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CASE REPORT

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Endoscope-assisted removal of separated instruments in primary molar: a case report with simplified method for separated instrument removal

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Abstract

Background: Separated instruments in primary teeth often lead to extraction due to challenges in non-surgical removal, which lacks detailed magnification techniques. Ultrasonics combined with microscopes offer a potential solution; however, their high cost restricts widespread use among dentists. **Case**: This case report details the effective non-surgical removal of a separated instrument from tooth 85 in a 3-year-11-month-old boy. During a pulpectomy, a #15 K-file was identified as separated. Utilizing a flexible endoscope and an ultrasonic device, the file was successfully extracted without complications. **Conclusions**: The use of an endoscope represents a cost-effective and practical alternative for dentists, allowing for successful non-surgical retrieval of separated instruments in primary teeth. This method not only preserves the tooth but also reduces the stress associated with such procedures.

Keywords

Pediatric dentistry; Endodontics; Separated instrument; Endoscope

1. Introduction

Endodontics presents a complex challenge in the use of separated instruments, which affect both permanent and primary teeth. Often, dentists recommend extraction over removing a separated file for primary teeth. Primary teeth must be preserved, especially for very young patients, which maintains space and offers several benefits [1]. Ultrasonic devices, H-files, or DG (David Green) 16 endodontic explorers are rarely used for nonsurgical management, most commonly without magnification [2, 3]. Endodontic studies have demonstrated the effectiveness of ultrasonic techniques combined with dental operating microscopes. These studies also outline procedures to evaluate case difficulty and removal techniques [4].

Due to the cost of microscopes, endoscopes offer an affordable alternative for dentists [5]. Endoscope depth of field perception closely resembles that seen with the naked eye, facilitating its use. For indirect vision, mirrors have a fixed depth of field, while the endoscope allows for easy adjustment. Observations from multiple perspectives are possible, and direct visual images are provided to enhance procedural accuracy and comfort [6]. This case report details the successful nonsurgical removal of a separated file from tooth 85 using an endoscope.

2. Case report

A 3-year-11-month-old boy, without systemic disease, was referred to the pediatric dentistry department in our hospital due to recurring toothaches. Facial swelling, redness, palpation pain, and extensive caries on at least 10 teeth were discovered during extraoral and intraoral examinations. Having trouble cooperating, full mouth rehabilitation was arranged under general anesthesia.

A comprehensive radiographic examination and clinical assessment was performed under general anesthesia in the operating room. Carious teeth 55, 53, 52, 51, 61, 62, 64, 65, 74, 75, 84 and 85 were present. Upon discussion with the family, a final treatment plan included pulpectomy for teeth 85 and 75, stainless steel crown fabrication for teeth 74, 75, 84, 85 and 55, strip crown fabrication for teeth 52 and 62, extraction of teeth 51, 61 and composite resin fillings for the remaining carious teeth (Fig. 1A).

An incident occurred during full-mouth dental treatment under general anesthesia that resulted in a separation of a #15 K-file (Maillefer Dentsply, Oklahoma, USA) in tooth 85, which was detected by the pediatric dentist while assessing the working length by periapical radiography, which revealed radiopaque material within the coronal area of the canal (Fig. 1B). The retained K-file separation was approximately 4 mm long. A subsequent evaluation of this region confirmed the presence of the separated instrument (Fig. 1C). After a first attempt of removal, the pediatric dentist sought help from endodontics.

Upon the arrival of an endodontist, the periapical film (Fig. 1D) and orifice area were examined under rubber dam isolation, where the separated instrument cannot be seen with the naked eyes. Initial removal attempts were conducted using K-files, H-files (Maillefer Dentsply, Oklahoma, USA),

and ultrasonic devices (Ultra-X, Eighteeth, Jiangsu, China) coupled with a 4.3× loupe magnification device (EyeMag Pro S, Carl Zeiss, Oberkochen, Germany). First, we rechecked the working length with a #15 K-file and tried bypassing it, but were unsuccessful. With a Gates Glidden drill, coronal pre-flaring was initiated to view the separated instrument directly. Following enlargement of the coronal area, a #15 K-file was used to bypass again and the instrument was found to be loose. Using a H-file, we tried braiding the bypass pathway near the instrument, but it failed. Upon verifying the Once the file's looseness, we placed the ultrasonic tip directly to the inner wall using an endoscope (DEN2116, MediVisionTech, Tainan, Taiwan) (**Supplementary Fig. 1A**). The canal was filled with 17% Ethylenediaminetetraacetic acid (EDTA), activated by an ultrasonic device (Ultra-X, Eighteeth, Jiangsu, China). A periapical film clearly showed the instrument was still located in the coronal area (Fig. 1E), moving from the apical area (**Supplementary Fig. 1B**). A H-file with mild clockwise rotation for braiding, and a DG 16 explorer for further loosening (**Supplementary Fig. 1C**). A missing instrument was found in the surgical view, so we reviewed the periapical film again for evaluation (Fig. 1F). We observed no instrument in the canal after checking the x-ray and intracanal condition using an endoscope (**Supplementary Fig. 1D**). Caviton (GC, Aichi, Japan), was used to seal the tooth, confirming the separate file removal procedure had been completed (Fig. 1G).

To complete the remaining dental treatments, this case was referred back to the pediatric dentist. In tooth 85, the root canal was debrided, shaped with K-files, and irrigated with 2.5% sodium hypochlorite. Vitapex (Neo Dental Chemical Products, Tokyo, Japan) was then filled into the canal to ensure effective treatment and maintain the tooth (Fig. 1H).

The patient reported no further toothache complaints at

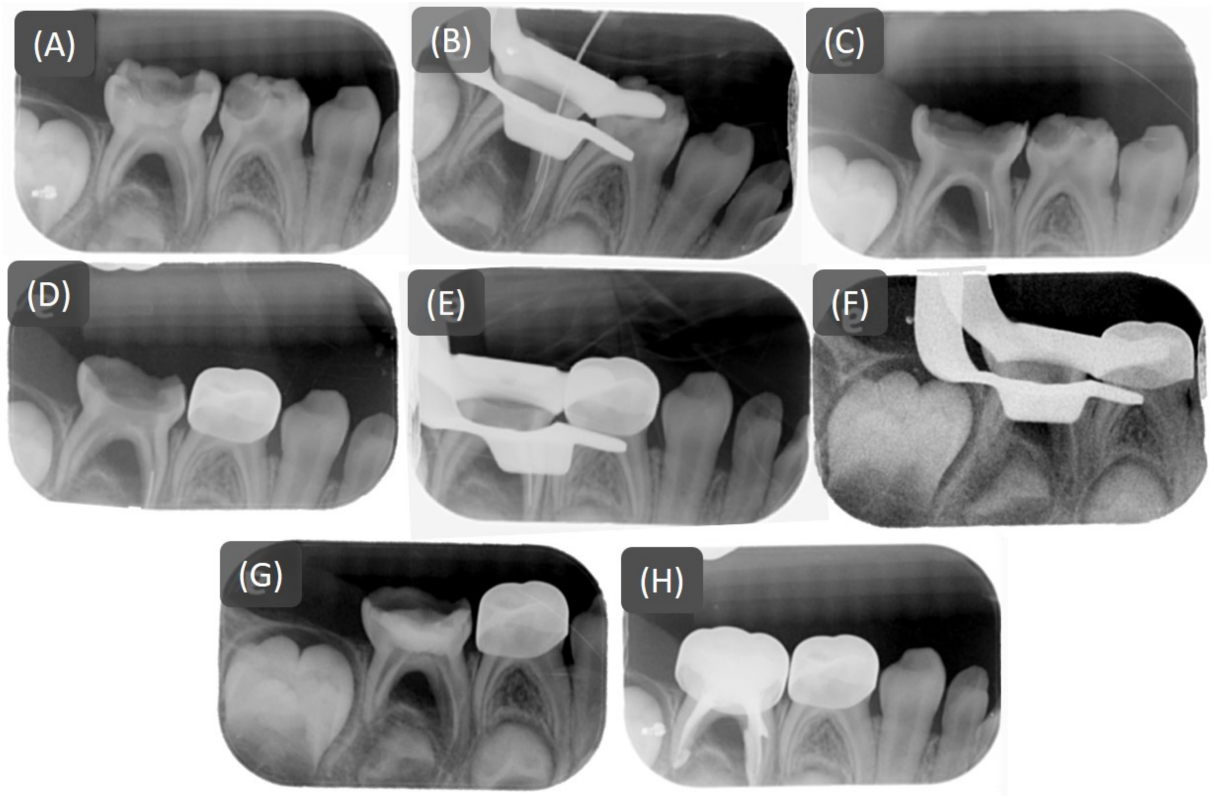

FIGURE 1. Preoperative, intraoperative, and postoperative periapical films. (A) Preoperative x-ray of tooth 85, showed deep caries involving the pulp. (B) Initial discovery: The initial occurrence of a separated file was identified by the pediatric dentist during the working length assessment with a periapical film, revealing radiopaque material in the coronal area of the canal. The retained K-file measured approximately 4 mm in length. (C) Location confirmation: The next periapical confirmed the presence of a separated instrument in the coronal area. (D) Endodontist's assessment: Upon arrival of the endodontist, an X-ray confirmed that the instrument had fallen into the apical area. (E) File position change: With rubber dam isolation, initiate coronal pre-flaring with a Gates Glidden drill aimed at directly exposing the separated instrument. A #15 K-file was used with help from an endoscope to determine whether the instrument was loose after enlarging the coronal area. Upon verifying the file looseness, 17% EDTA was irrigated into the canal and activated by ultrasonic (Ultra-X, Eighteeth, Jiangsu, China). The separated instrument was clearly visible in the coronal area of the canal. (F) Removal confirm: Once the separated instrument was loosened, an H-file was used with the braiding technique, followed by a DG 16 explorer to remove it. Periapical film confirmed the successful extraction of the separated instrument. (G) Final step of removal: Periapical film taken after sealing the tooth coronally with Caviton (GC, Aichi, Japan) confirmed the procedure's completion. (H) Postoperative x-ray of tooth 85 area, showed a pulpectomy with Vitapex and the fabrication of a stainless steel crown for tooth 85.

follow-up, and the family reported no additional discomforts. Patient continued to be followed up at our hospital.

3. Discussion

Healthy primary teeth are crucial to young children's overall development, since they affect general health, nutrition, speech, dental architecture, and psychological well-being. Having healthy primary teeth prevents severe complications like abscesses that lead to infections. Also, they provide children with a balanced diet, which prevents nutritional deficiencies. These teeth are essential for speech development, space preservation for permanent teeth, and dental crowding and alignment difficulties. In primary teeth, pulp therapy plays a critical role in removing infection and preserving tooth vitality. Separated files may occur during such treatments, necessitating careful management to avoid compromising tooth structural integrity and function [7].

Magnification is used in this case to remove separated instruments straightforwardly. A crucial strategy in endodontics is to combine ultrasonic techniques with dental operating microscopes to extract separated files [4]. The specifics of removing separated instruments from primary teeth have rarely been studied. As a preferred treatment strategy, most studies advocate extraction followed by adaptation of a space maintainer [1]. Primary molars, however, have different implications than anterior tooth. Moreover, pediatric dentists' anxiety can be reduced by removing separated instruments in canals [1]. Accordingly, the majority of research on such cases or series shows instrument removal by naked eye [1, 3]. Microscopes have only been used for magnification in a few studies [2]. In recent guidelines, illumination and magnification were emphasized as crucial components of all removal procedures Obtaining a microscope challenging, but relying solely on a loupe device is inadequate as well. Endoscope is an alternative method, which is infrequently used in dentistry [5].

Previous rigid endoscopes were used for evaluation of temporomandibular disorders, apical surgery, among others [5]. Endoscope training is not typically included as a part of standard dental education. For general dentists, flexible endoscopes are more user-friendly than rigid models because of their ease of navigation in canals or chambers. In this case, we used a flexible soft endoscope from MediVisionTech that allows flexibility and can operate underwater with a focus range of 3 to 30 mm. An innovative soft endoscope (MediVisionTech, Tainan, Taiwan) features a front-end maximum size of approximately 2.1 mm, a middle tube outer diameter of approximately 1.9 mm, and a total tube length of approximately 155 cm, excluding the back-end connector and larger components. Dental microscope offers magnifications ranging from 12× to 30×. A similar magnification range of 10× to 50× is available with this endoscope, which varies according to screen size and distance observed. It is essential to initially evaluate a case in accordance with endodontic protocol [4]. In pediatric dentistry, securing preoperative cone-beam computed tomography images can be challenging. However, for primary teeth with shorter roots, selecting cases with visible instruments enhances extraction success. With an endoscope, the separated instrument can be visualized directly in the apical part, facilitating its removal without harming the permanent teeth underneath. The removal of separated instruments is recommended due to conditions specific to primary teeth. In this case, as the space for the separated instrument was clear and easily accessible, the decision was made to proceed with removal despite the risk of perforation and damage to permanent teeth. A 20-minute procedure minimized damage and preparation. It might be appropriate not to proceed with removal if the process becomes too prolonged. It is crucial to acknowledge that while the flexible endoscope facilitated direct visualization of the separated instrument in the apical part, enabling effective removal without harming the permanent teeth, this method still faces limitations. The field depth cannot be adjusted to view from different angles as efficiently as in non-dental applications, often necessitating manual adjustments or additional tools to obtain the optimal visual field [8].

4. Conclusion

This case report introduces an innovative technique using an endoscope for magnification and illumination, which facilitates the removal of separated instruments and alleviates pediatric dentist anxiety during premature primary molar extractions. A comprehensive account of the procedure is provided, along with photographs to illustrate the step-by-step process. The use of an endoscope to remove separated instruments is therefore a viable clinical option.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

PHC and MHC—conceived the ideas. PHC and KYT—collected the data and led the writing and add this section in the title page. KYT—critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Consent for publication was obtained from the patient's legal guardian, with assent from the patient. This case, involving standard treatment, was exempt from formal ethical approval as per the Institutional Review Board of National Cheng Kung University Hospital. All procedures were conducted under informed consent, adhering to the ethical standards of the aforementioned institution.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.jocpd.com/files/article/1896451635512524800/attachment/Supplementary%20material.docx.

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