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# Comparison of the Rotary and Piezoelectric Osteotomy Techniques for Third Molar Impaction

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**ABSTRACT**

**Introduction:** The present study was conducted to evaluate and compare the surgical and postsurgical outcomes of third molar removal using piezoelectric surgery and rotary bur. Many authors have reported injuries to the adjacent tooth, especially the distal part of periodontium, after removal of the second molar. As a result, it is necessary to choose a surgical method or instruments that conform to anatomic landmarks and are based on physiological principles. Bone removal is required for the extraction of third molars that are erupted, partially erupted, and/or impacted in bone.

**Materials and methods:**The study comprised 30 healthy adults who needed to have their impacted mandibular third molar tooth removed prophylactically and in optimal condition. To ensure that both groups would experience the same level of surgical difficulty, participants were randomly assigned to research groups of 15 each. Piezoelectric osteotomy technique is used in group I, and rotational osteotomy technique is used in group II. A hand piece and a rotating speed of about 35,000 rpm make up the rotary device. The piezoelectric device is a hand piece that operates in a boosted working mode at a frequency of 25 to 29 kHz and microvibration of 60 to 200 mm/sec. Fischer's exact test was used to assess qualitative data, and the unpaired t-test was used to analyze quantitative data.

**Results:** The study participants in the rotary group were 30.06 ± 3.15 years old, while those in the piezo surgery group were 28.40 ± 2.69 years old. It was statistically significant ($p < 0.05$) that the rotary bur took less time to remove the affected tooth than the piezoelectric device. The rotary group experienced more severe pain until the fourth postoperative day, which was statistically significant ($p < 0.005$). Up until the seventh postoperative day, the piezoelectric group's mouth opening was noticeably better than the rotary bur's.

**Conclusion:**The piezosurgery technique lessens edema, trismus, and postoperative pain. Additionally, it might be crucial in boosting bone density in the extraction socket and reducing the distal tooth's neighboring bone loss.

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**Clinical significance**: Because piezosurgery lowers postoperative discomfort, trismus, and edema, it is a significant tool in clinical practice.

**Keywords:** Impacted tooth, Mouth opening, Pain, Piezoelectric osteotomy, Rotary osteotomy.

**Source of support:** Nil

**Conflict of interest:** None

## INTRODUCTION

With a prevalence of 33 to 58.7%, impacted third molars are commonly reported issues in clinical practice. Pericoronitis, regional discomfort, dentoalveolar abscess, trismus, distal caries on the second molar, cysts, tumors, and crowding of the dental arch are among the well-documented issues linked to impacted third molars, whether they are partial or total.

As a result, impacted third molars that are symptomatic or asymptomatic are frequently extracted in order to alleviate the clinical symptoms listed above.[1] Among the surgical procedures that dentists must perform, the removal of impacted teeth is one of the most frequent and delicate therapies. The most popular and widely used tool for this procedure is a high-speed rotary hand piece.

However, piezoelectric ultrasonic vibrations have lately been used in the piezosurgery technique to remove bone in a safe and efficient manner. During the surgical extraction of the third molar, oral surgeons employ both instruments for osteotomy and odontotomy.[2] A number of postoperative adverse effects, such as discomfort, edema, trismus, nerve damage, hemorrhage, and dry sockets, can result from the surgical extraction of impacted third molars. Various tactics, such as altering the osteotomy technique, are used to lessen these issues[3].

Whether a third molar is entirely impacted or partially erupted, bone removal is required for extraction. When extracting impacted third molars, surgical handpieces with carbide burs are frequently utilized to remove bone. The high temperature created during bone removal causes the bur to produce uneven surfaces and marginal osteonecrosis, according to the morphological study of bone.[4].

Horton et al[5] introduced the ultrasonic inserts in the surgical removal of alveolar bone. The authors have studied histologically the effect of ultrasonic cutting inserts on alveolar bone and reported that ultrasonic inserts remove bone easily and precisely. In addition, the hemorrhage from surgical sites is minimal and there is improved healing with less postoperative complications. Furthermore, the discomfort level of patients after surgery will be minimal.

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According to Vercellotti et al. [6], the piezoelectric device, also known as piezosurgery, can be a useful instrument for performing procedures on the maxillary sinus. Following these reports, piezosur gery has become a popular substitute for rotary instruments. In maxillofacial and oral surgery, piezoelectric surgery techniques have ushered in a new era of osteotomy, osteoplasty, and exodontia. The micrometric incisions made feasible by these procedures are not only selective but also maximize surgical precision with little soft tissue damage. Furthermore, a blood-free surgical site and optimal intraoperative visibility are provided by the cavitation effect.[7] One innovative method that has emerged as a useful substitute to address the drawbacks of traditional spinning bone-cutting tools is piezosurgery. It is carried out by a machine that employs microvibration at a frequency strong enough to break bone. Its working principle is based on the fact that some crystals and ceramics can distort when an electric current is sent through them, which causes microvibration at ultrasonic frequencies. Bone tissue can be sliced selectively using a nitride-hardened or diamond-coated insert operating at a frequency of 25 to 30 KHz.[8.]

## AIM

This article's objective is to evaluate and contrast the surgical and postoperative results of removing a third molar with a rotary bur and piezoelectric surgery.

## MATERIALS AND METHODS

People who visited Rama dental college and hospital and research centre mandhana kanpur Department of Oral and Maxillofacial Surgery participated in this clinical study. The following criteria were used to evaluate about 30 healthy adults who came to the Department of Dentistry in need of the preventative extraction of an impacted lower third molar tooth in optimal condition.

### Inclusion Criteria

• Healthy individuals above 20 years of age • Individuals having vertical, mesioangular, horizontal mandibular third molar impactions based on radio graphic interpretation.

### Exclusion Criteria

• Individuals with systemic disease that could influence healing • Individuals who do not provide consent • Individuals on antibiotics in the past 6 weeks or who require antibiotic prophylaxis before extraction • Individuals who had acute local infection involving the impacted teeth.

The study methodology was described to the participants as soon as they were reported, and their written consent was obtained. People were divided into research groups at random, so that until there were 15 people in each group, the surgical complexity would be the same for both

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groups. Group I: the technique of piezoelectric osteotomy Group II: the technique of rotational osteotomy Strict aseptic conditions were followed when administering adequate local anaesthetic. Under group I, the impacted tooth was surgically extracted using piezoelectric osteotomy technique, and under group II the impacted tooth was surgically extracted using the rotator osteotomy technique. Hand piece and foot switch were the components of the rotary device, and it was attached to the power plug.

About 35,000 rpm was the range of the rotary speed that was used. We employed rotary burs 702 and 703. A foot switch and a hand piece make up the piezoelectric device (Fig. 1), which was connected to the power outlet. With a boosted working mode, a frequency of 25 to 29 kHz and a microvibration of 60 to 200 mm/sec were employed. SL 1, SL 2, and SL 3 piezoelectric burs were employed. All the individuals underwent surgical removal (Fig. 2) of impacted mandibular third molars under 2% lignocaine with 1:200,000 adrenaline, with inferior alveolar, lingual, and long buccal nerve blocks administered. Postoperatively, all individuals received amoxicillin 500 mg tid and diclofenac sodium 50 mg tid for 3 daysOn the seventh day, the sutures were taken out and postoperative instructions were given. The following factors were analyzed for each patient: postoperative pain, postoperative trismus, patient satisfaction with the procedure, and procedure time. The process took a certain amount of time, beginning with the bone guttering and ending with the tooth being raised out of its socket. Patient satisfaction was assessed subjectively using a graded scale from “very satisfied” to “very unsatisfied.” The degree of pain was recorded for a period of 7 days with reference to predefined values on visual analog scale (VAS). Trismus was evaluated on days 3, 5 and 7 of the postoperative period in millimeters. Descriptive analysis was done. Results are explained as mean ± standard deviation (Min – Max) and also as number (%); 5% was considered as level of significance with 95% confidence interval. Quantitative data were analyzed using unpaired t-test and qualitative data were analyzed using Fischer’s exact test.

**Fig. 1:** Piezoelectric device

**Fig. 2:** Surgically removed impacted mandibular third molar

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## RESULTS

While there was no statistically significant difference in mean age between the groups, Table 1 compares study subjects by mean age. The mean age of study individuals in the piezosurgery group was 28.40 ± 2.69, which was slightly lower than the mean age of the rotary group, which was 30.06 ± 3.15. Table 2 compares study individuals by type of impaction.

Fischer's exact test revealed no statistically significant difference in the types of impaction between the groups. The piezoelectric device took 48.20 ± 15.39 minutes to remove the impacted tooth, while the rotary bur took 34.33 ± 11.31 minutes, which is less time than the piezoelectric device. There was a statistically significant difference between the groups' procedure times (Table 3). A grading system was used to assess patient satisfaction.

The results for satisfaction of the procedure were almost similar in both the groups, and were without any statistical significant difference (Table 4).

**Table 1:** Comparison of mean age among the study groups

| *Groups* | *n* | *Mean* | *Std. deviation* | *t-value* | *p-value and significance* |
|---|---|---|---|---|---|
| Piezosurgery | 15 | 28.40 | 2.69 | 1.557 | 0.131 NS |
| Rotary | 15 | 30.06 | 3.15 | | |

p > 0.05, NS: Nonsignificant

**Table 2:** Type of impaction

| *Type of impaction* | *Piezosurgery* | *Rotary* | *Fischer's exact test* |
|---|---|---|---|
| Vertical | 7 | 9 | $\chi^2 = 0.650$ |
| Mesioangular | 6 | 4 | p = 0.723 NS |
| Horizontal | 2 | 2 | |
| Total | 15 | 15 | |

p > 0.05, NS: Nonsignificant

**Table 3:** Comparison of time taken for the procedure

| *Groups* | *Mean* | *Std. Deviation* | *t-value* | *p-value and significance* |
|---|---|---|---|---|
| Piezosurgery | 48.20 | 15.39 | 2.811 | 0.009 S |
| Rotary | 34.33 | 11.31 | | |

p < 0.05, S: significant

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**Table 4:** Comparison of patient's satisfaction of the procedure

| *Patient satisfaction grade* | *Piezoelectric (n = 15) %* | *Rotary (n = 15) %* | *Fischer's exact test* |
|---|---|---|---|
| Very satisfied | 6 (30.0) | 8 (40.0) | $\chi^2 = 1.385$ |
| Fairly satisfied | 6 (40.0) | 5 (25.0) | p = 0.435 NS |
| Fairly unsatisfied | 3 (30.0) | 2 (35.0) | |
| very unsatisfied | 0 | 0 | |

p > 0.05, NS: Nonsignificant

There was no statistically significant difference in pain intensity between the piezoelectric and rotary burs on day 1, according to Table 5's VAS score. However, there were more people in the rotary group who were in excruciating agony. Additionally, the rotary group experienced more severe discomfort until the fourth day, which was statistically significant (p < 005). There was no statistically significant difference between the two groups on days 5, 6, and 7 (p < 0.05). The measurement of mouth opening in millimeters revealed a statistically significant difference (p < 0.01) between the rotary bur and piezoelectric bur groups on the third, fifth, and seventh days.

Mouth opening was significantly better in the piezoelectric group as compared with the rotary bur group until the 7th postoperative day (Table 6).

**Table 5:** Evaluation of pain (VAS) between the study groups

| *Duration and groups* | | *No pain* | *Slight pain* | *Mild pain* | *Severe pain* | *Very severe pain* | *Fischer's exact test* |
|---|---|---|---|---|---|---|---|
| Day 1 | Piezoelectric | 0 | 2 | 6 | 5 | 2 | $\chi^2 = 5.810$ |
| | Rotary | 0 | 0 | 2 | 9 | 4 | p = 0.121 NS |
| Day 2 | Piezoelectric | 0 | 5 | 8 | 2 | 0 | $\chi^2 = 12.788$ |
| | Rotary | 0 | 0 | 4 | 9 | 2 | p = 0.005 S |
| Day 3 | Piezoelectric | 0 | 8 | 7 | 0 | 0 | $\chi^2 = 11.091$ |
| | Rotary | 0 | 3 | 4 | 7 | 1 | p = 0.011 S |
| Day 4 | Piezoelectric | 5 | 7 | 3 | 0 | 0 | $\chi^2 = 8.085$ |
| | Rotary | 1 | 4 | 7 | 3 | 0 | p = 0.044 S |
| Day 5 | Piezoelectric | 10 | 4 | 1 | 0 | 0 | $\chi^2 = 5.238$ |
| | Rotary | 4 | 8 | 2 | 1 | 0 | p = 0.155 NS |
| Day 6 | Piezoelectric | 12 | 3 | 0 | 0 | 0 | $\chi^2 = 3.300$ |
| | Rotary | 8 | 5 | 2 | 0 | 0 | p = 0.192 NS |
| Day 7 | Piezoelectric | 13 | 2 | 0 | 0 | 0 | $\chi^2 = 1.677$ |
| | Rotary | 10 | 5 | 0 | 0 | 0 | p = 0.390 NS |

S: Significant; NS: Nonsignificant

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**Table 6:** Comparison of mean score mouth opening for procedure in the two groups

| *Duration* | *Groups* | *Mean* | *Std. Deviation* | *t-value* | *p-value and significance* |
|---|---|---|---|---|---|
| Pre-op | Piezoelectric | 35.53 | 1.64 | 0.913 | 0.369 NS |
| | Rotary | 34.93 | 1.94 | | |
| Day 3 | Piezoelectric | 32.80 | 1.37 | 6.634 | <0.001 HS |
| | Rotary | 28.93 | 1.79 | | |
| Day 5 | Piezoelectric | 33.60 | 1.68 | 8.702 | <0.001 HS |
| | Rotary | 29.13 | 1.06 | | |
| Day 7 | Piezoelectric | 34.26 | 1.22 | 4.603 | <0.001 HS |
| | Rotary | 32.40 | 0.98 | | |

p > 0.05, HS: Highly significant; NS: Nonsignificant

## DISCUSSION

When removing an impacted third molar, it is crucial to preserve the integrity of the neighboring tooth because surgical procedures can expose roots and cause pulpal necrosis.[9] Therefore, it is best to use a precise technique to remove the tooth without damaging the neighboring tooth. Numerous studies indicate that the distal aspect of the second molar will be injured after the mandibular third molar is removed, but this is still considered a successful treatment.[10–12.]

Piezosurgery was developed recently to conduct accurate and safe procedures.[13.] In order to exclude the gender factor that can contribute to postoperative difficulties because of hormonal changes that may occur in females, our study was conducted on 30 males, ages 25 to 33, in order to standardize our findings. Due to the high degree of education and dedication of the chosen individuals to their therapy, there was not a single dropout from the sample.

Furthermore, social media's accessibility facilitates follow-up interaction with the people. From the flap's establishment to the suturing process' conclusion, the procedure's duration at each site was measured in minutes. In comparison to the control location, the piezosurgery took longer. This is comparable to the study conducted by Goyal et al.[14.]

Comparing piezoelectric techniques to conventional drilling methods, Stacchi et al. discovered a little drop in implant stability quotient values while increasing stability patterns. Other research has shown that the piezoelectric technique not only promotes faster wound healing in the near term, but it also significantly lessens pain after mastoidectomy. Together with our own, these findings demonstrate the special advantages of piezoelectric devices as low-invasive and safe instruments.[11, 15]

Because of the sluggish micrometric cutting activity, piezosurgery took longer than surgery utilizing rotary techniques. As the surgeons gained experience, the duration of surgery employing the ultrasonic osteotomy tended to decrease.[16] Therefore, even if the piezoelectric technique is

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linked to a longer surgical duration, we anticipate that piezosurgery will have a shorter surgical duration as the technique improves and expertise grows. When compared to employing the rotary instrument, the pain score was much lower at the site of the piezoelectric surgery in the current investigation. This result is consistent with what Goyal et al.[14] found.

Piersanti et al.[13] and Mantovani et al.[17] They all agreed that the location where the impacted mandibular third molar is located has reduced postoperative pain after piezosurgery, and they reported a substantial difference in pain scores using the same scale. The findings of a meta-analysis research by Jiang et al.[1] that included seven papers in its analysis are consistent with these findings. The study's primary goal was to compare the methods of rotary osteotomy and piezosurgery. According to their meta-analysis, patients had reduced postoperative swelling even though they underwent piezosurgery for a longer period of time. It is also a superior substitute method for extracting an impacted mandibular molar.

## CONCLUSION

Despite its limitations, the current study found that piezosurgery lowers edema, trismus, and postoperative pain. Additionally, it might be crucial in boosting bone density in the extraction socket and reducing bone loss in the nearby mandibular second molar. There are fewer postoperative problems with piezosurgery than with traditional rotational techniques.

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