

Ultrasonic bone surgery in the treatment of impacted lower third molar associated to a complex odontoma: a case report

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Summary

The removal of impacted mandibular third molar is a common surgical procedure entailing some risk of complications, especially when the tooth and the inferior alveolar nerve and/or lingual cortical plate are in close proximity. A technique that can reduce the possibility of damage is the Ultra Sonic Bone Surgery. The aim of this report is to present a paradigmatic case of an impacted mandibular third molar closely associated with a complex odontoma, which was treated with the Ultrasonic Bone Surgery (UBS) device. This technique appeared to be a valid alternative to manual or mechanical treatment, strongly minimizing trauma to the inferior alveolar nerve, vascular tissues, or surrounding dental tissues.

Key words: lower third molar, odontoma, ultrasonic bone surgery.

Introduction

The extraction of the lower third molar is one of the most frequent procedures in oral surgery (1). Common complications following third molar surgery include sensory nerve damage, alveolar osteitis, infection, or haemorrhage during or after surgery (2,3). Less common complications are severe trismus, iatrogenic damage to the adjacent second molar, and iatrogenic mandibular frac-

ture (4-5). Rare complications are brain abscess, epidural abscess, benign paroxysmal positional vertigo, subcutaneous and tissue space emphysema, subdural emphysema, and herpes zoster syndrome (6). The incidence of inferior alveolar nerve (IAN) injuries ranges from 0.41% to 8.1% for temporary decreases of sensitivity and from 0.014 % to 3.6% for prolonged signs and symptoms (7). When the radiographic signs of proximity of the mandibular canal to the roots of the third molar are present, the incidence of damage can be as high as 35% (8).

Risk factors also include advanced age, surgeon's experience, the use of burs during bone removal or tooth sectioning, and surgical difficulty associated with deeply impacted teeth, particularly if distal bone removal is required (9,10).

Thus, any technique that could reduce the possibility of these nerve damages is worthy of exploration: a good example is the Ultra Sonic Bone Surgery (UBS). This technique consists of inducing energetic micro-vibrations with a frequency in the 20–32 kHz range, above the audible spectrum. The vibrations are generated by a transducer, which is electrically, piezo-electrically or magnetically controlled. Piezo-electric materials vary in size when they are submitted to an intense electric field, typically in the 500-750 V/mm range. These deformations can further transmit energetic micronic mechanical forces to a tip vibrating up to amplitudes of 200µm. UBS uses piezo-electrical transducers, because the generated movements are more energetic. Ultrasonically moved knives have the ability to cut hard tissues, like teeth and bone. In contrast, soft tissues like gingiva, blood vessels, nerves and sinus membranes are preserved from injury because they vibrate with the tip. This makes UBS particularly suitable for a broad spectrum of surgical applications including apicectomy, bone block section, sinus lifting, split-crest, nerve lateralization, resective bone surgery, and biopsies (11). We present here a case of a deeply located odontoma encompassing an impacted left mandibular third molar in close proximity to the inferior alveolar nerve, which was treated by Ultrasonic Bone Surgery (UBS) device.

Case report

A 40-year-old man was referred to the Oral Surgery Unit - Department of Oral and Maxillofacial Sciences (Sapienza University of Rome, Italy) for recurrent episodes of infection and pain in the mandibular left third molar region. Clinical examination revealed the presence of a partially impacted left mandibular third molar showing

mild signs of gingival inflammation (plaque retention and bleeding on probing), without deformations or swelling of the region (Fig.1). The panoramic x-ray (Fig.2) revealed the presence of two large dense radiopaque masses in close association mesially and distally to the roots of the impacted tooth, consistent with the provisional diagnosis of complex odontoma. A computed tomography (CT) with the Dentascan program (Siemens Rs Somatom Volume Zoom Kv 120 mA 140; Siemens, Erlangen, Germany) (Figs. 3, 4), obtained in order to define the extension of the lesion and the anatomical topography, showed an intimate relationship between the inferior alveolar nerve and the odontoma-tooth unit. Surgical removal of the impacted third molar and the associated odontoma was planned. The patient received a single dose of 2 g of amoxicillin and clavulanic acid (Augmentin 1 g, GlaxoSmithKline, Verona, Italy) 1 h before surgery, together with a single dose (100 mg) of non-steroidal anti-inflammatory drug (Nimesulide, Aulin, Hoffmann-La Roche, Basel, Switzerland). Surgery was performed under local anesthesia. Local anaesthesia was performed (2% mepivacaine with 1:100,000 epinephrine) by IAN block injection and tissue infiltration. A mucoperiosteal buccal flap was reflected and bone was removed on the mesial, buccal and distal aspect of the third molar area with the Ultra-



Figure 1 - Clinical examination of the impacted left mandibular third molar showing mild signs of gingival inflammation.

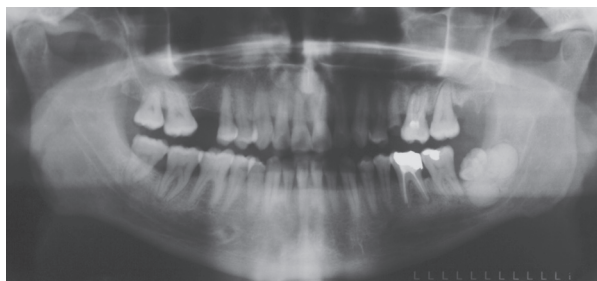


Figure 2 - Appearance of two large dense radiopaque masses closely associated to the roots of the impacted lower third molar at the orthopantomogram examination.

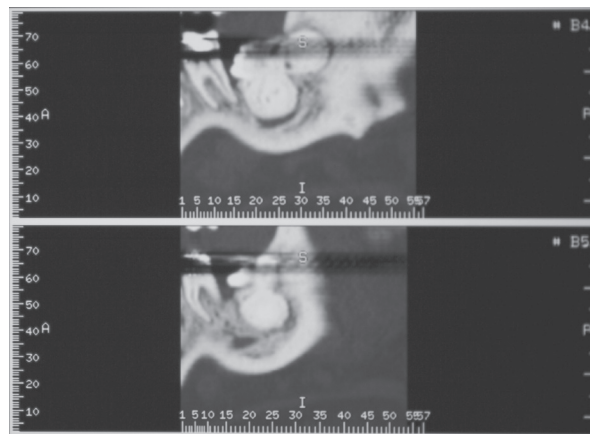


Figure 3 - Panorex CT scan obtained in order to define the extension of the lesion and regional anatomical topography.

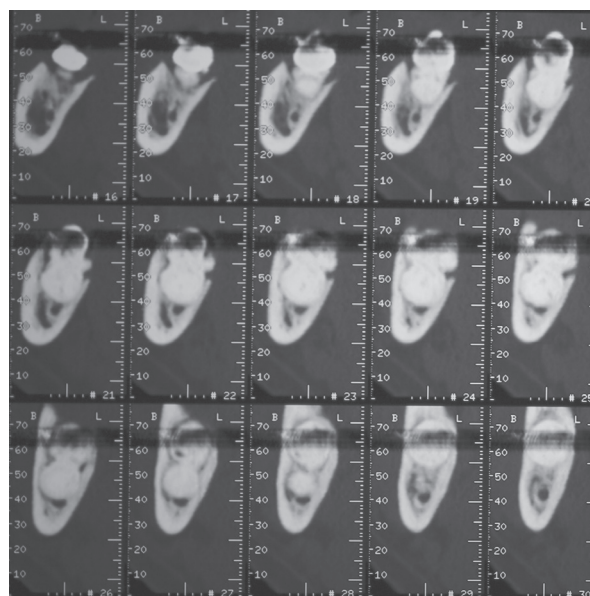


Figure 4 - Sagittal CT scan examination showing an intimate relationship between the inferior alveolar nerve and the odontoma-tooth unit.

Sonic Bone Surgery UBS® device (Italia Medica, Milan, Italy) (Fig.5). The same device was used to separate the odontoma from the tooth. After sectioning, both the third molar and the associated lesion were gently removed using root elevators (Figs. 6, 7). The wound was carefully irrigated and the flap was repositioned and sutured with 4.0 suture (Vicryl®, ETHICON GmbH, Germany) (Figs. 8, 9). On macroscopic examination, the masses appeared to be a complex odontoma (Fig. 10), and the histopathological examination confirmed this diagnosis (12). After surgery, amoxicillin and clavulanic acid (1 g twice a day for 1 week) and nimesulide (100 mg twice a day for 2 days, and then as needed) were prescribed to the patient. Immediate postoperative wound healing was satisfactory, and the post-operative panoramic radiograph showed the integrity of the mandibular canal (Fig. 11). No symptoms or signs of neurosensory impairment

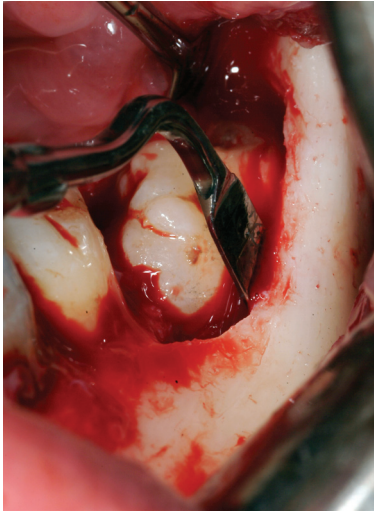


Figure 5 - Mucoperiosteal buccal flap reflection and bone removal with the Ultrasonic Bone Surgery.

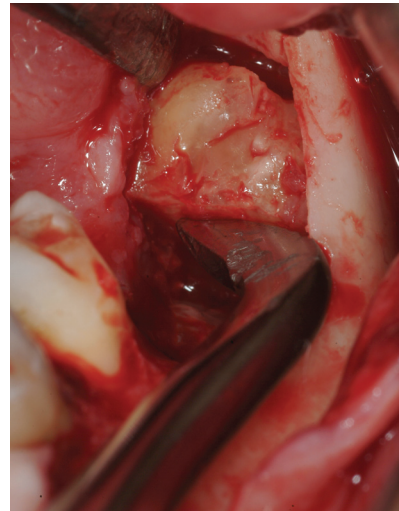


Figure 7 - The third molar sectioned and then removed using root elevators.

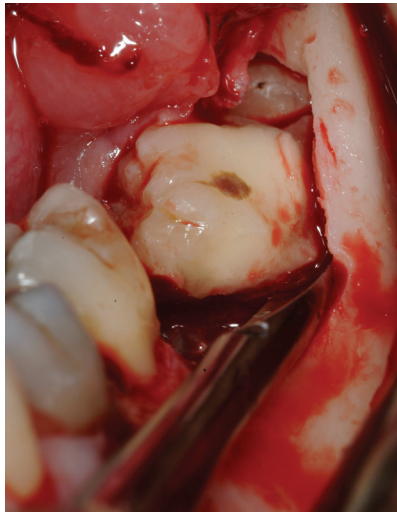


Figure 6 - The separation of the odontoma from the third molar and its removal with the ultrasonic device.

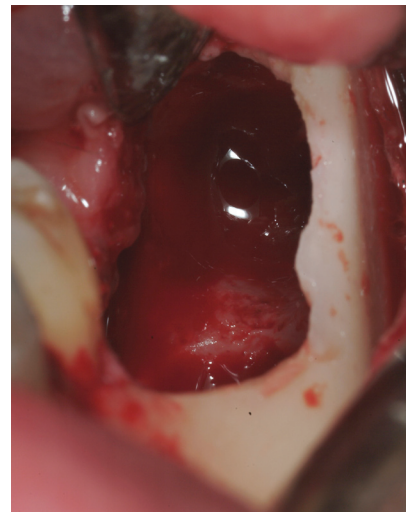


Figure 8 - The wound after third molar removal.

of the innervated area, the inferior alveolar nerve, or the lingual nerve could be detected.

We confirm that we have read the Helsinki Declaration and have followed the guidelines concerning this report.

Discussion

The present case showed an impacted lower third molar associated with a relatively large complex odontoma in an intimate relationship with the inferior alveolar nerve canal. Surgical technique seems to play a major role in causing complications related to third molar extraction (13). Thus, a careful operating technique and adequate instruments may limit the occurrence of complications. Here, the removal of the odontoma-tooth unit was carried out by using an ultrasonic surgery device in order

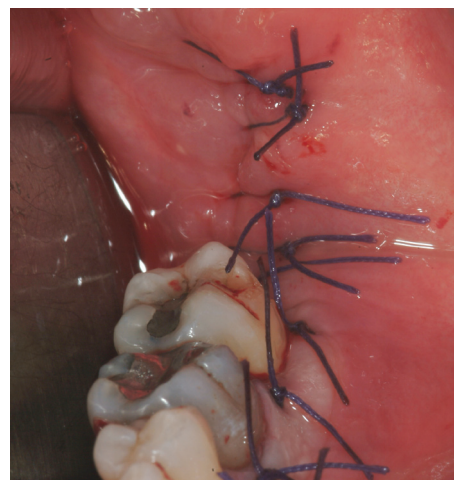


Figure 9 - The flap repositioned and sutured.

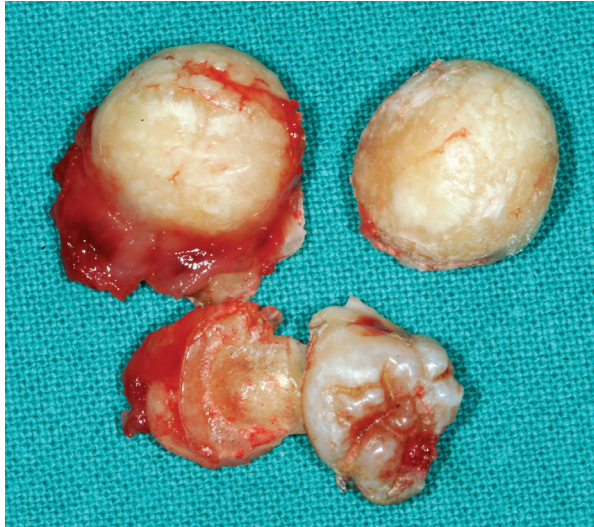


Figure 10 - The complex odontoma.

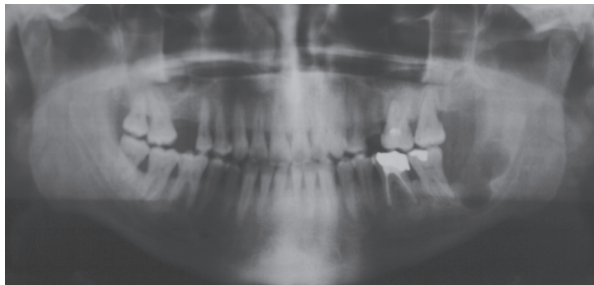


Figure 11 - The post-operative orthopantomogram radiographs showing the integrity of the mandibular canal.

to reduce risk for inferior alveolar nerve damage. Ultrasonic surgery is a tissue-selective technique that allows a micrometric, precise and smooth cut into mineralized tissue, while adjacent soft tissue such as nerves, vessels, periosteum or Schneiderian membrane (in case of maxillary sinus surgery) remain uninjured, because surgical action ceases when the device tips come in contact with non-mineralized tissue (14,15). An *in vitro* study concerning inferior alveolar nerve transposition by piezoelectric surgery showed that after surgery the epineurium became roughened without any damage to the deeper structures (16). Compared to traditional surgery by conventional burs or chisels, ultrasonic cutting precision and selectivity constitute important advantages, particularly in those cases where the surgery target is in close relationship with noble soft tissue structures (17). As a result, even less experienced surgeons (though properly trained) can perform such procedure, since the learning curve with ultrasonic surgery technique is strongly reduced compared to traditional surgery with rotating instruments (15). Nevertheless, a careful surgical approach remains critical considering that soft tissue can be damaged by excessive mechanical force while using the device. In addition, when compared with traditional surgery, bone healing following piezoelectric surgery

seems similar (18) or even improved because piezoelectric bone surgery seems to induce an earlier increase in neo-osteogenesis, resulting in a more positive osseous response (19, 20). The latter may depend on the cavitation effect induced by ultrasonic cutting that allows an effective cooling avoiding significant hyperthermia and coagulation damages to the surrounding area (21). The same effect is responsible for a higher visibility during surgery compared to conventional instruments due to the evacuation of detritus with the aerosol formation (14). In the present case, the piezoelectric device used is the Ultra Sonic Bone Surgery UBS® (UBS). The vibration frequency of UBS is in the 20-32 kHz range and the maximum ultrasound power is 90 W. Increased power of the ultrasonic vibration and a higher vibrating frequency may result in a higher cutting efficiency in hard bone. Therefore, less pressure on the working tip is required further reducing the risk of thermal damage to the bone. High power also allows for good cutting in case there is soft bone, since the softer the bone the higher the ultrasound power required (21). Finally, the decrease of post-surgical complications with the use of ultrasound bone surgery after lower third molar removal must be considered, as reported by different authors (22,23).

Conclusion

The use of Ultrasound Bone Surgery in surgical cases, where risk for noble soft tissue damage is high, appears to be a valid alternative technique confirming other literature reports.

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