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Piezosurgery versus rotary instrument in mandibular third molar surgery

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Abstract

Background: The purpose of this study is to compare the effect of surgical removal of third molar by using piezosurgery versus rotary instrument in terms of pain, swelling, infection, and trismus along with operative time difference between the procedures.

Method: The study was designed as an observational prospective study, and implemented on patients who required surgical removal of impacted mandibular third molar visiting the Department of Oral and Maxillofacial Surgery, UCMS College of Dental Surgery, Bhairahawa, Nepal. Patients were divided into two equal groups, Gr A: Piezosurgery, and Gr B: Rotary instrument. Variables measured were intraoperative time, pain, swelling, mouth opening, and infection on the 1st, 3rd, and 7th postoperative days. A p-value <0.05 was considered statistically significant.

Result: Out of 70 patients, 35 in Gr A and 35 in Gr B; the pain was less on all post-operative days in Gr A but the difference was statistically non-significant. The swelling was lesser in all postoperative days in Gr A than in Gr B, and the differences were statistically significant for 3rd, and 7th days. The mean intraoperative duration was 31.4 minutes in Gr A and 23.8 minutes in Gr B, differences were statistically significant. Mouth opening was more in Gr A than in Gr B, on postoperative days and the differences were statistically significant for 3rd, and 7th days.

Conclusion: Piezosurgery took a longer time, but had a better outcome in terms of postoperative pain, swelling, and trismus.

Keywords: Piezosurgery, Rotary Instruments, Third Molar Surgery

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Introduction

Third molar surgery is a common procedure performed by oral and maxillofacial surgeons.[1,2] Impacted teeth are seen in up to 20% population, commonly affected are mandibular and maxillary third molars.[3] Impaction causes infection, crown resorption, cysts or tumors, and crowding dentition.[4] Studies from Nepal report third molar impaction in 52.4% of men and 47.6% of women.[5]

Traditional chisel and mallet technique had superior healing but it was challenging under local anesthesia and more chances of fracture of the bone and uncontrolled osteotomy cuts. Rotary cutting instruments cut and remove bone easily but can cause soft tissue injury, produce high heat during osteotomy casing marginal osteonecrosis, and impair healing. Surgery may lead to various post-operative pain, swelling, trismus, bleeding, nerve injury, etc.[6]

Piezoelectric surgery or piezosurgery has the advantage of atraumatic osteotomy with precision, safety, and rapid recovery.[7] The outcome of piezosurgery versus rotary micromotor hand-piece technique is still debatable. The present study aims to compare piezosurgery versus conventional rotary instruments for the outcome (pain, swelling, trismus, wound infection) and duration of surgery in impacted mandibular third molar surgeries.

Method

The prospective observational study was carried out at the Department of Oral and Maxillofacial Surgery, UCMS College of Dental Surgery, Bhairahawa, Nepal from 15th August 2020 to 15th January 2022. Approval was obtained from the UCMS Institutional Review Committee.

The sample size was calculated as 35 in each group. We used formula $(n)=(r+1)/r\{(Z_\alpha+Z_\beta)^2/d^2\}\sigma^2$. The mean difference of survey time interval between Group A and Group B (d) was 17-22.92, standard deviation (σ)=8.88.[8] Level of significance at 5%(Z_α)=1.96, power of test at 80% (Z_β)=0.84, ratio of group A where osteotomy by conventional rotary bur and Group B piezoelectric device (r)=1. The sample size, $n=(1+1)/1\{(1.96+0.84)/(1722.92)\}^2 8.88^2=34.42$ i.e. 35 (in each group).

Random allocation was done in equal numbers for piezosurgery (GrA) or a rotary instrument (GrB) using a shuffled deck of cards, odd number for GrA and even number for GrB. Patients were briefed about the treatment approach and informed written consent was obtained.

Inclusion criteria were patients aged 18-36 years requiring surgical removal of impacted mandibular third molar for prophylactic or therapeutic reasons, history of repeated discomfort in the mandibular third molar region because of an impacted third molar, history of chronic cheek biting in the region of third molars.

Exclusion criteria were patients with systemic diseases like uncontrolled diabetes and blood disorders, a deleterious habit of chronic smoking, chronic alcoholism, and drug abuse, and patients with recurrent acute pericoronitis, and abscess.

A thorough medical history and clinical examination were carried out in a patient with an impacted mandibular third molar followed by routine intra-oral periapical radiograph (IOPA), orthopantomogram (OPG), and routine blood investigations. The surgical difficulty was assessed radiographically through Winter's WAR lines and Pederson's difficulty index.

Surgeries were done by single surgeon under local anesthesia containing 2% lidocaine hydrochloride (1:200000 adrenaline). The surgical site was prepared with a 5% povidone-iodine solution and Ward's incision was made followed by the elevation of a full mucoperiosteal flap to expose the impacted tooth and surrounding bone. For patients who were in Group A, osteotomy was done by a tungsten carbide straight fissure bur in a micromotor handpiece at 20,000 rpm under continuous normal saline spray through a 20 ml syringe for cooling purposes, and for patients in Group B category osteotomy was done by

piezoelectric device with a frequency of 28-36 kHz and an amplitude of 30-60 m/s. The tooth was retrieved with elevators or forceps under controlled force. Unwanted remnants of dental follicles were removed with a blade, scissors, or curette. Bony spicules were smoothened with bone Rongeur, bone file, or vulcanite bur. The socket was irrigated with normal saline. Adequate hemostasis was achieved, flap repositioned and wound closure was done with 3-0 silk suture without tension.

All patients were prescribed amoxicillin 500 mg, 8 hourly/day for 5 days; Ibuprofen 400mg 8 hourly/day for 3 days and pantoprazole 40 mg once daily for 5 days. Post-surgical instructions were given to all patients. Patients were recalled on the 1st, 3rd, and 7th postoperative days for evaluation of pain, swelling, mouth opening, and infection.

Operative time was defined as time in minutes from the incision to the closure of the wound.
For assessment of pain, a numeric rating scale (NRS) was used where patient rated their pain on a scale (0-10), where 0 was no pain and 10 was the worst pain imaginable.[9]

Facial swelling was measured with measuring tape using three measurements technique described in literature. Pre- and post-operative three measurements included, 1) distance from the lateral corner of the eye to the angle of the mandible, 2) tragus to the corner of the mouth, and 3) tragus to soft tissue pogonion of facial swelling.[10]

Mouth opening was measured as maximum interincisal distance with a Vernier caliper on preoperative day, the 1st, 3rd, and 7th postoperative days. It was calculated in millimeters.

Assessment of infection was done by three different oral and maxillofacial surgeons independently based on purulent discharge, local abscess, the onset of facial cervical cellulitis, and other signs of infection such as pain, increased heat, and erythema. The most frequently occurring decision was taken as the presence or absence of infection.

All the data were recorded and tabulated in an MS Excel Sheet 2013. Descriptive and analytical statistics were done using SPSS 25.0 (IBM Corporation Chicago, USA) 2021. The normality of data was analyzed with the Kolmogorov-Smirnov test. For normally distributed data the independent sample t-test was used to check to mean difference between sides. Statistical significance was established at $p<0.05$.

Result

Out of a total of 70 patients included in the study, females were 49(70%) more in numbers than males, Figure 1.

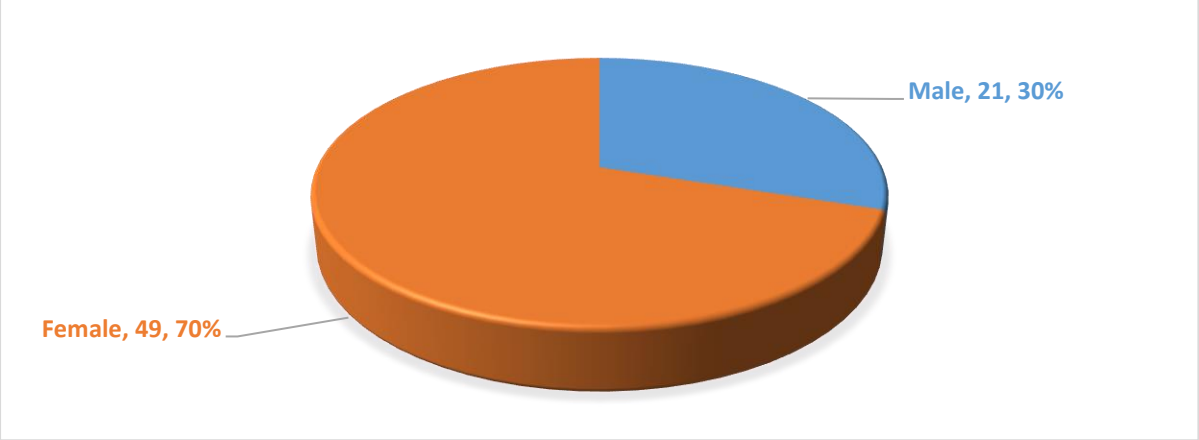

Figure 1. Gender-wise distribution of patients who underwent mandibular third molar surgeries (n=70)

The rotary instrument group had more pain on all post-operative days as compared to the piezosurgery group but was not statistically significant, Table 1.

The procedure time of piezosurgery group was 31.4±8.5 minutes, significantly more than the rotary instrument group <0.001, Table 2.

The mouth opening in piezosurgery group was comparatively more than rotary group in all post-operative days, Table 3. The swelling in the piezosurgery group was less than the rotary group in all post-operative days, Table 4.

There was no incidence of wound infections in both the groups.

Table 1. Post-operative pain after piezosurgery vs. rotary instrument group in mandibular third molar surgery

Postoperative pain	Piezosurgery pain NRS mean±SD (n=35)	Rotary pain NRS mean±SD (n=35)	p-value
Day 1	4.50±1.19	5.30±1.59	0.11
Day 3	3.40±1.19	3.50±1.35	0.78
Day 7	1.05±0.96	1.10±1.30	0.75

NRS=numeric rating scale

Table 2. Procedure time in piezosurgery vs. instrument group in mandibular third molar surgery

Operative time	Piezosurgery time mean±SD (n=35)	Rotary time mean±SD (n=35)	p-value
Minutes	31.40±8.5	23.80±6.5	<0.001

Table 3. Mouth opening after piezosurgery vs. instrument group in mandibular third molar surgery

Mouth opening mm	Piezosurgery mean±SD (n=35)	Rotary mean±SD (n=35)	p-value
Day 1	46.70±4.50	43.30±5.50	0.006
Day 3	27.68±7.90	25.80±9.20	0.362
Day 7	36.40±6.80	31.20±6.80	0.002
Day 7	44.80±5.30	39.02±7.06	<0.001

Table 4. Comparison of mean swelling in millimeter piezosurgery vs. instrument group in mandibular third molar surgery

Post-operative days	Piezosurgery mean±SD (n=35)	Rotary group mean±SD (n=35)	p-value
Day 1	4.10±2.95	5.06±2.89	0.173
Day 3	2.20±2.35	4.09±3.03	0.005
Day 7	0.33±1.83	1.74±2.34	0.006

Discussion

The mean duration of the operation was longer in the piezosurgery (31.4±8.5 min) than in the rotary instrument (23.8±6.5 min) and was statistically significant (p<0.05) which is similar to other studies.[8,11] The NRS scale was used for assessing pain in the present study as it shows high correlation among other pain assessment tool like VAS. The mean pain score on day 1, 3, and 7 in piezosurgery group was 4.50±1.19, 3.40 ±1.19, and 1.05± 0.96 respectively and in rotary group was 5.30±1.59, 3.50±1.35, and 1.10±1.30 respectively. The mean pain recorded in the piezosurgery group was lower than the rotary instrument group during all post-operative days but the values were not statistically significant (p>0.05). This result was in accordance with other reported studies.[12,13]

It is necessary to perform a surgery without hampering surrounding bone, adjacent tooth, inferior alveolar nerve and soft tissues. So, piezosurgery has been used for safe and precise surgeries plus it provides optimal visibility to

surgical field, protection of adjacent soft tissues, less surgical complication such as pain, swelling, trismus, infection with longer intraoperative duration.[12,13]

Swelling was assessed through the modification of tape measuring method described in the literature where baseline measurements were taken preoperatively and the difference between each postoperative and baseline measurement indicates the facial swelling for that day.[10] Swelling in piezoelectric group was lesser comparatively to rotary group but statistically significant on day 3 and day 7 only ($p<0.05$). These findings are similar to other studies.[8,14,15] In contrast, another similar study found decrease in mouth opening in all postoperative period in rotary group compared to piezosurgery group.[16]

Mouth opening was evaluated by measuring interincisal opening during regular follow up period showed better results in piezosurgery group compared to rotary group. Mouth opening in piezoelectric group was comparatively more than rotary group in all post-operative days but was statistically significant on day 3 and day 7 ($p<0.05$).

There was no postoperative wound infection seen in either of the piezosurgery group and rotary group in the present study, which was similar to other reported studies.[17,18]

Overall, piezosurgery was found beneficial probably because of its optimal visibility of the surgical field, better soft tissue protection, reduced blood loss, less vibration and noise for better comfort to the patient, and protection of tooth structure. Though piezosurgery took longer duration than conventional rotary instrument, it is efficient in reducing the complications like pain, swelling and trismus. Even though we did not specifically study in details the quality of life and cost issues, it can be deduced that less postoperative complications would have improved the postoperative quality of life of patients, and this in turn may reduce the absence from work and indirect cost.

The limitation of the present study could be single center, single surgeon bias. Further study with larger sample size from multicenter for the choice of instrument either piezosurgery or rotary for bone removal during surgical removal of impacted mandibular third molar for better generalizability.

Conclusion

In present study the piezosurgery had better result compared to rotary instrument surgery group of mandibular third molar surgery in terms of surgery time, postoperative pain, swelling and trismus. We did not encounter infection in both the groups.

Author contribution

Concept design- DY; Literature search- BK, RM, LK ; Data collection- BK, RM, LK; Data analysis- BK; Draft manuscript- BK, RM; Final manuscript and accountability - all.

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Conflict of interest

None

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None

Supplementary Material

The data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

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