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Bimaxillary orthognathic surgery with a conventional saw compared with the piezoelectric technique: a longitudinal clinical study

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Abstract

The only cutting technique used for osteotomies in orthognathic surgery for many years has been a saw, but recently piezoelectric surgery has been introduced as a possible alternative. The aim of this study was to find out if piezoelectric surgery can be more comfortable for patients having orthognathic surgery. A total of 25 patients with dentofacial deformities (seven male and 18 female), were treated from January 2016 to September 2017. In 11 patients, osteotomies were made using a conventional saw, while in 14 a piezoelectric device was used. The variables assessed were: operating time, postoperative swelling, postoperative pain, and cutaneous sensitivity of the upper and lower lips. The duration of operation for the piezosurgery group was significantly longer than that for controls, but the patients had less swelling at all follow-up visits, and the difference was significant at the 30-day follow-up ($p = 0.045$). Those who had piezosurgery had significantly less pain at the three-day follow up ($p = 0.035$). There was a significant difference in cutaneous sensitivity only for the right side of the upper lip and only at the one-day follow-up. We conclude that piezoelectric surgery offers some advantages in lessening swelling and the perception of pain after orthognathic surgery, but further investigations are required.

Keywords: Orthognathic Surgery; Piezoeletric; Saw; post-operative comfort

Introduction

The aim of orthognathic surgery is to correct severe dentofacial deformities in adult patients whenever an orthodontic approach alone is not enough.[1] In addition to obviously compromised function, cosmesis is usually the main factor that motivates these patients to request surgical treatment. Modern orthognathic surgery, with advanced fixation systems and 3-dimensional programming, is capable of fulfilling both functional and aesthetic requirements, and most patients have reported long-term satisfaction with the outcome.[2] However, the procedure remains uncomfortable, particularly during the postoperative recovery.[3]

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It was not until the introduction of piezoelectric instruments that an alternative to the conventional saw technique for osteotomies was available. Piezoelectric surgery uses ultrasonic vibrations with low frequency (25–29 kHz) to cut mineralised tissues.[4] It was first introduced by Vercellotti in 2004 as a new and safe procedure for sinus lifts,[5] and it was soon exploited for other purposes including: extraction of impacted third molars;[6] positioning of the inferior alveolar nerve;[7] splitting of the alveolar ridge;[8] placement of implants and removal of fractured implants; [9] enucleation of cysts;[10] endodontic surgery;[11] and periodontal surgery.[12] Ultrasonic devices are thought to offer the advantages that they cut mineralised tissues selectively, and leave soft tissues or relevant structures such as nerves or blood vessels unharmed. Because of their cavitation effect and reduced bleeding, they offer better intraoperative visibility, and because of their low vibration amplitude, they are thought to cut more precisely and cause less trauma to the surrounding tissues.[13]

Because of these benefits, orthognathic surgeons started using the piezoelectric technique for osteotomies, with the main aim of reducing operative complications and postoperative discomfort.[14] Several studies have compared the two techniques, and most concluded that piezoelectric surgery is superior to the conventional technique because of reduced bleeding and greater safety.[15–18] However, few of the studies reported variables such as: swelling, postoperative pain, or sensitivity of the upper and lower lip.[15] Consequently, the real impact of piezoelectric surgery is still not clear.

The aim of this longitudinal case series study was to evaluate the effect of piezoelectric surgery compared with the conventional saw technique for osteotomies during orthognathic surgery on swelling of soft tissues, postoperative pain, and sensitivity of the upper and lower lips. We also recorded the overall operating time in both groups.

Materials and methods

A total of 25 consecutive patients with dentofacial deformities (seven male and 18 female) were treated from January 2016 to September 2017 at the division of maxillofacial surgery of the Fondazione IRCCS Cà Granda, Ospedale Maggiore Policlinico di Milano, Italy. Inclusion criteria were: adult patients with dentofacial deformities who needed bimaxillary orthodontic surgery without genioplasty and with no fragmentation of the maxilla. Exclusion criteria were: patients who needed segmented osteotomies or dentoalveolar osteotomies; skeletally immature patients or those with a history of maxillofacial trauma; suspected or confirmed pregnancy; patients with a reported problem with coagulation or patients with chronic diseases; and patients unable to give informed consent.

The study was approved by the ethics committee of the Università degli Studi di Milano and written consent was given by all patients after they had been fully informed of the procedure and the essential follow-up plan. All patients were treated according to the principles of the Helsinki Declaration of 1980 for biomedical research involving human subjects, as revised in 2013.

Surgical technique

General anaesthesia was given by nasal intubation, and the same surgeon (who had more than 20 years' experience in orthognathic surgery and was familiar with piezoelectric surgery) did all the bimaxillary orthognathic operations. The procedure included a LeFort I osteotomy for the maxilla and a bilateral sagittal split osteotomy (BSSO) for the mandible, with techniques previously reported elsewhere.[19,20] Eleven patients had both maxillary and mandibular osteotomies using a conventional saw, while in 14 patients a piezoelectric device (PIEZOSURGERY®, Mectron s.p.a Carasco (GE) was used. In the piezo group, all the osteotomies for LeFort I, and all the specific cuts for the BSSO (lingual, saggital, buccal, and lower mandibular border) were made using the piezoelectric saw. For all osteotomies we used the Piezo Tip Mectron MT1-10. Once all the mandibular cuts had been made with the piezoelectric tip, an osteotome was used to split the two fragments.

All patients were given a total of hydrocortisone 24 mg of in three doses at precisely 30 minutes preoperatively (8 mg), the night of the operation (8 mg), and the first morning postoperatively (8 mg).

All patients were also give acetaminophen 1 g and ketorolac 10 mg three times/day for two days postoperatively. On the third postoperative day the patient was given analgesics only if they were requested. This regimen was standardised for all patients.

Outcomes

The overall outcomes assessed included duration of operation and postoperative swelling. This was measured by ultrasonography (frequency 7.5 MHz) at nine selected anthropometric points: three midline and six bilateral (Fig. 1), with the patient sitting upright and with the head straight. Little gel and no pressure were used during the procedure and the thickness of soft tissues was measured.[21] All ultrasound procedures were done by the same experienced operator.

Postoperative pain was measured using a Visual Analogue Scale (VAS). It consists of a line that measures from 0 to 100 mm, the "0" indicating "no pain" and "100" indicating "the worst paint possible". Patients were asked to sign the line at the point that they thought indicated the amount of pain that they were experiencing at that particular moment.

Cutaneous sensitivity of the upper and lower lip were also measured, using a clinical neurosensory test (the Weber test), which is based on the discrimination of two different points.[22,23] Four different areas were measured: the right and left sides of the upper lip, and of the lower lip. The test was done using open calipers, and the tips of the calipers consti-

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