

Bypassing a Separated Instrument in Mandibular First Premolar with Two Canals – A Case Report

Mohd Nazrin Isa, Aws Hashim Ali AL-Kadhim

Faculty of Dentistry, Universiti Sains Islam Malaysia (USIM), Selangor, Malaysia

Received

3rd July 2020

Received in revised form

12th August 2020

Accepted

7th September 2020

Corresponding author:

Dr Mohd Nazrin Mohd Isa

Dental Officer, Faculty of Dentistry,
USIM, Level 15, Menara B, Persiaran
MPAJ, Jalan Pandan Utama,
Pandan Indah, 55100
Kuala Lumpur, Malaysia
Email: mohdnazrin@usim.edu.my
Tel: 011-10275750

ABSTRACT

Fracture of an endodontic instrument will impair the debridement procedure and thus affects the endodontic outcome. This case report focuses on the management of separated instrument and highlights the anatomical variation of mandibular first premolar. An in-depth knowledge on the internal anatomy of this particular tooth as well as following a proven and safe technique as a guideline is important in preventing these endodontic mishaps.

KEYWORDS: Separated instrument, bypassing technique, type V canal

INTRODUCTION

The principle of endodontic therapy relies on complete elimination of the periapical tissues irritation by root canal infection. This process can be achieved by proper chemo mechanical debridement and complete sealing of root canal system [1]. However, there are procedural errors that may occur during treatment such as separated instrument, which can impair the debridement procedure and thus influences the endodontic outcome [2].

The mandibular first premolars provide a massive challenge in performing a successful endodontic treatment due to their unpredictable and unique internal anatomy [3]. Versiani (2019) reported that the incidence of mandibular first premolar with two canals was 31.3% [4].

CASE PRESENTATION

35 years old female came with a chief complaint of spontaneous localised throbbing pain at lower right

back tooth for the past 3 weeks. The pain was aggravated when biting hard food, and painkillers were taken to reduce the pain. Past dental history revealed that the tooth had been attempted for a root canal treatment and separated instrument had occurred. The Patient was subsequently informed of the procedural error from previous root canal treatment.

The patient was fit and healthy. Intraoral examination showed a firm tooth 44 with intact glass ionomer cement restoration on distal and occlusal with a swelling (3mm x 3mm) over buccal area, no deep pocket was detected as shown in Figure 1A.

The tooth was tender on percussion and palpation. Preoperative radiograph showed the lower first premolar with two canals split at mid root with apical radiolucency of 4mm in diameter at apical of the 44 with separated instrument at apical third of mesial canal as shown in Figure 1B. Following the American Association of Endodontist (AAE, 2013), the diagnosis of previously initiated with symptomatic apical



periodontitis of tooth 44 was established. Non-surgical root canal retreatment was proposed and patient agreed for the treatment of choice.



Figure 1A: Buccal view of tooth 44



Figure 1B: Preoperative radiograph: evidence of two canal of lower premolar and separated instrument noted at apical third of mesial canal

To achieve anesthesia for inferior dental nerve, a 2.2ml mepivacane 3% containing 1:100 000 adrenaline (*Scandonest, Lancaster, United Kingdom*) was administrated followed by rubber dam isolation (*Blossom, Union City*). The old glass ionomer cement restoration was removed and an endodontic access was created. A pre-endodontic build up was done using composite (*Filtek Z350, 3M ESPE, Minnesota*). Two canals with one orifice split at the middle third of the root were able to be located under dental operating microscope (*OMS2380, Zumax Medical, Suzhou, China*) (*Figure 2A*). Glide path was achieved at distal canal with K-file size 10 (*DentsplyMaillefer, Ballaigues, Switzerland*). Since the separated instrument was located at the apical third, bypassing technique was preferred as it offered more conservative approach. The mesial canal was enlarged coronally and K-file size 8 and 10 were used to reach the bypass instrument (*Figure 2B*). Irrigation with 17% EDTA was done to dissolve the smear layer and to lubricate the canal during the procedure. The working length was confirmed for both canals using apex locator and radiographic examination. Mesial and distal canals were shaped and cleaned to size 30 with a 4% taper using *Edgefile X7* (*EdgeEndo, Albuquerque, New Mexico*). Copious irrigation was done with 5.2% sodium hypochlorite (*NaOCl*). Non setting calcium hydroxide (*Ultracal XS, Ultradent, Utah, USA*) was subsequently placed intracanal and left for 14 days. A temporary filling was also placed with *Kalzinol* (*Dentsply, North Carolina, USA*).

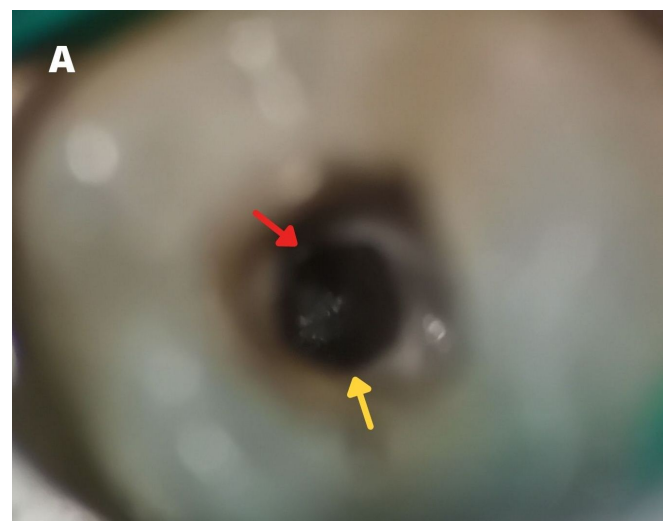


Figure 2A: Red Arrow: mesial canal; Yellow Arrow: distal canal



Figure 2B: After bypassing separated instrument at mesial canal

After 14 days, no symptoms were reported and the swelling was completely resolved (Figure 3A). The tooth was isolated and the temporary filling (Kalzinol) and the intracanal medicament (Calcium Hydroxide) were removed. Intracanal irrigation with 5.2% (NaOCL) was done. A Master Gutta Percha size 30 with 4% tapered (*Coltene, Alstatten Switzerland*) was inserted to the confirmed working length and tug back for both canals were achieved. Periapical radiograph was taken for confirmation. Final irrigation was done using 5.2% NaOCL, followed by normal saline, and then 17% EDTA with sonic activation. The canals were later dried with paper point. Obturation was done by hydraulic condensation technique using a single cone matched gutta percha and bio ceramic sealer (*Ceraseal, Metabiomed, Cheong Ju, South Korea*) at the bifurcation level and thermo plasticized gutta percha was injected from bifurcation up to orifice level. Post obturation radiograph was taken as shown in Figure 3B.



Figure 3A: Buccal view of tooth 44 after 14 days medication with Calcium Hydroxide



Figure 3B: Post obturation radiograph

Semi-permanent composite filling (*Filtek Z350*, *3M ESPE*, *Minnesota*) was placed. The patient was referred for full cuspal coverage and was given an appointment in 6 months' time to monitor the healing progression.

DISCUSSION

The incidence of a separated nickel titanium endodontic file ranged between 0.4 to 5%, which was similar to stainless steel [5][6]. The two main reasons for separated instruments were torsional fatigue and flexural fatigue [7]. Continuous rotation of the file shank while locking the instrument tip in the canal would subsequently cause torsional fracture. This would lead to file fracture once the elasticity of the alloy reached its limit [8]. In addition, continuous free rotation of the instrument within the curved canal would cause flexural fatigue, producing tension/compression cycles at flexure maximum point leading to fracture [8]. Apart from that, flexural fatigue may occur with file overuse and excessive distortion of fractured file surface [9]. Several factors which may contributed to the fractured instrument are clinician skill experience, instrumentation technique, dynamics of instrument use, usage number, design of instruments, canal anatomy, metallurgy and sterilization cycle frequency [8][9].

Versiani et al (2019) reported that the first mandibular premolar had type I canal in 71.3% cases, type II canal in 0.7% cases, type III canal in 2.8% cases, type IV canal in 3.5% cases, type V in 13.4% cases, type VI in 0.07% cases and lastly type VII in 0.04% cases. In addition, 97.5% cases were reported with one root and 2.5% with two roots [4].

The use of magnification was necessary when dealing with branch canal anatomy to help in locating and preparing the canal. Dental operating microscope usage had been proven to be significant in promoting an adequate visual field. This was achieved by providing magnification and illumination where it would increase the number of canals which were able to be observed. The use of dental operating microscope has succeeded in providing the location of 50 extra canals which was equivalent to 7.8% increment in canal location [10].

There were several approaches in dealing with separated instruments, such as fragment removal, bypassing fragment, leaving the fragment in situ as well as surgical approach [8]. In order to retrieve the file, the

position of fragmented file should be determined beforehand. In this case, the fragmented instrument that was located at the apical third and retrieval of file possessed a high tendency for root perforation and weakening root structure [11]. Thus, bypassing fragment was preferable as it showed more conservative approach and able to preserve the root integrity [12].

A favorable prognosis was achieved by bypassing procedure's ability in cleaning the whole working length of the root canal [13]. The success rate for bypassing instrument was 37.5% as reported by Navares et al (2012) [13].

CONCLUSION

This case report is intended to share on the management of separated instruments using bypassing technique and the anatomical variation of mandibular first premolar. An in-depth knowledge on the internal anatomy and instruments used are essential. The same goes with following safe and proven concept and technique in preventing such incidence. Various options should be analysed beforehand to decide on the methods to manage the separated instrument.

Conflict of Interest

Authors declare none.

Acknowledgement

We would like to acknowledge Dr Balqis for editing process and Dr Erfa Zainaldin, dental clinic owner in providing equipment and treatment place. Permission to report the case from the patient was obtained.

Author's Contribution

Mohd Nazrin Mohd Isa involves in patient's management and draft for the case report while Aws Hashim Ali Al-Khadim contributes in the critical revision for the content in the case report.

REFERENCES

1. Reit C. Factors Influencing Endodontic Retreatment. Textbook of Endodontology. 1st ed. Eds Bergenholtz G, Horsted-Bindslev P, UK: Blackwell Publishing, Oxford, UK. 2003. pp 199–201.

2. McGuigan, MB, Louca, C, Duncan, HF. Endodontic instrument fracture: causes and prevention. *British Dental Journal*. 2013; 214(7), 341–348. doi:10.1038/sj.bdj.2013.324
3. Habib, AA, Kalaji, MN, Al Saysd Tyseer J, Al Jawfi Khaled A. Root canal configurations of the first and second mandibular premolars in the population of north Syria. *Journal of Taibah University Medical Sciences*. 2015; 10(4), 391–395. doi: 10.1016/j.jtumed.2015.02.011
4. Versiani M, R. Pereira M, D. Pecora J, D Sousa-Neto M. Root Canal Anatomy of Maxillary and Mandibular Teeth. In: *The Root Canal Anatomy in Permanent Dentition*. 1st ed. Eds A.Versiani M, Basrani B, D. Sousa-Neto M. Springer International Publishing AG, Cham, Switzerland. 2019. pp. 190.
5. Pettiette MT, Conner D, Trope M. Procedural errors with the use of nickel titanium rotary instruments in undergraduate endodontics. *J Endod* 2002; 28:259.
6. Al-Fouzan KS. Incidence of rotary ProFile instrument fracture and the potential for bypassing in vivo. *Int Endod J*. 2003; 36(12): 864-867. doi:10.1111/j.1365-2591.2003.00733.x
7. Sattapan B, Palamara JE, Messer HH. Torque during canal instrumentation using rotary nickel-titanium files. *J Endod*. 2000; 26(3): 156-160. doi:10.1097/00004770-200003000-00007
8. Parashos P, Gordon I, Messer HH. Factors influencing defects of rotary nickel-titanium endodontic instruments after clinical use. *J Endod*. 2004; 30(10):722-725. doi:10.1097/01.don.0000129963.42882.c9
9. Cheung, GSP. Instrument fracture: mechanisms, removal of fragments, and clinical outcomes. *Endodontic Topics*, 2007; 16(1):1–26. doi:10.1111/j.1601-1546.2009.00239.x
10. de Carvalho MC, Zuolo ML. Orifice locating with a microscope. *J Endod*. 2000; 26(9): 532-534. doi:10.1097/00004770-200009000-00012
11. Shen Y, Peng B, Cheung GS. Factors associated with the removal of fractured NiTi instruments from root canal systems. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2004;98(5):605-610. doi:10.1016/j.tripleo.2004.04.011
12. 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
13. Nevares G, Cunha RS, Zuolo ML, Bueno CE. Success rates for removing or bypassing fractured instruments: a prospective clinical study. *J Endod*. 2012; 38(4): 442-444. doi:10.1016/j.joen.2011.12.009