



Randomized clinical study comparing piezosurgery and conventional rotatory surgery in mandibular cyst enucleation



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ABSTRACT

Purpose: The aim of the present study is to compare piezoelectric surgery to the conventional rotatory surgery in mandibular cyst enucleation, and to determine the 2 method's suitability and the post-operative outcomes.

Material and methods: Eighty patients were included in the study. 35 male and 45 female, which showed cystic mandibular lesions, compared with the inferior alveolar nerve or the mental nerve. The patients were randomly divided into two groups. In the test group, cystectomy was performed using conventional rotatory instrumentation (rotatory-group), and in the other one piezoelectric surgery (piezo-group).

The swelling was documented 24/48/72 h and 1 week post-surgery and the patients recorded their subjective postoperative pain daily for 7 days using a Visual Analog Scale (VAS).

Results: Patients treated with piezoelectric technique have presented a lower VAS, minor swelling and less recovery time compared to the rotatory-group. No lesions of the mandible nerve were detected with piezosurgery whereas surgery with rotary instruments resulted in 8% hypesthesia at least up to one week.

Conclusion: The results of this study suggest that piezosurgery may be considered effective in cyst enucleation compared to traditional procedures with burs, since it grants the patients significantly less post-surgical pain and swelling.

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1. Introduction

Jaw cysts are common lesions in the maxillofacial area (Sabino-Bezerra et al., 2012). Historically, Partsch as "Cystectomy" (Partsch, 1910) first described the treatment of these lesions, consisted in enucleation of the cysts and watertight primary closure. The procedure involves opening of the cyst, complete removal of the cystic lining, and primary closure of the cavity.

In order to accelerate bone regeneration and to prevent soft tissue collapse into the defect and to improve bone strength, in the last years numerous authors have proposed for the treatment of jaw cystic lesions the combined use of additional graft biomaterials as filling.

However, currently available data (Ettla et al., 2012) do not indicate the superiority of additional bone grafts, and the enucleation of jaw cysts with safe closure of the wound still represents the standard procedure to the present day. In cases of mandibular cysts

with intact vestibular wall, osteotomy of access often must be performed in close vicinity to nerve tissue, with the potential risk of transient or permanent neurologic injuries.

Traditional tools, such as rotating burs and oscillating saws, are highly effective in cutting bone tissue but are not selective for bone, and thus can produce significant harm the surrounding soft tissues, especially nerves.

Piezosurgery (piezoelectric bone surgery) is a promising, meticulous and soft tissues paring system for bone cutting and it may be considered effective in procedures such as mandibular cyst enucleation that require sensitive manipulation (Kocyigit et al., 2012). It is based on ultrasonic microvibrations developed to overcome the limits of traditional instrumentation in oral bone surgery by modifying and improving conventional ultrasound technology. Piezosurgery allows a reduction of intraoperative bleeding, creating a better visibility of the surgical field (Sakkas et al., 2008), and makes the cutting of hard tissue possible, through a "selective cutting" without encountering necrosis from overheating, and without damaging nerves and vessels (Seshan et al., 2009; Crosetti et al., 2009).

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Not only is this technique clinically effective, but histological and histomorphometric evidence of wound healing and bone formation in experimental animal models has shown that tissue response is more favorable in piezosurgery than it is in conventional bone-cutting techniques such as diamond or carbide rotary instruments (Vercellotti et al., 2005). Currently, the number of indications for piezosurgery is increasing in oral and maxillofacial surgery, and in other disciplines such as otorhinolaryngology, neurosurgery, ophthalmology, traumatology and orthopedics (Dobieżńska et al., 2008; Rullo et al., 2013; Ueki et al., 2004; Robiony et al., 2004; Salami et al., 2007; Kotrikova et al., 2006; Schaller et al., 2005; Dellepiane et al., 2008).

Although the advantages of ultrasonic surgery such as incomparable atraumaticity and precision in surgery are widely accepted by oral and craniomaxillofacial surgeons, its use in the treatment of cystic lesions has not yet been well documented.

To investigate this critic closer the authors established a study protocol to objectively value the benefits of ultrasonic piezosurgery compared to conventional procedures, with particular attention to highlight any neurologic complications (neurapraxia, axonotmesis and neurotmesis), its symptoms (paresthesia, anesthesia, dysesthesia), and the pain symptoms, resulting in most cases by use of the rotating instruments.

2. Material and methods

Eighty patients were selected: 35 males and 45 females, enrolled at the University Hospital Policlinic Vittorio Emanuele-PO "Gaspere Rodolico" of Catania, for a period that was from 2007 to 2010. All patients were surgically treated with surgery enucleation of the cyst. The study population was randomly subdivided into two groups: the test group (comprising 40 patients, mean age 43.2 years, range 21–67 years) in which the osteotomy for access has been implemented with piezosurgery technique and the control group (composed of 40 patients, mean age 41.4 years; range 20–66 years), in which the osteotomy was made with surgical micromotor. All patients were examined with OPT/Dentascan, for pre- and postoperative evaluation of lesion size and its relationships with the nervous structures (inferior alveolar nerve and mental nerve).

The inclusion criteria were:

- Cysts with vertical apico-coronal (AP) dimension in the range between 15 and 30 mm and with a horizontal mesio-distal (MD) dimension in the range between 15 and 40 mm;
- Intact vestibular cyst wall, and greater than 1 mm;
- Cysts involving the inferior alveolar nerve or mental nerve.

The exclusion criteria were:

- Patients with drug allergies;
- Patients with systemic diseases;
- Patients who smoke;
- Pregnant women;
- Patients treated with bisphosphonates or suspended for at least a period of not less than 12 years.

A specifically designed locked computer software program was used to randomly assign patients to one of two study groups to receive conventional rotatory- or piezo-surgery. Randomization by minimization (Altman, 1991) was used to balance possible prognostic variables between the treatment groups. Minimization was used for the variables age (≤ 30 years, $>31 \leq 60$ years, >60 years), and mean size of cysts (small = AP dimensions $\geq 15 < 20$ mm/MD dimensions $\geq 15 < 20$ mm; medium = AP dimensions $\geq 20 < 25$ mm/MD dimensions $\geq 20 < 25$ mm; large = AP dimensions ≥ 25

≤ 30 mm/MD dimensions $\geq 25 \leq 40$ mm). The allocation result was kept in a locked computer file that was not accessible for the examiner and the practitioner. The surgeon was informed about the allocation on the day of surgery.

Before surgery, antibiotic therapy was administered with amoxicillin and clavulanic acid, in doses of 1 gr/die every 12 h, from starting minutes before intervention, and to continue for 4/5 days in the postoperative setting, accompanied by ibuprofen 800 mg every day for three days. In addition, advised to rinses with chlorhexidine digluconate in order to reduce the bacterial local load.

Conventional surgery with rotating instruments was performed according to the valid surgical protocol prior to the introduction of ultrasonic piezosurgery: after preparing the mucoperiosteal flap with a periosteal elevator, the vestibular compacta was removed by milling with a 3-mm Tungsten Carbide Bur (Meisinger), and was performed excision of the cyst wall with hand tools.

Ultrasonic surgery was performed resecting the vestibular compacta as one bone block after osteotomy with the ultrasonic scissile and the micro-bone-saws (Fig. 1). The prepared bone block was kept in saline solution for later anatomically correct reconstruction of the surgical site. The bone block was re-positioned before wound closure to reconstruct the original anatomy of the surgical site (Fig. 2).

The surgical site was inspected for clinically visible damages of the mandible nerve when applicable (Fig. 3).

In the case of radicular cyst, a root canal therapy was performed before surgery.

The retrograde filling of radicular apexes was made during surgery. Neurosensory "stabbing" test was used for the diagnosis and interpretation of possible deficit. The test consists of stinging touch or pinch the skin of the patient with periodontal probe, clamp, or needle, and considering the painful feeling expressed itself by the patient. For this, we used the Visual Analog Scale (VAS).

A continuous horizontal line (100 mm in length) constitutes the VAS. Patients indicate on the line the point representing the perception of their current status. The score was determined by measuring, in millimeters, from left end of the line to the point marked. For this purpose, the VAS scale, specially designed, provided for a value of 0, which corresponded to a condition of absence of pain and a value 10, which corresponded to the maximum painful sensation imaginable. The other parameter evaluated was the swelling. Before local anesthesia a marker on the skin on both sides in the area of the patient's mandibular angle with a non-water

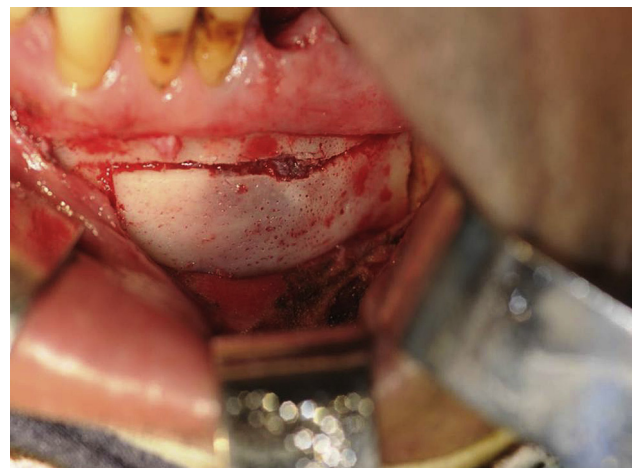


Fig. 1. Access osteotomy with piezoelectric surgery.

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