ORIGINAL RESEARCH

Conventional Rotary Technique and Piezosurgical Technique in the Removal of Impacted Mandibular Third Molar: A Comparative Study

Shameem Hamza P[1], Sachin Aslam[2], Roshni A[3], Mathew Pynummoottil Cherian[4], Sooraj Soman[5], Akhila K[6]

Abstract

Aim: To compare the operating time, postoperative pain, edema, trismus, and patient acceptance following surgical removal of impacted third molar using piezosurgery and conventional rotary technique.

Materials and methods: About 42 patients with impacted mesioangular mandibular third molars were included in this study. Subjects are divided into two groups: group I (treated with conventional rotary technique) and group II (treated with piezosurgery). Duration of surgery, pain, trismus, and swelling were assessed. The patients were evaluated on the 1st, 3rd, and 7th postoperative days.

Results: Postoperative pain, trismus, and edema were reduced with piezosurgery compared with conventional technique. Even though the duration of time was longer with piezosurgery, patient comfort was found to be better.

Conclusion: Piezosurgery is a meticulous and innovative ultrasonic technique with selective bone cutting and better postoperative outcomes. However, it is expensive, and the operating time is prolonged.

Clinical significance: Piezosurgery is an alternative in the surgical removal of third molars as it ensures precise and selective cutting, with no injury to the surrounding soft tissues. Postoperative outcome and patient acceptance are improved with piezosurgery.

Keywords: Conventional, Mandibular, Pain, Piezoelectric, Rotary, Trismus.

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Introduction

Surgical removal of impacted third molar is one of the most performed procedures in oral and maxillofacial surgery.[1–4] The surgical removal of an impacted third molar can traumatize soft tissues and bone structures in the oral cavity. It can cause postoperative complications like pain, trismus, swelling, nerve injury, and dry socket. It can interfere with the patient's quality of life (QoL). Flap design, the technique of bone removal, and surgeon's skill are important factors that influence the severity of these complications.[2]

Cutting the bone, or osteotomy, is one of the most important procedures in surgical removal, for which a variety of techniques are used. Chisels, osteotomes, and mallet were used on splitting bone and tooth. A rotary instrument that works at 35,000–50,000 rpm was a fast way to remove adequate bone. Rotary cutting instruments, if not used properly, can cause potential damage to the jaw bones because of the high temperature generated during osteotomy. This can result in marginal osteonecrosis and impair regeneration and healing process.[3] Slippage can result in soft tissue trauma. In order to overcome the disadvantages of the conventional rotary technique, piezoelectric surgery was introduced in oral and maxillofacial surgery.

Piezosurgery works on the principle of piezoelectric effect, which is based on the cavitation effect and microvibration phenomenon. The crystals in the piezoelectric substances get deformed when they are placed in an electric field. The periodic change in the polarity of the field produces ultrasonic vibrations, which are amplified and transferred to the vibration tip to diverse solid, liquid, or gaseous materials. The tip on the bone tissue with slight pressure generates a mechanical cutting effect called the cavitation phenomenon. Usually, it produces a functional frequency of 20 kHz, as in ultrasonic scalers. The addition of a 50 kHz pulse every 10 ns to this basal frequency increases the power of the receiver device, allowing bone cutting without damaging soft tissues. That is, it does not cause trauma to soft tissues, nerves, and blood vessels, which is a usual complication associated with the usage of conventional burs. Piezosurgery, when employed in the removal of an impacted tooth, can be advantageous in limiting the bone loss and maximizing the maintenance of the alveolar bone integrity, especially when the alveolar bone is thin, and the technique requires a high degree of precision.

According to various studies, piezosurgery, being minimally invasive and soft tissue-sparing, can be an alternative to the conventional rotary technique for surgical removal of impacted mandibular third molars.[5] So the goal of this study was to evaluate the efficacy of conventional rotary technique and piezosurgical technique by comparing the operating time, postoperative pain,

[1–6]Department of Oral and Maxillofacial Surgery, MES Dental College, Perinthalmanna, Kerala, India

Corresponding Author: Sachin Aslam, Department of Oral and Maxillofacial Surgery, MES Dental College, Perinthalmanna, Kerala, India, Phone: +91 9895580108, e-mail: drsachinaslama@gmail.com

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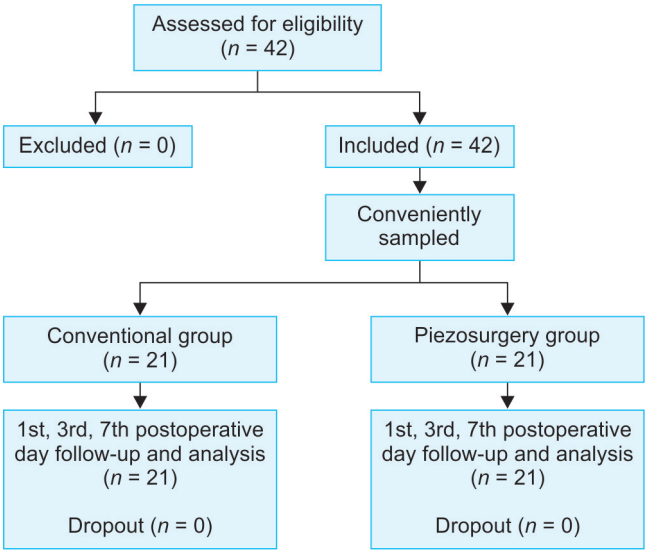
Flowchart 1: CONSORT flow diagram for the study



Inclusion Criteria

Subjects within the age-group of 18–35 years with mesioangular mandibular third molar impaction.

Exclusion Criteria

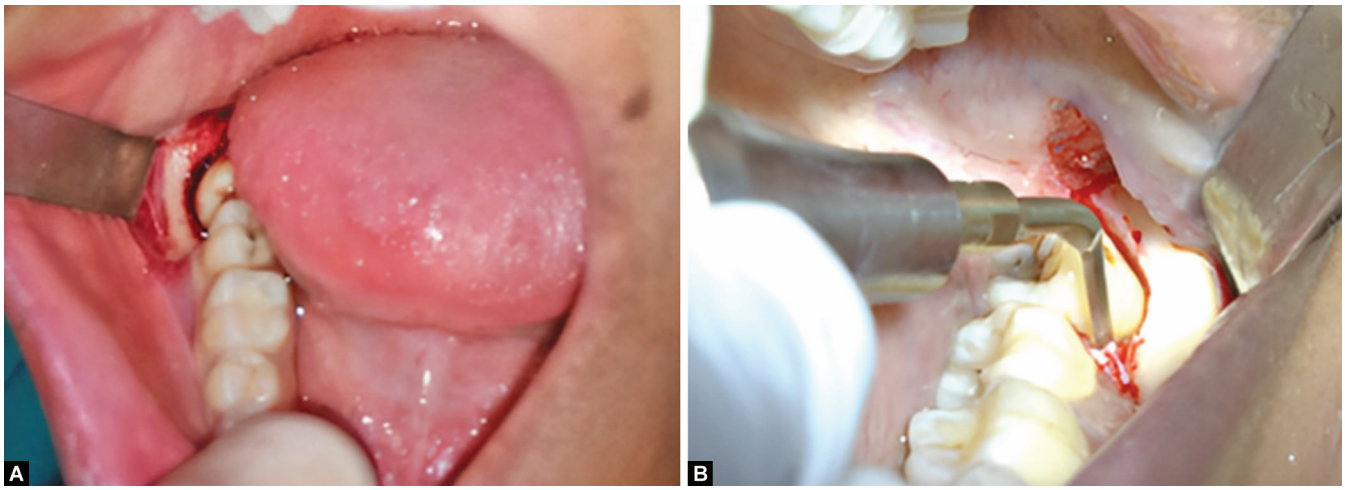
Subjects with systemic diseases or pathologies, infections related to the site, heavy smokers, and pregnant women.

After obtaining informed consent, patients were thoroughly examined, and a detailed case history was taken along with intraoral periapical radiograph/orthopantomograph evaluation.

After the patient was prepared under standard aseptic conditions, 2% lignocaine hydrochloride with adrenaline in 1:80,000 dilution was used for inferior alveolar, lingual, and buccal nerve blocks. Using no. 15 Bard-Parker blade, TG Ward's incision was placed. Full-thickness mucoperiosteal flap was reflected using Molt no. 9 periosteal elevator.

Conventional Rotary Technique

In this group, the impacted teeth were surgically extracted using rotatory osteotomy technique. Osteotomy (Fig. 1A) and odontectomy were done using no. 702 SS White Tungsten carbide burs of 1.5 mm diameter and 7 mm head length with a straight handpiece (Saeyang Marathon). Normal saline was used for irrigation. The socket was irrigated using a combination of povidone-iodine and normal saline. Primary closure of wound was done with simple interrupted sutures using nonresorbable 3.0 black braided silk sutures, and the releasing incision was left to heal by secondary intention in all cases.



Figs 1A and B: Osteotomy done with (A) conventional rotary technique and (B) piezosurgical technique

edema, trismus, and patient acceptance following surgical removal of impacted third molar. This novel study was intended to compare the efficacy of two techniques from not only the surgeon's point but also involves active participation by patients in terms of interference with their quality of life.

Materials and Methods

This prospective study was carried out for a period of 1 year from 1st January 2020 to 1st January 2021 among patients availing treatment in the outpatient department of Oral and Maxillofacial Surgery, MES Dental College and Hospital, Perinthalmanna. The study was initiated after obtaining clearance from the Institutional Ethical Committee (IEC/MES/63/2019). Prior to the initiation of the study, a written informed consent in accordance with ethical codes adopted by the National Committee for Medical Research Ethics was completed by all participants. The patients were randomly selected based on inclusion and exclusion criteria and conveniently sampled into two groups by lottery method (Flowchart 1).

Piezosurgery Technique

In this group, osteotomy was done using SAW and S610 inserts of piezoelectric device under cortical bone cutting mode (Fig. 1B). Cooled normal saline was used as an irrigant at moderate pumping speed, which functioned automatically with the piezotome. After exposure of the impacted tooth, odontectomy was done using no. 702 SS White carbide burs of 1.5 mm diameter and 7 mm head length with a straight handpiece (Saeyang Marathon). Extraction socket was irrigated using a combination of povidone-iodine and normal saline. Wound closure was done using nonresorbable 3.0 black braided silk sutures. Primary closure was done by placing a

few simple interrupted sutures, and the releasing incision was left to heal by secondary intention in all cases.

Postoperatively, patients were prescribed the same antibiotic regimen, irrespective of the study group to which they are allocated.

Intraoperative Parameters Examined

The duration of the operation was noted from the beginning of the incision up to the closure of the wound using a stopwatch.

Postoperative Parameters Examined

The patients were reviewed on the 1st, 3rd, and 7th postoperative days, and the following parameters were assessed:

- Pain: Was assessed by the Visual Analogue Scale (VAS) scale of 10 units.
- Trismus: Evaluated by the interincisal distance at maximum mouth opening (mm).
- Edema: Assessed by using facial measurement with two reference points.
  - Tragus to the corner of mouth (mm).
  - Tragus to soft tissue pogonion (mm).
- A comprehensive questionnaire was given to each patient on the 7th postoperative day.

The data were expressed in number, percentage, mean, and standard deviation. Statistical Package for Social Sciences (SPSS) 16.0 version was used for analysis. Unpaired *t*-test and Chi-square test were applied to find the statistical significance between the groups. *p*-value < 0.05 was considered statically significant at 95% confidence interval.

Results

The duration of the procedure was longer with the piezosurgery group (40.71 ± 3.88 minutes) than the conventional group (52.19 ± 2.60 minutes) with a *p*-value of 0.0001.

Assessment of pain was done using the VAS on the 1st, 3rd, and 7th day. When comparing the two groups for pain on postoperative day 1, the mean value in the conventional group was 5.04 ± 0.74, and in the piezo group was 3.84 ± 0.68 with a *p*-value of 0.0001. In the postoperative day 3, the conventional group expressed a mean value of 3.04 ± 0.86, and in the piezo group, the mean value was 2.15 ± 0.50 with a *p*-value of 0.0001. On postoperative day 7, the mean value turns to 0.71 ± 1.10 for the conventional group and 0.10 ± 0.45 for the piezo group with a *p*-value of 0.031. There was significant reduction in pain intensity in the piezosurgery group compared with the conventional group from postoperative day 1 to the subsequent days (Table 1, Fig. 2).

Trismus was assessed by the maximum mouth opening. Mean interincisal opening of preoperative, 1st, 3rd, and 7th day showed significant difference compared with the groups I and II. On the 1st postoperative day, values of interincisal opening showed significant decrease compared with preoperative day between conventional and piezosurgery groups. Preoperatively, the interincisal opening was 46.3 ± 6.70 mm in the conventional group and 43.90 ± 6.81 mm in the piezosurgical group, which was decreased to 30.90 ± 7.80 mm and 33.76 ± 8.70 mm, respectively, with a *p*-value of 0.04. There was a significant increase in interincisal opening on the 3rd and 7th postoperative days between the groups, with *p*-values of 0.03 and 0.04, respectively. On the 3rd postoperative day, interincisal opening was 34.52 ± 6.80 mm and 37.23 ± 7.56 mm in conventional and piezo groups, respectively.

Table 1: Comparison of pain at different time intervals

	Conventional		*Piezosurgery*			
Pain	*Mean*	*SD*	*Mean*	*SD*	*T*	*P*
Preoperative	0.00	0.00	0.00	0.00	0	–
Postoperative (1st day)	5.04	0.74	3.84*	0.68	5.31	0.0001
Postoperative (3rd day)	3.04	0.86	2.15*	0.50	3.92	0.0001
Postoperative (7th day)	0.71	1.10	0.10*	0.45	2.23	0.031

*$p < 0.05$, statistically significant

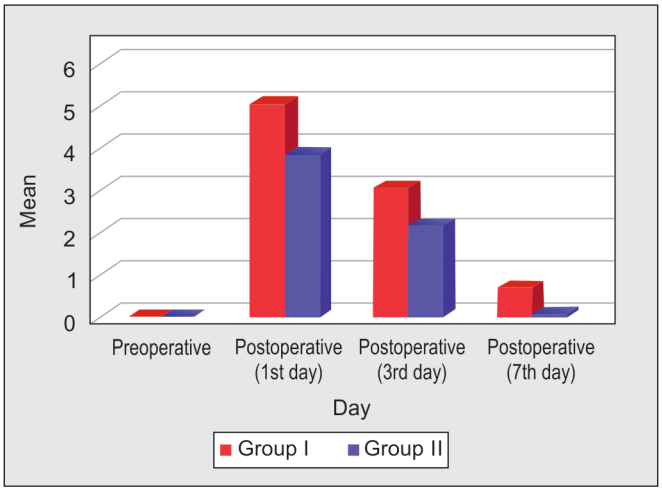


Fig. 2: Comparison of pain between the conventional and piezosurgical groups

Table 2: Comparison of interincisal opening between the groups

	Conventional		*Piezosurgery*		
Interincisal opening (mm)	*Mean*	*SD*	*Mean*	*SD*	*p-value*
Preoperative	46.23	6.70	43.90*	6.81	0.04
Postoperative (1st day)	30.90	7.80	33.76*	8.70	0.04
Postoperative (3rd day)	34.52	6.80	37.23*	7.56	0.03
Postoperative (7th day)	43.57	6.85	46.14*	7.56	0.04

*$p < 0.05$, statistically significant

On the 7th postoperative day, the interincisal opening was 43.57 ± 6.85 and 46.14 ± 7.56 mm, respectively, in conventional and piezo groups (Table 2, Fig. 3).

While evaluating mean vertical dimension of swelling (tragus to pogonion) in both the groups, mean edema values on preoperative, 1st, 3rd, and 7th days did not show any significant difference with *p*-values 0.107, 0.18, and 0.239, respectively. In the conventional group, the mean value 15.36 ± 1.06 mm preoperatively was increased to 16.25 ± 1.27 mm on postoperative day 1 and to 16.35 ± 1.07 mm on postoperative day 3, which indicates facial swelling. The mean value was reduced to 15.60 ± 1.02 mm on postoperative day 7 which did not show any statistical difference from the preoperative mean value. In the piezosurgery group, the mean value 15.12 ± 1.38 mm preoperatively showed a slight increase to 15.58 ± 1.35 mm on postoperative day 1, thereafter, a slight decrease in mean value to 15.30 ± 1.64 mm was observed. This was suggestive of the presence of facial swelling. The mean value of 15.15 ± 1.37 mm on postoperative day 7 did not show any statistical difference from the preoperative mean value. The mean values of edema were lesser

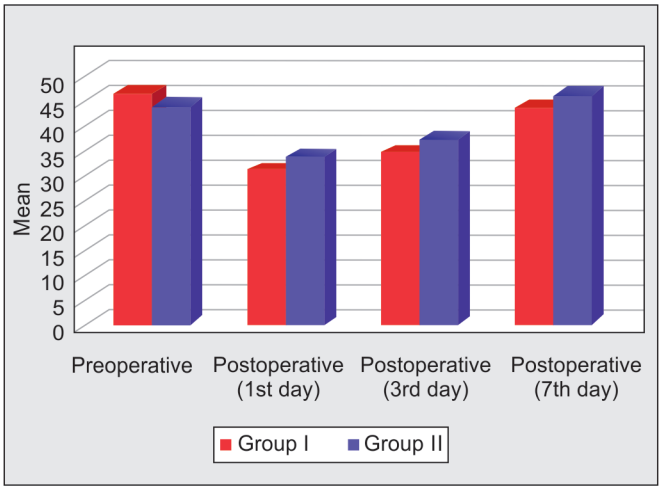


Fig. 3: Comparison of interincisal opening between the conventional and piezosurgical groups

Table 3: Comparison of edema (tragus to pogonion) between the groups

	Conventional		*Piezosurgery*		
Edema (tragus to pogonion)	*Mean*	*SD*	*Mean*	*SD*	*p-value*
Preoperative	15.36	1.06	15.12	1.38	0.544
Postoperative (1st day)	16.25	1.27	15.58	1.35	0.107
Postoperative (3rd day)	16.35	1.07	15.30	1.64	0.18
Postoperative (7th day)	15.60	1.02	15.15	1.37	0.239

*$p < 0.05$, statistically significant

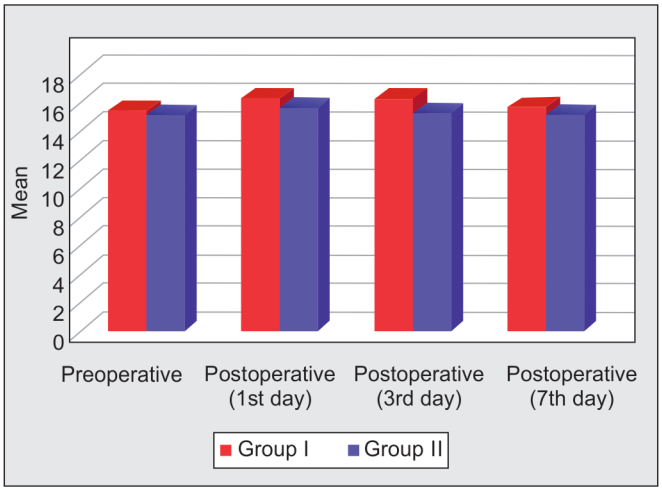


Fig. 4: Comparison of edema, tragus to the corner of mouth, between the conventional and piezosurgical groups

in the piezosurgery group compared with the conventional group, but this decrease was not statistically significant (Table 3, Fig. 4).

While evaluating mean horizontal dimension of swelling (tragus to the corner of mouth in both the groups at different time intervals), mean edema values of preoperative, 1st, 3rd, and 7th day showed only a slight decrease, but this difference was not statistically significant (*p*-values 0.723, 0.885, and 0.216, respectively). In conventional group, the mean value was 12.06 ± 0.85 mm preoperatively, which showed a slight increase to 12.95 ± 1.09 mm on postoperative day

Table 4: Comparison of edema (tragus to the corner of mouth) between the groups

	Group I		*Group II*		
Edema (tragus to corner)	*Mean*	*SD*	*Mean*	*SD*	*p-value*
Preoperative	12.06	0.85	11.81	0.95	0.179
Postoperative (1st day)	12.95	1.09	12.26	0.90	0.723
Postoperative (3rd day)	13.15	1.05	12.07	1.03	0.885
Postoperative (7th day)	12.23	0.92	11.80	1.05	0.216

*$p < 0.05$, statistically significant

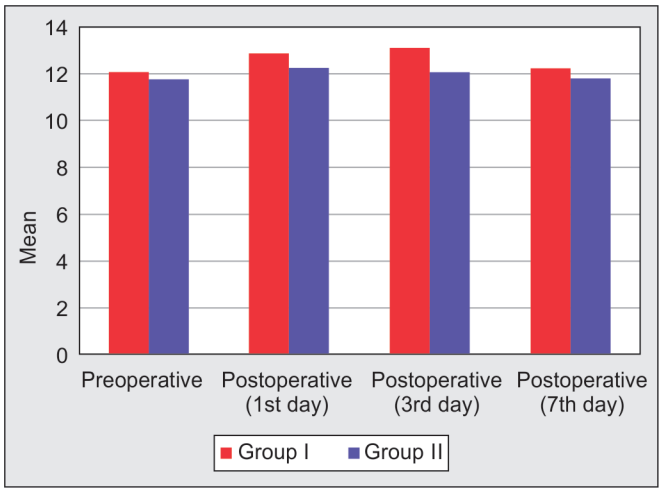


Fig. 5: Comparison of edema, tragus to pogonion, between the conventional and piezosurgical groups

Table 5: Comparison of PoSSe scale between the groups

	PoSSe scale		
Groups	*Mean*	*SD*	*p-value*
Group I	32.71	6.16	0.0001
Group II	20.52*	4.02	

*$p < 0.05$, statistically significant

1, and on postoperative day 3, was increased to 13.15 ± 1.05, which was suggestive of facial swelling. On postoperative day 7, the mean value was 12.23 ± 0.9 mm which has no significant difference from the preoperative mean value. In the piezosurgery group, the mean value 11.81 ± 0.95 mm preoperatively was increased to 12.26 ± 0.90 mm on postoperative day 1, which indicates facial swelling. A slight decrease in mean value to 12.07 ± 1.03 mm was observed on postoperative day 3. The mean value was 11.80 ± 1.05 mm on postoperative day 7, which had no significant difference from the preoperative mean value. The maximum mean value of edema was seen on the 3rd postoperative day in the conventional group and on the 1st postoperative day in the piezosurgery group. On the 7th postoperative day, the mean value was nearest to the preoperative value in the piezosurgery group (Table 4, Fig. 5).

On the 7th postoperative day, the patient was given a questionnaire to assess the effect of surgical removal of the third molar in the patient's life in the postoperative period. The mean value of postoperative symptom severity (PoSSe) scale was 32.71 ± 6.16 in the conventional group and 20.52 ± 4.02 in the piezosurgery group. Piezosurgery group showed a significant decrease in PoSSe scale compared with conventional group, with a *p*-value of 0.0001 (Table 5, Fig. 6).

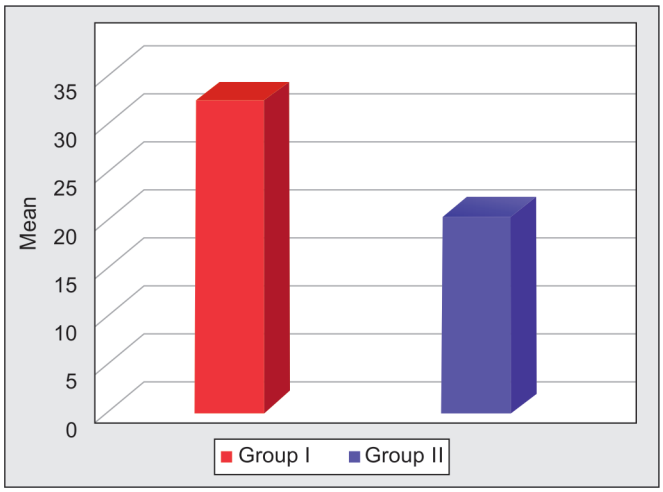


Fig. 6: Comparison of PoSSe scale between the conventional and piezosurgical groups

Discussion

Piezosurgery was introduced to minimize the complications of conventional rotary techniques and improve surgical outcomes from the patient's perspective. Jean and Marie Curie, in 1880, described the microvibrations produced by piezosurgical devices. In 1997, TomasoVercellotti first introduced the idea to use a piezoelectric tip to extract an ankylosed root of a maxillary canine.[5,6] Piezosurgery is based on the two fundamental concepts in bone microsurgery. The first is minimally invasive surgery, which improves tissue healing and reduces discomfort for the patient. The second concept is surgical predictability, which increases treatment effectiveness. Piezosurgical technique provides precise cuts, better operating fields, and improved tissue healing. These features enable piezosurgery to be used in anatomical areas where vital structures are to be preserved.

The selective cutting feature of piezosurgery is utilized for osteotomies in sites where vital structures are to be protected. Constant irrigation during piezosurgery not only provides a clearer operating field but also helps to avoid extremes of temperature change that can affect bone healing. Clinical investigations have shown that the specificity of the operation and the procedures used in piezoelectric bone surgery allow patients to benefit from variances in hard and soft tissue structure. This was associated with improved postoperative outcomes.

Our study revealed that the piezosurgical procedure required more time to complete than the rotary osteotomy and was more time-consuming due to the slower micrometric cutting action. The mean duration of time in conventional technique was 40.71 ± 3.88 minutes, and that in piezosurgical technique was 52.19 ± 2.60 minutes. That is, piezosurgery required more duration compared with conventional rotary technique. This was consistent with the findings in a meta-analysis conducted by Al-Moraissi et al. in 2015.[7–9] Operating time will reduce once the surgeon acquires more experience with the piezosurgical technique.

We have assessed pain in both the groups preoperatively as well as postoperatively based on VAS. Patients in both the groups did not have any pain preoperatively. On overall observation, there is significant reduction in pain intensity in the piezo group compared with the conventional group from postoperative day 1 to the subsequent days. The findings of our study were similar to those of Goyal et al.,[6] Pappalardo et al.,[7] and Rullo et al.[8] In a study done by Chang et al.,[9] there was no significant difference between group I and group II. According to Jiang,[10] pain perception is subjective and is influenced by the patient's perception as well as surgeon's skill.

Preoperative and postoperative mouth opening (interincisal opening) was assessed to determine the mean reduction in mouth opening following the surgical removal of third molars by conventional rotary or piezosurgical method. Mean interincisal opening of preoperative, 1st, 3rd, and 7th day showed a significant difference compared with the conventional and piezo groups. On the 1st postoperative day, values of interincisal opening showed a significant decrease compared with the preoperative day between the conventional and piezo groups. There is a significant increase in the interincisal opening on the 3rd and 7th postoperative days between the groups ($p < 0.05$). Similar findings were found in the studies of Pappalardo et al.,[7] Troedhan et al.,[11] and Baqain et al.[12] Our study has shown significantly lower postoperative pain and trismus in piezotome group. Hence, the conclusion reached is that even though the duration of the operation was longer with piezoelectric surgery, the outcome was still relatively favorable.

We have evaluated facial swelling with a tape measure as described by Schultze-Mosgauet et al. Two measurements were made between three reference points: tragus, pogonion, and the corner of the mouth. Mean vertical dimension of swelling (tragus to pogonion) was observed in each group at different time intervals. While evaluating both the groups, there is not much difference in the edema (tragus to pogonion) between groups I and II. Mean horizontal dimension of swelling (tragus to the corner of mouth) was observed in each group at different time intervals. While evaluating both the groups, there is not much difference in the edema (tragus to corner of mouth) between groups. Chang et al.[9] found no statistically significant change in postoperative swelling, which was supportive of the findings in our study.

In our study, we have evaluated the subjective experience of patient satisfaction using a comprehensive questionnaire given to each patient on the 7th postoperative day. The PoSSe scale assessed the patient's perception of postoperative adverse effects in seven subscales: eating, speech, sensation, appearance, pain, sickness, and interference with daily activities.[13,14] PoSSe score was obtained by adding the response to each of the individual questions. The mean value of PoSSe scale was 32.71 ± 6.16 in the conventional group and 52 ± 4.02 in the piezosurgical group. Piezosurgery group showed a significant decrease in PoSSe scale compared with the conventional group, which suggests that the patients treated with piezosurgical method had improved quality of life and reduced interference with daily-life activity. Similar studies done by Al-Delayme[14] and Piersanti et al.[15] also suggest PoSSe scale was significantly lower for piezosurgery, denoting less discomfort. With piezosurgery, postoperative pain, trismus, and edema were significantly lower, and operating time was longer, but patients with improved patient acceptance.

Piezosurgery is a promising surgical tool for safe and effective use in various surgeries. For an oral and maxillofacial surgeon, piezosurgery allows safer and effective osteotomy or osteoplasty compared with conventional rotating instruments such as burs and saw blades, even in complex anatomical areas. Over the past decade, it has been increasingly used in OMFS, neurosurgery, orthopedic surgery, and otorhinolaryngology. In addition to the surgical advantages, it helps the patient by reducing procedural stress, postoperative swelling, and pain, and overall improves the surgical experience. The major drawback of piezosurgery is the lack

of efficiency or cutting speed, which can be balanced by improved clinical outcomes. Future generations of piezotomes may bring about better efficiency and ultimately replace all conventional cutting tools. Volumetric analysis of postoperative swelling was desirable, which is considered as a limitation of the study. Future studies must be conducted at multicenter levels considering the aforementioned recommendations.

Conclusion

The current research concludes that piezosurgery is an alternative in the surgical removal of third molars as it ensures precise and selective cutting, with no injury to the surrounding soft tissues. It is associated with a reduced amount of postoperative facial swelling, pain, and trismus. Patients who underwent piezosurgery had a better quality of life compared with conventional method. Piezosurgery also provides better access and a bloodless surgical site. However, piezosurgical technique requires longer duration for removal of impacted mandibular third molars.

References

1. Blondeau F, Daniel NG. Extraction of impacted mandibular third molars: postoperative complications and their risk factors. J Can Dent Assoc 2007;73(4):325. PMID:17484797.
2. Kumar S, Sarumathi T, Veerabahu M, et al. To Compare standard incision and comma shaped incision and its influence on postoperative complications in surgical removal of impacted third molars. J Clin Diagn Res 2013;7(7):1514–1518. DOI: 10.7860/JCDR/2013/6200.3135.
3. Mistry FK, Hegde ND, Hegde MN. Postsurgical consequences in lower third molar surgical extraction using micromotor and piezosurgery. Ann Maxillofac Surg 2016;6(2):251–259. DOI: 10.4103/2231-0746.200334.
4. Keyhan SO, Fallahi HR, Cheshmi B, et al. Use of piezoelectric surgery and Er:YAG laser: Which one is more effective during impacted third molar surgery?. Maxillofac Plast Reconstr Surg 2019;41(1):29. DOI: 10.1186/s40902-019-0212-6.
5. Spinelli G, Lazzeri D, Conti M, et al. Comparison of piezosurgery and traditional saw in bimaxillary orthognathic surgery. J Craniomaxillofac Surg 2014;42(7):1211–1220. DOI: 10.1016/j.jcms.2014.02.011.
6. Goyal M, Marya K, Jhamb A, et al. Comparative evaluation of surgical outcome after removal of impacted mandibular third molars using a piezotome or a conventional handpiece: A prospective study. Br J Oral Maxillofac Surg 2012;50(6):556–561. DOI: 10.1016/j.bjoms.2011.10.010.
7. Pappalardo S, Guarnieri R. Randomized clinical study comparing piezosurgery and conventional rotatory surgery in mandibular cyst enucleation. J Craniomaxillofac Surg 2014;42(5):e80–e85. DOI: 10.1016/j.jcms.2013.06.013.
8. Rullo R, Addabbo F, Papaccio G, et al. Piezoelectric device vs. conventional rotative instruments in impacted third molar surgery: Relationships between surgical difficulty and postoperative pain with histological evaluations. J Craniomaxillofac Surg 2013;41(2):e33–e38. DOI: 10.1016/j.jcms.2012.07.007.
9. Chang HH, Lee MS, Hsu YC, et al. Comparison of clinical parameters and environmental noise levels between regular surgery and piezosurgery for extraction of impacted third molars. J Formos Med Assoc 2015;114(10):929–935. DOI: 10.1016/j.jfma.2014.02.003.
10. Jiang Q, Qiu Y, Yang C, et al. Piezoelectric versus conventional rotary techniques for impacted third molar extraction: A meta-analysis of randomized controlled trials. Medicine 2015;94(41):e1685. DOI: 10.1097/MD.0000000000001685.
11. Troedhan A, Kurrek A, Wainwright M. Ultrasonic piezotome surgery: Is it a benefit for our patients and does it extend surgery time? A retrospective comparative study on the removal of 100 impacted mandibular 3rd molars. Open J Stomatol 2011;1(4):179–184. DOI: 10.4236/ojst.2011.14027.
12. Baqain ZH, Al-Shafii A, Hamdan AA, et al. Flap design and mandibular third molar surgery: A split mouth randomized clinical study. Int J Oral Maxillofac Surg 2012;41(8):1020–1024. DOI: 10.1016/j.ijom.2012.02.011.
13. Al-Moraissi EA, Elmansi YA, Al-Sharaee YA, et al. Does the piezoelectric surgical technique produce fewer postoperative sequelae after lower third molar surgery than conventional rotary instruments? A systematic review and meta-analysis. Int J Oral Maxillofac Surg 2016;45(3):383–391. DOI: 10.1016/j.ijom.2015.10.005.
14. Al-Delayme RM. Randomized clinical study comparing piezoelectric surgery with conventional rotatory osteotomy in mandibular third molars surgeries. Saudi Dent J 2021;33(1):11–21. DOI: 10.1016/j.sdentj.2019.11.010.
15. Piersanti L, Dilorenzo M, Monaco G, et al. Piezosurgery or conventional rotatory instruments for inferior third molar extractions? J Oral Maxillofac Surg 2014;72(9):1647–1652. DOI: 10.1016/j.joms.2014.04.032.