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Retrieval of Separated Instrument in Left Maxillary 2nd Molar using Ultrasonics: A Case Report

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Abstract
One of the most frequent endodontic errors is the separation of an endodontic instrument while performing a root canal. For improved therapeutic results, reclaiming the instrument should be explored. A case study of the management of separated instruments is presented in this essay. The separated instrument was successfully extracted from the maxillary 2nd molar. The centre section of the maxillary 2nd molar tooth is where the instruments were separated in the canal. An ultrasonic device was used to remove the separated instrument after locating the level of separation and performing staging. After removing the separated instrument, the working length was obturated till the post-endodontic restoration was completed. The dentist can successfully retrieve separated instruments with the help of case analysis, a good arsenal, and experience. In every situation, caution must be exercised to prevent canal damage.

Keywords: Case Report, Ultrasonics, Separated Instrument, Instrument Retrieval, Root Canal Complication

Introduction
Instrument intracanal separation is a problem that endodontists could encounter while working with patients. Both the patient and the provider are disappointed in this circumstance [1]. A dental instrument used in endodontic treatment may break at any time during normal therapy due to flexural fatigue, torsion, or manufacture flaws [2]. According to reports, stainless steel instruments may separate at rates between 0.25% and 6% [3-5], while nickel-titanium instruments can separate at rates between 1.3% and 5.77% [5, 6]. Endodontic files, sectioned silver points, lentulo spirals, gates glidden drills, a portion of carrier-based obturators, finger spreaders, paste fillers, and any other instrument remained inside the canal [7] are examples of broken root canal equipment. The root canal anatomy, the type of instrument material, the location of the fragment in the canal, the plane in which the canal curves, the length of the separated fragment, and the diameter of the canal itself are just a few of the variables that affect how clinical cases involving fractured instruments turn out. Instrument breakage is always a possibility when performing root canal preparation operations. When addressing these cases, one could experience one of three outcomes: Retrieval, bypass, sealing the fragment inside the root canal space, and true blockage are the three steps. Since they are currently the mainstay of root canal instrumentation, nickel-titanium (NiTi) hand files and rotary devices have gained popularity. This is mainly due of the substantially greater flexibility of NiTi files compared to their stainless-steel equivalents, which offers special clinical beneficial circumstances in curved root canals [8, 9, 10]. The difficulty of retrieval increases with larger rakes, greater helix angles, and deeper flutes in the file [11]. Rotary files are more challenging to remove than hand files [12] due to their propensity to thread into root canal walls. The vibrations produced by ultrasonics during removal may shorten or further separate the fragment. The detached fragment may straighten and reengage with the dentin because of the shape memory of NiTi [13]. With a reported success rate ranging from 55 to 79% [14, 15] the removal of dissociated devices from root canals is exceedingly challenging and occasionally impossible. In this report, we provide a case of a separated instrument in which the separated instrument fragment was recovered from the root canal using ultrasonic method.

Case report
A 45-year-old female patient reported to the Department of Conservative Dentistry and Endodontics, Srinivas dental college, mukka, mangalore, with the chief complaint of pain in upper left back tooth region since last 2months. On clinical examination involved tooth showed deep carious lesion. Tooth was tender on percussion. There was no associated swelling in relation to the involved tooth region. Surrounding gingival tissue appeared inflamed but the pocket depths were within the normal limits.

According to clinical findings, we gave the provisional diagnosis of apical periodontitis in tooth #27. Pre-operative intra oral periapical radiograph (IOPA) (Fig 1) revealed radiolucency involving enamel, dentine and pulp with periodontal widening. The medical history was non-contributory. Conventional root canal therapy was proposed.
Access cavity preparation was done under local anesthesia in tooth #27 (Fig 2). Root canal orifices were located with the help of DG 16 explorer and widen using Gates Glidden drills (Dentsply International) (GG) and the patient was recalled for further treatment. During the next visit, the tooth was again isolated and opened, then working length was measured using electronic apex locator and then confirmed using IOPA (Fig 3) and biomechanical preparation was carried out. During the course of biomechanical preparation, neo endo 25 6% rotary file got separated at the coronal region of the mesiobuccal root canal (Fig 4). On radiographic examination, the separated instrument was visible in middle third region of mesiobuccal canal orifice. The patient was informed about the instrument inside the canal and ill-effects of keeping it untouched.
The separated instrument was located in the centre of mesiobuccal canal. Mesiobuccal canal orifice was enlarged using Gates Glidden drills up to #3. Modified Gates-Glidden drills (Dentsply International) were used to create circumferential staging platform to expose 2-3 mm of the coronal most part of the broken instrument.
After this,**,** eighteeth medical ultra gold 25 2 % piezoelectric handpiece at a power setting of 3 was placed into the mesiobuccal canal between the exposed end of the file and the prepared staging platform and activated to loosen the fractured instrument and continuous irrigation was done (Fig 5). Following the ultrasonic activation, the instrument fragment floated out from the canal. Fig 6 shows radiograph after removal of fractured instrument. Fractured instrument was found to be approximately 5mm in length (Fig 7).
Biomechanical preparation was completed by step-back technique using 2% sodium hypochlorite and 17% ethylene diaman tetetraaceticacid (EDTA) (Glyde, Dentsply International). Interappointment dressings of calcium hydroxide were given and the patient was recalled for obturation. Master cone was selected and checked radio graphically as seen in Fig 8. The root canals were obturated by single cone technique using guttapercha and AH Plus root canal sealer. Coronal restoration was done with silver amalgam. Fig 9 shows completed obturation and post endodontic coronal restoration on radiograph.

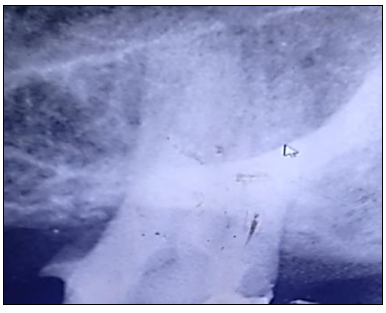

Fig 1: Intraoral periapical showing deep restorationinvolving the pulp chamber

Fig 2: Access opening done under local anesthesia

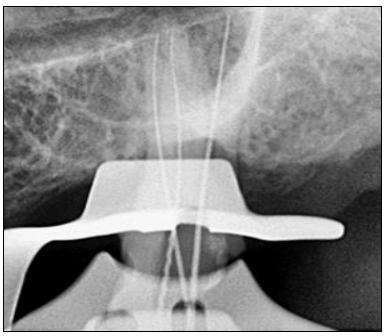

Fig 3: working length determination

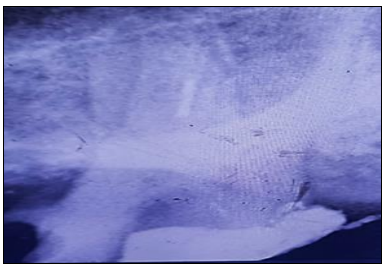

Fig 4: Fractured Instrument visible in middle third of mesiobuccal canal

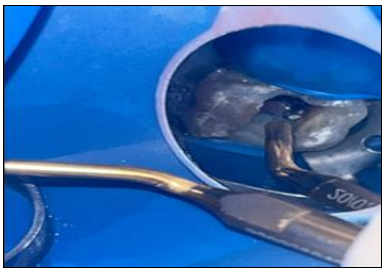

Fig 5: Ultrasonic tip (Eighteeth medical ultra x gold 25 /2%, at a power setting of 3) activated around the obstruction in a counter clockwise direction

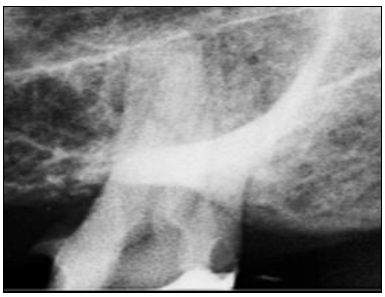

Fig 6: Radiograph shows retrieved instrument from mesiobuccal canal

Fig 7: Retrieved instrument fragment Measured around 5 mm

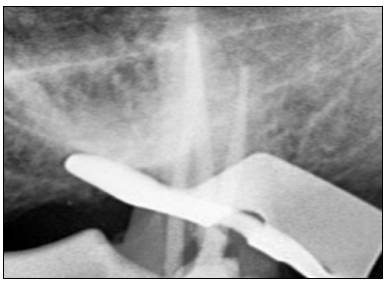

Fig 8: Mastercone Radiograph

Fig 9: Obturation and Coronal Restoration Radiograph

Discussion

Instrument fracture is more frequently recorded in molars, with mesiobuccal roots having a larger incidence [5]. The complete length of the canal can be reached by avoiding the detached instrument, or the coronal point of separation [16] can be cleaned, shaped, and obturated. Instrument removal has become more predictable thanks to recent improvements in instrument retrieval techniques [17]. The effective removal of a NiTi fragment from the mesiobuccal canal of tooth #27 is described in this study. The removal of shattered NiTi fragments from the root canal is more challenging than the removal of cracked stainless steel instruments. One of the most problematic events is when endodontic instruments break inside a root canal. As a result, straight-line access is essential for both the proper removal of the separated instrument and the prevention of instrument separation [17]. Using a Gates Glidden bur, a staging platform is built to accomplish this.

The instrument's position in relation to the canal's curvature, its depth inside the canal, the kind of separated instrument, and the size of the fragment all have an impact on how successfully separated instruments are removed. It is simple to collect an instrument if it is lying in the open space with its entire length visible [18, 19].

Broken equipment that is apical to canal curvature is frequently impossible to recover. The cleaning and shaping process is compromised when there is a detached instrument in the canal because it makes it difficult to reach the apical endpoint. Therefore, attempting to recover the detached instrument is thought to be the preferable course of action. However, it is important to keep in mind that removing separated instruments shouldn't weaken the already-existing radicular tooth structure further because doing so could result in root weakening, increased risk of perforation, and postoperative fracture [20]. The tooth's long-term prognostic value would decline as a result. In order to retrieve the separated fragment, superfluous radicular tooth structure may need to be removed using instrument retrieval methods like the Masserann kit.In 1957, the first application of ultrasound in endodontics was made. Initially, ultrasonic devices with frequencies between 25 and 40 kHz were used, but more recently, handpieces with frequencies between 1 and 8 kHz have been developed, resulting in lower shear stresses and fewer changes in canal surface [21].

Ultrasonic tips counter-angled construction and the availability of various lengths and diameters of tips permit its usage in deeper channel [22].The linear, "piston-like" motion of the tips of these units makes them appropriate for endodontics [21, 23]. Instrument fatigue and secondary fracture of the separated fragment may result from the heat produced as a result of the friction between the ultrasonic tips and canal dentin. Because of this, ultrasonic tips with modest power levels are used for brief application times [24].

Ruddle *et al*. [25] described a method using modified Gates-Glidden burs, ultrasonic equipment, and a dental operating microscope. In this method, a GG drill is used that has a maximum cross-sectional diameter just a little bit greater than the separated piece. Cutting the GG drill perpendicular to its long axis at its largest cross-sectional diameter modifies the bud. In order to introduce an ultrasonic instrument, it is used to build a tiny staging platform.To improve visibility when employing ultrasound, the ultrasonic tip should be triggered in a dry field without concurrent coolant irrigation. While the method typically removes dentin along with the obturation material [26], retrieving apical isolated tools does allow for greater cleaning of the root canals. It is important to prevent weakening the root, as this could cause it to fracture. Retained tool pieces seem to have less of an impact on healing than apical lesions [27, 28]. However, Spili P *et al*., reported minimal influence of a periapical lesion in the outcome of the endodontic treatment with the presence of separated instrument, provided the procedure is performed to a high technical standard [27]. If the approach utilised to remove the detached instrument is ineffective, he also reported a dismal prognosis. When the non-surgical trial is unsuccessful, symptoms continue, or periapical radiolucencies are found radiographically during follow-up visits, surgical intervention should be taken into account [29].

It is crucial to get rid of broken pieces of instruments without further harming the radicular dentin. Therefore, after setting up a staging platform, the preferred method for the effective removal of a separated instrument would be to use ultrasonic tips in conjunction with a direct working microscope.

Conclusion

The decision on the superiority of an instrument retrieval method is complex. Therefore, a careful analysis of the situation and evaluation of the potential risks should be made before attempting to remove the instrument.

Among the many methods available, the ultrasonic endodontic device recommended for recovering broken instruments is very effective since its application is not constrained by the location of the fragment in the implicated

tooth's root canal or tooth.Therefore, the preferred course of treatment is enhanced visualisation in conjunction with a cautious approach, balanced with a good prognosis.

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