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CASE STUDY

High-speed Hand piece Bur Fracture during mandibular third molar Surgery: A report of two cases with Review of literature

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ABSTRACT

In the oral and maxillofacial surgery department, surgical extraction of the mandibular or maxillary third molar is a common surgical treatment. However, even with sufficient effort to execute these surgeries with caution, a number of problems may arise. When extracting impacted mandibular third molars, the high-speed hand-piece bur is utilized to section the tooth. Numerous iatrogenic complications associated with this procedure have already been thoroughly covered in the literature. Inappropriate usage of the bur during tooth sectioning may result in its fracture. Here we discuss two case report where the bur fragment was fractured in case 1 and was embedded in the mandibular bone under the previously extracted tooth 38 and the bur fragment in case 2 it was fractured and embedded distal to tooth 48. When sectioning teeth, light pressure and minimal lateral force should be applied. The number of uses of the high-speed hand-piece bur should be tracked, and its integrity and condition should be thoroughly examined, to prevent breakage. The retrieval protocol when bur is fractured should be decided upon based on the imaging results and carried out as soon as bur fracture and displacement occur.

Keywords: *High Speed hand piece, Durs, Fracture, Iatrogenic complication, Third molar surgery.*

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INTRODUCTION

In the oral surgery, surgical extraction of the third molar is a routine surgical procedure [1]. Many major and minor complication might arise from the surgical extraction of third molar teeth. Major complications like abscess formation, excessive bleeding, mandible fracture, and nerve injury. These complications may have irreversible effects and require more care. Minor complications like pain, swelling, and bleeding, such complications patient can recover without any further treatment [2]. These minor complications occur frequently; hence they are also known as sequelae or post-operative sequelae [3]. These days, minimally traumatic tooth extraction is widely employed since it enhances clinical results by minimizing inflammation, discomfort, and healing time [3, 4].

Fracture of roots, crown or the entire tooth during third molar surgery is a complication that occurs very often during these minor surgical procedures. However, fracture of a high-speed hand piece bur not very common and least reported in the literature.

Additionally, one technique for tooth sectioning during the least traumatic extraction of impacted mandibular third molars is a contra angle high-speed hand-piece bur made of steel with a tungsten carbide coating [5-7]. More than one cut is usually required in the affected tooth during tooth sectioning, and if the instrument is not chosen correctly and the bur is not used correctly, the high-speed hand-piece bur may break or fractured and gets embedded in the bone during the extraction of an impacted mandibular third molar [7, 8].

In order to alert dental surgeons of this uncommon complication in dento alveolar surgery, the current article presents a rare complication of an accidental high-speed hand piece bur fracture during the mandibular third molar surgery. Two reports of a high-speed dental hand piece bur during the extraction of a mandibular third molar are reported by the authors along with review of literature regarding reasons, complications, Radiological investigation needed to localize the fractured bur in the bone and treatment needed to remove the fractured bur and prevention of high-speed hand piece burs fracture during third molar surgery.

Case 1:

Figure 1: *Case 1* A Preoperative panoramic radiograph

Figure 2: Intra-Oral Periapical view radiograph showing the bur fragment in the socket of the left mandibular third molar.

Figure 3: Post operative Intra-Oral Periapical view radiograph showing complete removal of the bur segment.

Figure 4: Postoperative panoramic view showing complete removal of the bur segment.

A 26 years old male patient was referred to the Oral surgery clinics for surgical extraction of mandibular left third molar (#38). The teeth was planned for surgical extraction. Written informed consent was taken from the patient before proceeding for the surgical under local anesthesia. 2% Lidocaine with 1:100,000 epinephrine and an inferior alveolar nerve, lingual and long buccal nerve block was given. Incision was made and the tooth was exposed, Buccal guttering was done with removal of bone from the disto-buccal aspect of the tooth with low-speed hand piece with surgical bur with irrigation with saline. The tooth was sectioned using high speed hand piece with bur. The tooth was sectioned in two-halves and removed from the socket using Cyer elevator.

Irrigation was performed using saline upon completion of the procedure, a shiny object was seen in the socket which was difficult to remove. Upon probing it looked like a broken bur embedded in the bone. This was confirmed upon check the high-speed handpiece with bur, which was broken. An IOPA was performed to reconfirm and locate the exact location of the fractured bur. The fractured bur was removed

by removing part of bone around it. And this was taken up by the section tube. An OPG was performed to confirm and to keep this in record. The socket was closed using 3-ooo interrupted suture. Hemostasis was achieved by gauze pressure and patient was dismissed after post-operative instructions were given along with the analgesics brufen 400 mg three times a day for 5 days. The patient was recalled after 1 week for suture removal. There was no post-operative complication after the extraction and after 1 week, healing was noticed after 1 week.

Case 2:

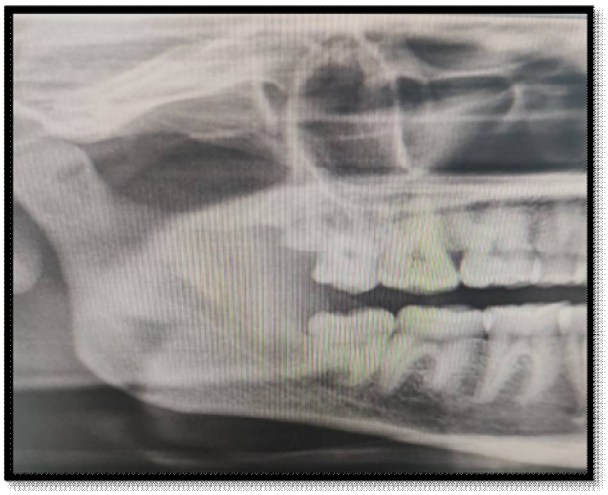

Figure 5: ***Case 2:*** **A Preoperative Intraoral periapical view (IOPA) radiograph**

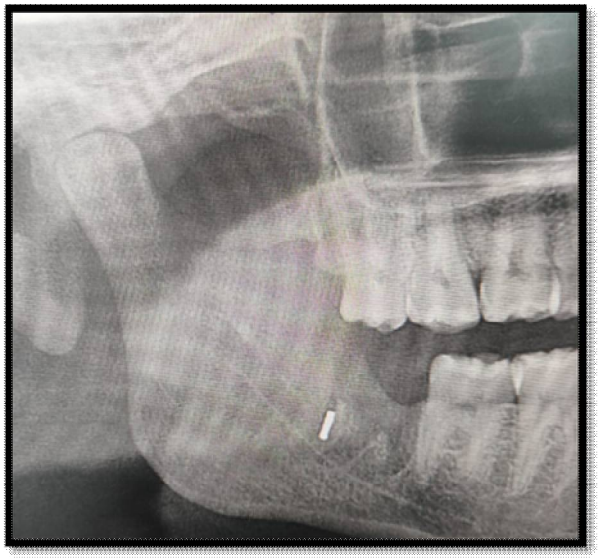

Figure 6: Intra-Oral Periapical view radiograph showing the bur fragment in the socket of the right mandibular third molar.

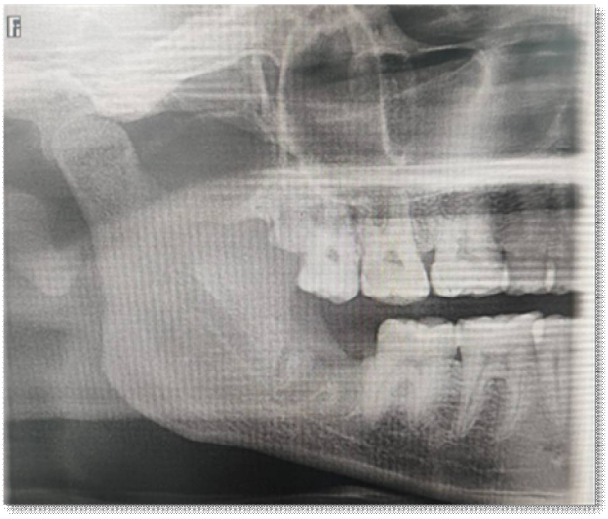

Figure 7: Post operative Intra-Oral Periapical view radiograph showing complete removal of the bur segment.

A 27 years old patient was referred to the Oral Surgery clinics for surgical extraction of mandibular right molar (#48). On clinical and radiographic examination revealed a distomolar impacted teeth. Written informed consent was taken from the patient before proceeding for the surgical extraction. The impacted teeth were removed under local anesthesia with 1: 100,000 epinephrine using 2% Lidocaine with 1:100,000 epinephrine with inferior alveolar, lingual, long buccal nerve blocks. Incision was given and buccal guttering was performed and distobuccal bone was removed. During bone removal, an accidental breakage of the bur had taken place, impacted tooth was removed and IOPA was performed to locate the fractured bur. The fractured bur was removed by removing a part of the bone around the bur. This fractured bur was taken up by the suction. To confirm, an IOPA was again taken. The socket was closed by 3-ooo black silk. The patient was recalled after 1 week along with the analgesics brufen 400 mg three times a day for 5 days and patient reported no post-operative complication and socket was healing uneventfully.

DISCUSSION

Many serious and minor complications might arise from the surgical extraction of third molar teeth. Complications that require further care and have the potential to have lasting effects are referred to as major complications. These complications, which include nerve damage, profuse bleeding, mandibular fractures, and abscess formation, have been reported often. Pain, swelling, and bleeding are examples of minor problems that can go recover on their own without the need for additional care [9-12]. A uncommon surgical complication that has been reported rarely in the literature in oral surgery is the accidental breaking of any surgical instrument. These problems are typically caused by a variety of circumstances, such as the patient (tooth-related issues), old equipment, and the surgeon's surgical expertise [13].

Even when every effort is made to remove teeth cautiously, mishaps can sometimes happen. The high-speed bur and dental elevator are two tooth extraction tools with comparatively tiny working tips. Although this has hardly ever been documented, their working tip may break and migrate. If the broken instrument fragments are left inside the body, infection-related symptoms including pain and edema could appear [14]. When a high-speed dental hand piece bur migrated during the extraction of a mandibular third molar, Matsuda *et al* [15] documented two instances: one in which the iatrogenic foreign body moved into the mandibular body and was later removed under general anesthesia, and another in which it moved into the floor of the mouth and was removed under local anesthesia.

Li K[16] reported three cases of bur fracture during third molar surgery. In case one, the bur fragment embedded in the mandibular bone. The bur fragment in case 2 was embedded in the lingual edge of the socket and partly beneath the mucosa on the lingual side. The position of the bur fragment in case 3 was similar to that of case 1 but was completely embedded in the spongious bone. Rajaran JR [7] reported a case of a high-speed tungsten carbide bur was accidentally broken and displaced into the mandibular bone during surgical procedure. To determine the precise location and size of the bur a cone beam CT scan was performed. The next day, the bur section was extracted while under general anesthesia.

Yalcin S [16], described an unusual instance of a foreign body in the submandibular area that had never been reported before. In this particular case, the surgeon made the decision to separate the roots and crown. But rather than using a surgical bur, he employed a high-speed hand piece with a diamond bur. using the right surgical instruments and techniques is one of the most crucial aspects of surgery.
Ali FM [17] reported a **rare case of non-symptomatic accidental buried of high-speed hand piece bur into the bone. In this particular case** the patient showed none of the symptoms associated with that fractured bur fragment, no treatment was performed and the patient remained under close supervision. Surgeons should attempt to remove any medical or dental materials that are discovered during surgery, such as gauzes and broken bits of medical or dental devices. Furthermore, patients typically complain of symptoms including infection-related discomfort and edema if they are left in the body. Consequently, it is a rare and undesired instance where an iatrogenic foreign body is accidently found during diagnostic imaging, as seen in the case reported by Ali FM [17].

Authors / Year	**Location where bur embedded in bone**	**Radiological Investigations**	**Treatment**
Yalcin S [9]	Submandibular space	Panoramic, CBCT	Bur was taken out from the submandibular space by constant upward external pressure in the submandibular region to push the foreign body toward the oral cavity.
Fareedi MA [17]	**Rt mandibular 3rd molar area**	OPG	**Observation.**
Rajaran JR [7]	Distal to the tooth 47	cone beam CT	The bur segment was later removed under general anaesthesia
Matsuda S [15]	Left mandibular body	CT examination	By elevating the mucoperiosteal flap and removing the alveolar crest bone of the right mandibular third molar region. Then, the foreign body was removed under General Anesthesia
Case 2	beneath the mucous membrane of the mouth's floor	CT examination	Emergency surgery under local anesthesia. Using a fiber light accompanied by suctioning and compression to the submandibular region contributed to the detection of the dental Hand-piece bur.
Li K [16] Case 1	distal to tooth 47	OPG and cone beam computed tomography CBCT)	Removed by using dental tweezers Under Local anesthesia
Case 2	lingual edge of the socket	-	Removed by using haemostatic forceps under anesthesi
Case 3	distal to tooth 47	CBCT	Dental probe and haemostatic forceps Under anesthesia

Table 1: Previous published case report on High speed dental hand-piece burs fracture during third molar surgery

High-speed dental hand-piece burs:
High-speed dental hand-piece burs are one of the least traumatic techniques for tooth sectioning because of their great cutting efficiency and potential availability in any dental office. Nonetheless, dentists should constantly be aware of the risk of fracture of bur, subcutaneous emphysema, and/or overheating. In third molar surgery, using a high-speed hand piece is not common and is not advised [9, 18]. A high-speed hand piece is a rotating device that runs on compressed air and rotates between 200,000 and 800,000 times per minute [7]. For general dental procedures, this hand piece is usually used with thin burs composed of steel coated with diamond or tungsten carbide [7]. In surgical cases, these burs are somewhat thinner when used with a high-speed hand piece than when used with a slow-speed hand piece. Since these thin, high-speed burs are not made to cut hard cortical bone, using them improperly for bone removal increases the risk of fracture [7].
Prevention of bur fracture [7, 15-17]:

- The number of uses of the bur used should be monitored.
- It is advisable to retire the bur after more than 20 uses
- The integrity of the instrument should be checked before and after each surgical procedure.
- To use reliable brands and products with good quality.

- Use of proper surgical techniques and instruments.
- Sectioning of tooth should be done with light pressure and minimal lateral force

Complication associated with High speed hand-piece burs:

Surgical emphysema is another well- documented and much written complication linked to the use of hand pieces in surgical procedures, in addition to the danger of bur fracture [9, 19].

Using air-water cooled high-speed dental hand pieces, which allow air to enter the soft tissue through the reflected flap and infiltrate the surrounding tissues, is typically the cause of subcutaneous emphysema attributed to tooth extractions [9].

It typically infiltrates the tooth's surrounding spaces, although occasionally it might travel beyond along the fascial planes. Although emphysema typically resolves away on its own, in extreme situations it might lead to consequences such secondary infections, airway blockage, tension pneumothorax, and pneumomediastinum [20]. To prevent complications from potential infections or the creation of fibrous granulomas, every broken instruments fragment should be removed [12, 17].

Radiological Investigations:

Cone-Beam Computed Tomography (CBCT) and OPG are great tools for identifying metal objects that are alien to the body. It is an effective method for defining foreign items in their original structure and orientation, according to earlier research. Additionally, a panoramic radiograph is less expensive and is less radiation-intensive than a CBCT [16, 18]. However, because CBCT produces a three-dimensional image, it may be an excellent imaging examination. However, metal artifacts may make it more difficult to determine the segment's precise placement [21].

Additionally, a magnifying glass or dental operating microscope can be utilized to find the bur piece and help remove it. However, not every clinic has a magnifying glass and dental operating microscope[16]. Although the periapical radiograph can also be utilized for identifying the precise site, the patient may experience discomfort during the evaluation of the mandibular third molar region [22].

In oral and maxillofacial surgery, tooth sectioning related to the extraction of an impacted tooth is a routine procedure. When extracting impacted mandibular third molars, the two most common dental tools utilized for tooth sectioning using high-speed dental hand pieces are surgical fissure burs and diamond burs[16]. The tungsten carbide surgical fissure bur is significantly longer (up to 28 mm) and has a comparatively short (4–5 mm) and thin (about 1 mm) working area than the diamond bur. These qualities prevent harm to the soft tissue and neighboring teeth. They do, however, increase the bur's tendency to breaking. The bur could break if it is used excessively [16].

Sufficient irrigation is necessary to maintain the bur's and the surrounding tissue's temperature within a reasonable range and to clear debris for better vision during surgery [23]. Additionally, this is necessary to prevent the bone and hand piece from overheating. For longer than one minute, 47°C is the generally recognized threshold temperature and "danger zone" for bone survival [24, 25].

Sectioning of the tooth should be done with light pressure and minimal lateral force, and the dental crown should only be sectioned within the tooth itself, not into the bone beneath it. Otherwise, the bur could break if it gets lodged in the tooth or bone [16].

This hand piece is usually used for general dental procedures with thin burs made of steel coated with diamond or tungsten carbide. In surgical cases, the burs used with the high-speed hand piece are somewhat thinner than those used with the slow-speed hand piece. Since hard cortical bone cannot be cut by these thin, high-speed burs, using them improperly for bone removal increases the risk of fracture [7].

Lastly, radiographic examination should be used to determine the precise position as soon as the bur breaks and is displaced. The imaging results should be used to define the retrieval protocol, which should be carried out as quickly as feasible.

A review of past five case reports published with 8 cases showed that CBCT and OPG were commonly used to locate the high speed hand speed bur fracture and also OPG was used to confirm the bur removal. Whereas in our case report we used OPG and IOPA (Fig 3, 4, 7), as panoramic radiograph and IOPA is less expensive and is less radiation-intensive than a CBCT. In our cases the reason for the bur must have been bulky crown which must have caused fatigue and stressed in the bur (Fig. 1, 5) which must have been the reason for bur fracture (Fig. 2,3,6). Another reason could have been multiple time the bur must have been reused before for sectioning the tooth. Hence it is imperative to check the surgical bur before the sectioning the tooth. The use of bur should always be monitored for the integrity of the bur and should be checked before and after each surgical procedure. The other reason could have been sectioning of the tooth was done with heavy pressure with maximum lateral force, the sectioning should always be done with light pressure with minimal lateral force.

Based on the imaging information, the retrieval technique for a fractured bur should be determined and implemented as soon as the bur fracture and displacement occur. In our cases, the bur was embedded inside the alveolar socket of mandibular third molar, A part of the bone was removed adjacent to the fractured bur for retrieval under local anesthesia as compared to other previous published papers, Le K [16] retrieval was done by using twizzer and hemostat under local anesthesia. Whereas a case published by Mastuda [15] reflected the mucoperiosteal flap and removed the alveolar crest bone of the right mandibular third molar region. Then, the foreign body was removed under General Anesthesia as the bur was displaced in the deeper tissues. In both of our cases (Fig. 2, 6) fractured bur was sucked up through the suction tube.

CONCLUSION

When sectioning teeth, light pressure and minimal lateral force should be applied. The number of uses of the high-speed hand-piece bur should be tracked, and its integrity and condition should be thoroughly examined, to prevent breakage. The retrieval protocol when bur is fractured should be decided upon based on the imaging results and carried out as soon as bur fracture and displacement occur.

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