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**Mohammed Sabe AlArab**
Prof, PhD in Oral and Maxillofacial Surgery, Faculty of Dentistry, Al Wataniya Private University, Hama, Syria

**Fawaz Jaber**
PhD in Oral and Maxillofacial Surgery, Faculty of Dentistry, Al Wataniya Private University, Hama, Syria

**Jehad Kharfan**
Master in Oral and Maxillofacial Surgery, Faculty of Dentistry, Hama University, Hama, Syria

**Abdalrahman Alhamood**
MSc student, Oral and Maxillofacial Surgery, Faculty of Dentistry, Hama University, Hama, Syria

**Corresponding Author:**
**Mohammed Sabe AlArab**
Prof, PhD in Oral and Maxillofacial Surgery, Faculty of Dentistry, Al Wataniya Private University, Hama, Syria

# Extraction of impacted lower third molars using bone splitting technique with ultrasonic (Surgical piezo): A clinical study

**Mohammed Sabe AlArab, Fawaz Jaber, Jehad Kharfan and Abdalrahman Alhamood**

**Abstract**
**Purpose:** Piezosurgery has been tremendously used in oral and maxillofacial surgery, but there has been no report systematically introducing an osteotomy method using piezosurgery in complicated mandibular third molar removal. This study aimed to evaluate a new technique for surgical removal of impacted mandibular third molars, using bone splitting technique with ultrasonic (surgical piezo).
**Materials and methods:** A total of 40 patients, their ages range between 18–40 years, who had asymptomatic impacted mandibular third molars, were selected for this study and randomized into two groups. Group A consisted of 20 patients who underwent surgical extraction with rotary instruments and Group B consisted of 20 patients who underwent surgical extraction done with bone splitting technique with ultrasonic (surgical piezo). The post-operative pain, swelling, and trismus were assessed over a 7 days follow-up period.
**Results:** The mean post-operative pain on day 0 was 6.06 ± (0.69) in Group A and 4.06 ± (0.69) in Group B, Then on day 3, it was 4.20 ± (0.7) in Group A and 2.50 ± (0.69) in Group B, and on day 5 it was 3.0 ± (0.73) in Group A and 0.50 ± (0.6) in Group B. On the 3rd post-operative day, the mean post-operative swelling was 3.51 ± (0.3) cm in Group A and the mean post-operative swelling was 2.3600 ± (0.28910) cm in Group B. On the 5th post-operative day, the mean post-operative swelling was 2.4 ± (0.31) in Group A and 1.6650 ± (0.21095) in Group B. The difference between both groups was significant for all parameters.
**Conclusion:** Although extraction of impacted lower third molar using bone splitting technique with ultrasonic (surgical piezo) takes more time and is more expensive, the advantages gained in terms of tissue preservation, and decreased pain and swelling make it a superior technique compared with using rotary instruments.

**Keywords:** Impaction, piezosurgery, rotary, bone splitting, third molar

## Introduction
Impaction of mandibular third molars is a commonly encountered condition that often proves to be problematic and with a higher incidence of iatrogenic complications during its removal. Newly published data revealed that 72,2% of the entire world's population has at least one impacted tooth (usually lower third molar). The data are well documented to be associated with several complications including pericoronitis, regional pain, dentoalveolar abscess, trismus, distal caries on the second molar, cysts, tumors, and the dental arch crowding The surgical removal of these impacted third molars may lead to various post-operative side effects including pain, swelling, trismus, nerve injury, bleeding, and dry socket [1, 2, 3, 4].
Conventionally, impacted third molars are most often removed using rotary cutting instruments for bone removal. However, these are potentially injurious because they generate excessively high temperatures during bone drilling, which leads to marginal osteonecrosis, and can impair osseous regeneration and healing. The resultant injury is also associated with significant post-operative pain and edema [5]. over the past five years, piezosurgery has been widely used in oral and maxillofacial surgery [6] also for sinus lift surgery, bone grafting, distraction osteogenesis, inferior alveolar nerve decompression, cyst excision, and the removal of impacted teeth [7]. Although various sources recommended piezosurgery for impacted mandibular third molar removal, little information is provided on the optimal osteotomy

method for the different types of impactions [8-9]. Furthermore, piezoelectric osteotomy techniques take a longer surgery time compared with rotatory osteotomy techniques [9-10].

## Materials and methods

### Patient selection and study design

We confirm that the present study runs in concordance with international ethical guidelines and applicable local regulatory laws. The ethical approval was obtained from the institutional review board (IRB) of Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Hama University. Informed written consent was obtained from every eligible patient before study enrollment**.**

A randomized, split-mouth study was accomplish using a consecutive series of 20 patients. Only healthy patients between 18 and 40 years of age were involved in this study. All patients who consented to participate in this study and having vertical, mesioangular or horizontal, Class 2 or Class 3, lower third molar impactions were delected in the study based on radiographic diagnosis. Patients with systemic diseases that could influence on healing process, patients who had active infections or currently using antibiotics, and those who are using analgesics or anti-inflammatory products that could interfere with the post-operative assessments were excluded from the study.

Patients were subdivided into two groups randomly of 20 patients. Group A patients were treated with rotary osteotomy technique and Group B patients were treated with piezoelectric osteotomy technique.

For pre-operative evaluation of patient, opening of mouth was measured with Vernier caliper, 5-point facial measurement was evaluated with thread as baseline measurements for assessment of edema, Radiographic examination was done using intraoral periapical radiograph.

### Surgical Procedure

The extraction direction and osteotomy line were designed according to the impacted molar's radiographical and clinical manifestations (the angulation of the tooth, the state of eruption, the root morphology, the root-inferior alveolar canal relationship and the amount of surrounding alveolar bone).

Both groups A and Group B were treated by the same operator, Preoperatively, patients were given chlorhexidine mouthwash 0.012% for mouth rinsing, then 2% lidocaine local anesthesia with 1:80,000 adrenalin was used. a full thickness flap was elevated. in Group A, bone osteotomy was done by micromotor at 35,000 rpm using carbide round bur no. 6 and carbide straight fissure bur no. 702, in Group B, bone osteotomy was performed by piezosurgical device using vibration frequency between 28 and 36 kHz and using piezosurgical tip BS1, the piezosurgical tip was used to made two vertical cuts with lingual convergence. This was made through the buccal bony plate, the inferior horizontal cut was connecting the two vertical cuts, and the superior horizontal cut was done, bone segment was removed with a periosteal detacher. [Figure 1] the tooth is therefore exposed and extracted by an elevator. After tooth extraction, the surgical site was debrided, irrigated, and was accuratelye repositioned the osteotomized bone segment was carried out without fixation, [Figure 2] Closure of the flap was performed using 3-0 silk sutures. Postoperative instructions were given, and patients were prescribed antibiotics, analgesics, and mouthwash.

Post-operative assessment consisted of the comparison of post-operative pain evaluation, rated on visual analog scale (VAS) from day 0 to day 6, trismus, evaluated by measuring the interincisal distance between incisal edge of upper and lower central incisors using a caliper at maximum mouth opening and swelling, and measured by assessment of the 5-point distance, from tragus to corner of the mouth, from tragus to chin, tragus to oral commissure, and angle to corner of the eye. Statistical analysis was performed using Wilcoxon signed-rank test and t-test using IBM SPSS. $P < 0.05$ was considered as statistically significant.

**Fig 1:** Clinical image showing buccal bone splitting was done using piezotome

**Fig 2:** Clinical image showing bone segment was carried out without fixation

## Results

The mean post-operative pain on days 0, 3, 5, and 7 [ summarized in Table 1] showed lower immediate post-operative pain in Group B compared to Group A as well as an earlier total relief pain in Group B compared to Group A. The difference in pain between the two groups, both in the immediate post-operative period and on the 5th post-operative day was significant ($P < 0.05$).The mean maximum mouth opening recorded on the third day in Group A and it was 24.35 ± (1.39) in group B and 30.40 ± (1.23), respectively. On day 5, the mean mouth opening was 34.3 ± (1.6) in Group A and 40.65 ± (1.18) in Group B. The difference in mouth opening between both groups on both days was found to be statistically significant ($P < 0.05$). [as illustrated in Table 2]

On the 3rd post-operative day, the mean post-operative swelling was 3.51 ± (0.3) cm in Group A and the mean post-operative swelling was 2.36 ± (0.289) cm in Group B. On the 5th post-operative day, the mean post-operative swelling was 2.4 ± (0.31) cm in Group A and 1.6650 ± (0.21095) in Group B. The difference in swelling between both groups on the 3rd day was significant. [Table 3]

**Table 1:** Post-operative pain in Group A and B

| Post-operative pain | Group A | Group B |
|---|---|---|
| Day 0 | 6.06 ± (0.69) | 4.06 ± (0.69) |
| Day 3 | 4.20 ± (0.7) | 2.50 ± (0.69) |
| Day5 | 3.0 ± (0.73) | 0.50 ± (0.6) |
| Day 7 | 0.70 ± (0.73270) | 0 |

P<0.05 is considered as statistically significant

**Table 2:** Post-operative maximum mouth opening in Group A and B

| Post-operative maximum mouth opening | Group A | Group B |
|---|---|---|
| Day 3 | 24.35 ± (1.39) | 30.40 ± (1.23) |
| Day5 | 34.3 ± (1.6) | 40.65 ± (1.18) |

P<0.05 is considered as statistically significant

**Table 3:** Post-operative swelling in Group A and B

| Post-operative swelling | Group A | Group B |
|---|---|---|
| Day 3 | 3.51 ± (0.3) | 2.2600 ± (0.28910) |
| Day5 | 2.4 ± (0.31) | 1.5650 ± (0.21095) |

P<0.05 is considered as statistically significant

## Discussion

The present study was done to post-operative swelling and pain, and other inflammatory events after the surgical removal of impacted third molar by bone splitting technique with piezoelectric device and conventional rotary instruments.

A tooth is said to be impacted when its path of eruption into the occlusal plane is obstructed by the presence of another tooth, bone, or soft tissue so that its further eruption is unlikely. Several therapeutic protocols have been used to decrease the post-operative complications of surgical removal of impacted tooth ranging from medication to operative procedure. Bone removal has been attempted by chisel and mallet, high- or low-speed rotary instruments, and piezoelectric device in an attempt to alleviate the post-operative complications. Rotary handpiece is used for surgical extraction of impacted third molar mainly. Surgical straight handpiece connected to a micromotor would be utilized for bone cutting with the aid of external saline irrigation. Rotary speed of straight handpiece is about 25,000 – 35,000 RPM [1].

The piezoelectric technique was tested in oral surgery during the 1970s when Horton *et al*. examined the recovery process of dogs that had undergone osteotomy. Piezo devices use a modulated ultrasonic frequency that permits bone cutting with microvibration. It works selectively, being inert against soft tissues including nerves and blood vessels, a significant advantage compared with bur. Piezoelectric surgery was reevaluated definitively at the end of the 1980s, and today, it is considered an alternative technique that can be used in osseous oral and maxillofacial surgery, as it also produces fewer post-operative complications [2].

The difference between the two groups in our study was assessed using various parameters such as post-operative pain, post-operative swelling, and the trismus**.**

## Pain

Pain is the most common post-operative complication after surgical removal of impacted mandibular third molar and it is caused by release of pain mediators from the injured tissues. It begins after the anesthesia subsides and reaches its peak level during the 1st post-operative day. If dry socket or infection occurs, the onset of inflammation will complicate alleviation of post-operative pain [11]. Pain was assessed over the post-operative periods in ous with a VAS of 10 units.

On 0 – and 3rd post-operative days, pain was severe in Group A as compared with Group B while on the 7th post-operative day, there was a mild post-operative pain in control Group A and there was no pain in Group B. A study conducted by Mantovani *et al.* to investigate the performance of piezosurgery compared with traditional rotating instruments during mandibular third molar removal, they observed that the mean VAS in rotary group on the 2nd post-operative day was 6.09, on the 4th post-operative day was 3.41, on the 6th post-operative day was 1.27, and mean VAS in piezoelectric group on the 2nd post-operative day was 5.97, on the 4th post-operative day was 2.81, and on the 6th post-operative day was 0.82 [12].

## Trismus

For the assessment of trismus the mean mouth opening was 24.35 mm on the 3rd post-operative day in Group A and 30.40 mm in Group B. On the 5th post-operative day, the mean trismus 34.30 mm in Group A and 40.65 mm in Group B. Fatima *et al.* conducted a study to find out the efficacy of piezoelectric device in impacted mandibular third molar surgery and noted greater trismus in the rotary group on 3rd (3.18 cm) and 5th (3.67) postoperative days, as compared with the peizosurgical group which was 3.88 cm on the 3rd and 4.09 cm on the 5th post-operative days and these results are in agreement with the present study [13].

## Swelling

Swelling is a normal post-operative complication following the surgical removal of impacted mandibular third molar. It is caused by the response of tissues to manipulation and trauma caused during surgery. its onset is gradual and maximum swelling is present during 48 h after injury. Regression of swelling is expected by the 4th day and completely resolution occurs in 7 days [14]. On the 3rd and 5th post-operative days, there is a significant difference between the measurements mean. At the 3rd post-operative day, the mean post-operative swelling was 2.51 cm in control Group A and the mean post-operative swelling was 1.26 cm in Group B. At the 5th post-operative day, the mean post-operative swelling was 1.39 cm in Group A and was 0.56 cm in Group B. A study conducted by Fatima *et al*. to evaluate swelling after surgical extraction of impacted mandibular third molar in rotary group on the 3rd post-operative day the swelling was 4.21 cm and on the 5th post-operative day was 3.84 cm After surgical extraction of impacted mandibular third molar done by piezoelectric device on the 3rd post-operative day the swelling was 2.86 cm and on the 5th post-operative day it was 1.28 cm. They concluded that swelling was less in patients undergoing surgical extraction of impacted third molar by piezoelectric device as compared with surgical extraction done by rotary handpiece which in line with the present study [15]. Pain, swelling, and the trismus in a patient undergoing surgical removal of the third molar are usually associated with the extent of tissue injury. The relatively lower incidence and intensity of these complications in the piezosurgical group are due to lesser tissue damage cause in this group compared with those who underwent surgical removal by rotary instrumentation. Moreover, the cavitation phenomenon, caused by implosion of gas bullae into blood vessels during osteotomy during piezosurgery, produces an important hemostatic effect to optimize intraoperative visibility, thus reducing accidental damage. In addition to the osteotomy instrumentation, extension of incision as well as tissue manipulation and length of surgery affect the entity of swelling [2]. In surgeries for impacted third molar region, time of intervention thought to be associated with tooth position, angle, and experience of surgeon and these parameters determine the difficulty of surgery and related to post-operative swelling and other

complications, longer surgical interventions thought to increase tissue damage and vascular permeability can cause post-operative edema and affect its intensity [14].

**Conclusions**

In conclusion, our study showed that the bone splitting technique using Piezosurgery is an excellent tool to reduce the risk of complications and to improve the postoperative period. Furthermore, appropriate preoperative evaluations of the patients are important factors for proper surgical planning.

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