence of this challenging clinical scenario. Moreover, in the event of file separation, clinical reports and accumulated scientific data can help the clinician choose and successfully implement the best treatment option according to the specific case.

LITERATURE REVIEW

Management of those clinical situations involves several options such as bypassing or retrieval of the broken fragment. In cases of failure to successfully carry out those two courses of action, the clinician may opt for obturation to the level of separation, followed by apical surgery [1]. Various techniques for the removal of broken instruments have been proposed and developed. The chosen approach depends on factors such as the location of the separated instrument, the type of file, and the skill

level of the clinician [2]. The techniques most used for the fragment retrieval are ultrasonics in combination with the operating dental microscope, the Masseran kit, Haedstrom files, braiding technique, apical negative pressure irrigation, glued instrument removal, the wire loop method, or a combination of them [3]. When the instrument is separated beyond the apical third of a curved canal, however, the clinical situation becomes even more challenging. We present such a case involving a lower molar with limited treatment options available, which was successfully treated in an alternative way.

MATERIALS & METHODS

A 43-year-old male came to our clinical rooms with aesthetic and functional complaints. Clinical and preclinical examinations were performed, including an orthopantomography (Figure 1) and a treatment plan for the full mouth rehabilitation of the patient was proposed.

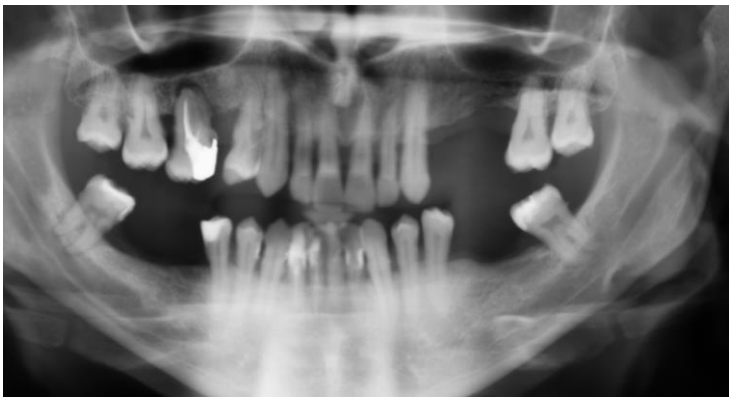

Figure 1. Orthopantomography of the patient. The mandibular canal is near the apices of the lower molars.

This included crown preparation of teeth 37 and 47 to use them as abutments for the fabrication of two metal-ceramic bridges in the lower region. Due to their malposition and severe medial inclination, they needed to be devitalised prior to crown preparation. The endodontic treatment of tooth 37 was performed under local anaesthesia and the use of rubber dam. Three root canals were located - distal, mesio-buccal and mesio-lingual. The canals were calcified, narrow and curved - the mesial ones, so machine-driver rotary nickel-titanium endodontic instruments were used for their preparation. Following the establishment of the working length and successful creation of the glide path, two of three canals were prepared to the desired final shape. During the final preparation of the mesio-buccal canal, however, the finishing nickel-titanium file was separated at the tip. The attempt at bypassing the fragment was unsuccessful. The patient reported pain on pressure at the time and an X-ray was performed (Figure 2).

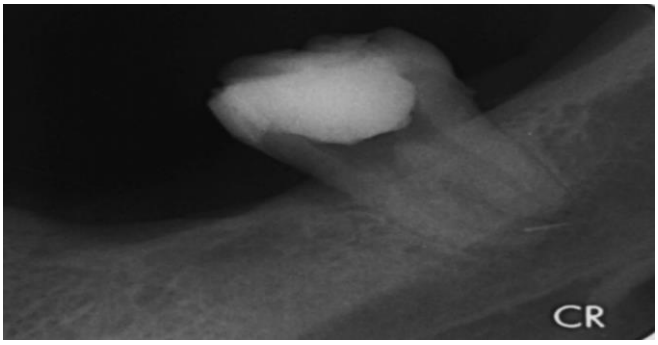

Figure 2. Segmental x-ray of tooth 37 with the separated fragment apically.

After careful consideration, the fragment was successfully pushed out into the periodontal space completely, freeing the canal. This was performed during instrumentation with hand K files sizes 8, 10 and 15 and subsequently, during the shaping process with the rotary files. Irrigation with sodium hypochlorite 5,25% was sued throughout the treatment. Patency was achieved at full working length and the case was completed using the single cone technique with bio ceramic sealer, and a direct composite obturation.

RESULT

The instrument was successfully extruded in the periapical space and the canals were hermetically sealed in all dimensions (Fig 3).

Figure 3. Completed obturation of the root canals, with the fragment extruded in the periapical space.

At the time of case completion, the patient reported no pain on pressure and was completely asymptomatic. The patient was scheduled for a 3 and 6-month and 12-month follow up.

DISCUSSION

Several factors contribute to the susceptibility of endodontic instruments to fracture. Mechanical stress during canal negotiation, shaping, and cleaning processes plays a crucial role, with the cyclic fatigue caused by torsional and flexural forces being a primary determinant [4,5]. The composition and design of the instruments, as well as their size, taper, and cross-sectional geometry, influence their resistance to fracture. Recent advancements in metallurgy and manufacturing techniques have led to the development of instruments with enhanced strength and flexibility. Nickel-titanium (NiTi) alloys have gained popularity due to their unique properties, such as superelasticity and shape memory, which contribute to improved resistance against fatigue [6]. Even so, manufacturers recommend that these instruments be single use, despite their improved characteristics. This recommendation was not followed by the operator in this particular case. The instruments were used once before on the tooth 47 of the same patient. This probably was the main contributing factor that led to the file separation. Furthermore, variations in the anatomical complexities of root canals and the presence of calcified or curved canals increase the risk of instrument failure. The treated molar presented with a challenging curve in the apical third of the mesial canal. Additionally, the mesiobuccal canal was narrow. In order to overcome these difficulties, a glide path was established with preparation of the coronal two-thirds of the canal first, followed by

preparation of the apical third under copious irrigation. Despite this protocol, the last file of the sequence did separate, which led us to the discussion of other possible aggravating factors.

In addition to these mechanical factors, the role of operator technique and experience cannot be understated. Inadequate irrigation, improper sequencing of instruments, and excessive force during instrumentation are common operator-related factors that contribute to instrument fracture. Our case was treated during the state training of dental students in their last year before graduation. Although the operator had some experience, it is possible that the loss of tactile sense when using rotary files or the application of excessive force at some point of the treatment contributed to the failure. Once the separation of the file was confirmed by x-ray, a treatment plan had to be proposed. The patient reported pain on pressure at the time, possibly because of the periapical irritation by the broken fragment. There were several factors that determined the course of action - the strategical importance of the tooth in the overall treatment plan, the configuration of the root canal with the severity of the curvature, the location of the broken file. The first option was retrieval of the fragment implementing the use of ultrasonics: a technique used with success in a lot of clinical cases [7]. Since the separated fragment was below the curvature, trying to retrieve it would have required the removal of a lot of dental structure, thus compromising the fracture resistance of the root. Obturation to the level of separation followed by apical surgery was not possible, since the molar was near the mandibular canal, risking injury to the mandibular nerve. This course of action is more favourable in treatment of upper teeth. For example, Liao et al. successfully surgically retrieved a fragment extruded in the maxillary sinus and soft tissues [8]. It is also possible to implement this technique in lower molars, provided that the mandibular nerve canal is at a sufficient distance from the apex of the tooth [9]. Another interesting approach is a limited resection of the mesial root, with or without the use of additional bone graft [10]. In our case, however, the patient refused any kind of surgical approach during treatment. Extraction of the tooth was not advisable as well, since that it was going to be an abutment for a future bridge in that region. Therefore, we decided to try pushing the fragment out of the canal, thus hermetically sealing the endodontic space, leaving the fragment in the periapical tissues. The possible microbial contamination of the endodontic space and the was minimal because of the absence of any prior infection, as well as the copious irrigation with sodium hypochlorite performed throughout the treatment. Therefore, we felt confident that once the canal was sealed, there would not be any further complications. This was supported by the fact that the patient reported absence of any pain immediately after the completion of the treatment.

CONCLUSION

The successful management of separated instruments is a challenging task with a myriad of factors to consider in each clinical case. In some cases, elective expulsion of the fragment beyond the apical foramen could be a beneficial option. The advantages of the method include preservation of tooth structure thus not compromising the fracture resistance of the tooth, less trauma to the patient compared to choosing a surgical approach, as well as faster and more accessible treatment that does not involve the need for any special armamentarium. The presented approach is possible only in vital cases with minimal bacterial contamination, to ensure that the extruded fragment would not case further periapical complications. It should be implemented with caution in severely infected root canals, such as cases of pulp gangrene or chronic apical periodontitis. Data for the application of this method in such cases is limited and warrants more research. In addition, guided endodontics using digital software is gaining popularity, especially

with the progress made in AI-development in recent years [11]. This approach could prove beneficial, enabling less experienced clinicians to safely and predictably remove separated instruments.

Declaration by Authors

Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Madarati AA, Hunter MJ, Dummer PM. Management of intracanal separated instruments. J Endod. 2013;39(5):569-581. doi: 10.1016/j.joen.2012.12.033. PMID: 23611371.
2. Nasiri K, Wrbas KT. Management of separated instruments in root canal therapy. J Dent Sci. 2023;18(3):1433-1434. doi: 10.1016/j.jds.2023.04.001. PMID: 37404615; PMCID: PMC10316507.
3. Jadhav G, Mittal P. Management of separated endodontic instruments: case reports. Gen Dent. 2022;70(1):35-39.
4. Sattapan B, Nervo GJ, Palamara JE, Messer HH. Defects in rotary nickel-titanium files after clinical use. J Endod. 2000;26(3):161-165.
5. Pruett JP, Clement DJ, Carnes DL Jr. Cyclic fatigue testing of nickel-titanium endodontic instruments. J Endod. 1997;23(2):77-85.
6. Cheung GS, Darvell BW. Fatigue testing of a NiTi rotary instrument. Part 2: fracture behaviour. Int Endod J. 2007;40(7):574-581.
7. Hindlekar A, Kaur G, Kashikar R, Kotadia P. Retrieval of Separated Intracanal Endodontic Instruments: A Series of Four Case Reports. Cureus. 2023;15(3): e35694. doi:10.7759/cureus.35694. PMID: 37012963; PMCID: PMC10066733.
8. Liao Q, Han ZM, Zhang R, Hou BX. Management of Separated Instruments Extruded into the Maxillary Sinus and Soft Tissue: a Case Series. Chin J Dent Res. 2022;25(1):67-73. doi: 10.3290/j.cjdr.b2752707. PMID: 35293712.
9. Mantri S. Management of fractured root canal treated mandibular molar with separated endodontic instrument extending in periapical region. SAGE Open Med Case Rep. 2018; 6:2050313X18809253. doi:10.1177/2050313X18809253. PMID: 30397476; PMCID: PMC6207969.
10. Satheesh SL, Jain S, Bhuyan AC, Devi LS. Surgical Management of a Separated Endodontic Instrument using Second Generation Platelet Concentrate and Hydroxyapatite. J Clin Diagn Res. 2017;11(6): ZD01-ZD03. doi:10.7860/JCDR/2017/25761.9991. PMID: 28764303; PMCID: PMC5535490.
11. Bordone A, Ciaschetti M, Perez C, Couvrechel C. Guided Endodontics in the Management of Intracanal Separated Instruments: A Case Report. J Contemp Dent Pract. 2022;23(8):853-856. doi:10.5005/jp-journals-10024-3395. PMID: 37283022.

How to cite this article: Ekaterina Karteva, Stefan Nyagolov. An alternative method of management of a separated endodontic file beyond the apex - a case report. *International Journal of Research and Review*. 2023; 10(12): 693-697. DOI: *10.52403/ijrr.20231269*

******