Original Article

Comparative Study of Piezoelectric and Rotary Osteotomy Technique for Third Molar Impaction

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Abstract

Introduction: One of the most common surgical procedures advocated by many of the oral and maxillofacial surgeons and many general dentists is extraction of impacted third molar due to insufficient anatomical space to accommodate normal eruption. The removal of these teeth is usually correlated with moderate-to-severe post-operative pain, swelling, and trismus whereas complications such as infection, dry socket, trigeminal nerve injuries, and, rarely, it may cause fracture of the mandible which is less common to occur. Due to the anatomical constraints during the osteotomy (bone removal) procedure, it is important to choose an apt surgical method and instruments. Although the conventional rotary bur technique requires short operator time than piezoelectric technique during osteotomy, it causes marginal osteonecrosis due to high temperature. Dental anxiety is an upsurge during tooth extraction due to the unpleasant notion and a longer surgical operator time which stimulates the adrenal cortex and increased secretion of cortisol. Hence, a reduced noise and vibration environment produced by the piezoelectric unit can help reduce such stress and hence be more psychologically comfortable for the patient. **Materials and Methods:** About 50 healthy adult individuals reporting to the department were taken into this study who were in need of prophylactic removal of the lower third molar impactions with ideal conditions were considered. Inclusion criterion is Healthy individuals above 20 years of age and individuals having vertical, mesioangular, and horizontal impactions based on radiographic interpretations. Exclusion criterion includes individuals with systemic diseases that could possibly interferes healing, individuals who were not willing to provide consent, those under antibiotic regime in the past 6 weeks or who require antibiotic prophylaxis before extraction, patients with acute infections at the site of impacted teeth. As soon as the individuals reported to the department, the study protocol was explained and written consent was obtained from the participants. Study participants were randomly allotted into two groups so that the surgery difficulty level will remain the same in both the groups. After obtaining adequate local anesthesia using inferior alveolar, long buccal, and lingual nerve blocks under strict aseptic conditions, surgical procedures were followed in both the groups as per the protocol. Hand piece and foot pedal were the common components of the rotary device, and it was attached to the power plug. The rotary speed used was set at the range around 35,000 rpm. Seven hundred and two and 703 rotary burs were used. **Results:** The comparison of all the study participants according to mean age. Mean age of study individuals in the piezosurgery group was 28.60 ± 2.69, which was slightly less than the mean age of the rotary group at 30.52 ± 3.15. No statistically significant difference was observed in mean age between the groups. Comparison of the study individuals based on the type of their impaction. There was no statistical difference for the type of impaction among the groups. The time taken for removal of impacted tooth using the piezoelectric device was 48.35 ± 15.39 and for rotary technique, it was 34.43 ± 11.31, which is less than for the piezoelectric device. Statistically significant difference was found for time taken for the procedure between the groups. Patient satisfaction was estimated using a grading scale. The results for satisfaction of the procedure were almost same in both the groups and were without any statistically significant difference. Mouth opening was measured in millimeters, which showed a statistically significant difference ($P < 0.01$) measured on the 3rd day, 5th day, and 7th day between the piezoelectric and rotary bur groups. Mouth opening was significantly better in the piezoelectric group as compared with the rotary bur group until the 7th post-operative day. **Conclusion:** The piezosurgery technique has proved to be a better alternative to rotary surgical technique in terms of its post-operative outcomes of pain, edema, and trismus in spite of the increased surgery duration in piezosurgery technique. Salivary cortisol level seems to be a reliable indicator of intraoperative stress; therefore, it is suggested that further scientific research is needed to study the nature of salivary cortisol response in transalveolar extraction of lower third molars.

Keywords: Osteotomy, Piezoelectric, Transalveolar extraction

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Introduction

One of the most common surgical procedures advocated by many of the oral and maxillofacial surgeons and many general dentists is extraction of impacted third molar due to insufficient anatomical space to accommodate normal eruption.[1] Although, there is no widespread evidence of third-molar infection and pathology or of medical necessity to justify so much surgical removal of maxillary and mandibular third molar (wisdom tooth).[2] The removal of these teeth is usually correlated with moderate-to-severe post-operative pain, swelling, and trismus whereas complications such as infection, dry socket, trigeminal nerve injuries, and, rarely, it may cause fracture of the mandible which is less common to occur.[3]

Due to the anatomical constraints during the osteotomy (bone removal) procedure, it is important to choose an apt surgical method and instruments. Although the conventional rotary bur technique requires short operator time than piezoelectric technique during osteotomy, it causes marginal osteonecrosis due to high temperature.[4] The piezoelectric surgery (Piezotome) technique has been used to overcome the disadvantages of the conventional rotatory technique. It is performed by means of microvibration at a frequency of 28–36 KHz capable of selective hard-tissue cutting thereby reducing the chances of soft tissue and nerve injuries.[5] In addition to it, the cavitation effect of piezoelectric device improves the intraoperative visibility and a blood-free clean surgical site. Apart from osteotomy procedures, piezoelectric devices play a vital part for other surgical procedures such as autologous bone graft harvesting, orthognathic, maxillary sinus lifting, inferior alveolar nerve lateralization technique, and neurologic surgeries.[6]

Dental anxiety is an upsurge during tooth extraction due to the unpleasant notion and a longer surgical operator time which stimulates the adrenal cortex and increased secretion of cortisol. Hence a reduced noise and vibration environment produced by the piezoelectric unit can help reduce such stress and hence be more psychologically comfortable for the patient.[7] However, no clinical evidence to support this claim. Hence, the aim of this article is to assess and compare the surgical and post-surgical outcomes of third molar removal using piezoelectric surgery and conventional rotary bur.

Materials and Methods

This study was carried out on those patients who visited the Department of Oral and Maxillofacial Surgery.

About 50 healthy adult individuals reporting to the department were taken into this study who were in need of prophylactic removal of the lower third molar impactions with ideal conditions were considered.

Inclusion criterion is healthy individuals above 20 years of age and individuals having vertical, mesioangular, and horizontal impactions based on radiographic interpretations.

Exclusion criterion includes individuals with systemic diseases that could possibly interferes healing, individuals who were not willing to provide consent, those under antibiotic regime in the past 6 weeks or who require antibiotic prophylaxis before extraction, and patients with acute infections at the site of impacted teeth.

As soon as the individuals reported to the department, the study protocol was explained and written consent was obtained from the participants. Study participants were randomly allotted into two groups so that the surgery difficulty level will remain the same in both the groups.

- Group - I – Piezoelectric osteotomy
- Group - II – Rotary osteotomy.

After obtaining adequate local anesthesia using inferior alveolar, long buccal, and lingual nerve blocks under strict aseptic conditions, surgical procedures were followed in both the groups as per the protocol. Hand piece and foot pedal were the common components of the rotary device, and it was attached to the power plug. The rotary speed used was set at the range around 35,000 rpm. Seven hundred and two and 703 rotary burs were used.

The piezoelectric device includes a hand piece and a foot switch which was attached to the power plug. A frequency of 25–29 kHz with a microvibration of 60–200 mm/s was used with a boosted working mode. SL 1, SL 2, and SL 3 piezoelectric burs were used.

Postoperatively, all the study subjects received amoxycillin 500 mg 8 hourly and diclofenac sodium 50 mg 8 hourly for 3 days. Post-surgical instructions were given and sutures were removed on the 7th day. The parameters that were taken into account in each patient were: Time taken for the procedure, patient satisfaction for the procedure, post-operative pain and swelling, and post-operative trismus.

Time required for the procedure has been calculated from the starting point of bone guttering until the tooth elevation from 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 1 week with reference to the predefined values on visual analog scale. Trismus was evaluated on days 3, 5, and 7 of the post-operative periods 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.

Results

Table 1 shows the comparison of all the study participants according to mean age. Mean age of study individuals in the piezosurgery group was 28.60 ± 2.69, which was slightly less than the mean age of the rotary group at 30.52 ± 3.15. No statistically significant difference was observed in mean age

between the groups. Table 2 shows comparison of the study individuals based on the type of their impaction. There was no statistical difference for the type of impaction among the groups. The time taken for removal of impacted tooth using the piezoelectric device was 48.35 ± 15.39 and for rotary technique, it was 34.43 ± 11.31, which is less than for the piezoelectric device. Statistically significant difference was found for time taken for the procedure between the groups and is tabulated in Table 3.

Patient satisfaction was estimated using a grading scale. The results for satisfaction of the procedure were almost same in both the groups and were without any statistically significant difference (Table 4).

Mouth opening was measured in millimeters, which showed a statistically significant difference ($P < 0.01$) measured on the 3rd day, 5th day, and 7th day between the piezoelectric and rotary bur groups. Mouth opening was significantly better in the piezoelectric group as compared with the rotary bur group until the 7th post-operative day (Table 5).

Discussion

The most important aspect in the removal of impacted third molar is to maintain the integrity of the adjacent tooth. The surgical methods might create a root exposure and pulpal necrosis.[8] Many studies show that after removal of the mandibular third molar, there will be an injury to the distal aspect of the second molar and it is still be considered as a successful treatment.[9-11]

Table 1: Comparison of mean age among the study groups

Groups	n	Mean	Standard deviation	*T*-value	*P*-value
Piezoelectric	25	28.60	2.85	1.569	0.135
Rotary	25	30.52	3.25		

P>0.05, NS: Non-significant

Table 2: Type of impaction

Type of impaction	Piezoelectric	Rotary	*P*-value
Vertical	10	15	0.732
Mesioangular	9	9	
Horizontal	3	6	

P>0.05, NS: Non-significant

Table 3: Comparison of time taken for the procedure

Groups	Mean	Standard deviation	*T*–value	*P*–value
Piezoelectric	48.35	15.42	2.823	0.009
Rotary	34.43	11.45		

P<0.05, S: Significant

Recently, piezosurgery has been devised to perform safe, precise, and meticulous surgeries.[12] To standardize our results, it was conducted on 50 male individuals having their age ranging from 25 to 33 years, to remove the gender criteria which may play a role in post-operative complications due to hormonal changes that can usually occur in females. There was no dropout from the selected sample and this may be attributed to the well-educated level of the selected individuals and their commitment toward their treatment. Furthermore, the availability of social media makes the follow-up communication with the individuals easier. The duration of the procedure in each site was calculated in terms of minutes starting from the establishment of the flap until the end of suturing. The piezosurgery took a longer time when compared with the control site. This is in favor to the research conducted by Goyal *et al*.[13]

Stacchi *et al.* found a limited decrease of implant stability quotient values when piezoelectric method was used. This showed that increased stability patterns attained when compared with traditional drilling techniques. Not only does the piezoelectric method improve short-term wound healing, various other studies have also proved that it provides the benefit of significantly reduced pain following mastoidectomy. These results, in combination with ours, highlight the important benefits of piezoelectric devices as safe and minimally invasive tools.[10,14]

Compared with third molar surgery using rotary techniques, piezosurgery was more time consuming due to its slow micrometric cutting action. Surgery time using the ultrasonic osteotomy tended to be shorter as the surgeons gained more experience.[15] Even though the piezoelectric technique is

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

Patient satisfaction grade	Piezoelectric (*n*=25)	Rotary (*n*=25)	*P*-value
Very unsatisfied	10 (40%)	12 (48%)	0.463
Fairly satisfied	10 (40%)	8 (32%)	
Fairly unsatisfied	5 (20%)	5 (20%)	
Very unsatisfied	0	0	

P>0.05, NS: Non-significant

Table 5: Comparison of mean score mouth opening for procedure in the two groups

Duration	Groups	Mean	Standard Deviation	*T*-value	*P*-value
Pre-operative	Piezoelectric	35.55	1.66	0.925	0.373
	Rotary	35.01	1.98		
Day - 3	Piezoelectric	32.92	1.43	6.723	<0.001
	Rotary	29.12	1.82		
Day - 5	Piezoelectric	33.72	1.72	8.801	<0.001
	Rotary	29.23	1.22		
Day - 7	Piezoelectric	34.73	1.32	4.693	<0.001
	Rotary	32.64	1.03		

P>0.05, HS: Highly significant; NS: Non-significant

associated with longer surgery time, we believe that with increased experience and the improvement of the technique, piezosurgery will show reduced surgery time.

In the present study, the pain score was recorded, and it was significantly lesser in the piezoelectric surgery site than while using the rotary instrument. This finding is in concordance to the results obtained by Goyal *et al.*,[13] Mantovani *et al.*,[16] and Piersanti *et al*.[12] They all reported in their studies that a significant difference in pain score using the same scale and all agreed that the site where the impacted mandibular third molar resides, using piezosurgery has less post-operative pain when compared to the standard surgical technique. These results run along the same line of the findings of a meta-analysis study conducted by Jiang *et al.*[1] where seven studies were included in their analysis. The main principle of the study was to make a comparison between piezosurgery and rotary osteotomy techniques. Their meta-analysis shows that although individuals experienced a longer time in piezosurgery, they had less post-operative swelling. In addition, it is a better alternative technique for removal of impacted mandibular molar.

Conclusion

The piezosurgery technique has proved to be a better alternative to rotary surgical technique in terms of its post-operative outcomes of pain, edema, and trismus in spite of the increased surgery duration in piezosurgery technique. Salivary cortisol level seems to be a reliable indicator of intraoperative stress; therefore, it is suggested that further scientific research is needed to study the nature of salivary cortisol response in transalveolar extraction of lower third molars.

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