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Original Research Article

Surgical outcome after impacted mandibular third molar surgery using piezotome and conventional rotary handpiece: a comparative study

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ABSTRACT

Background: This study was performed to compare the surgical outcome in impacted mandibular third molar surgery using piezotome and conventional rotary handpiece.
Methods: Total 40 patients were selected with similar Pederson Index for mandibular third molar surgery with either piezosurgical unit or conventional rotary handpiece. Pain, trismus, oedema and alveolar osteitis were evaluated preoperatively and then postoperatively 1st, 3rd, and 7th day.
Results: Statistical analysis showed that the average time needed to complete the osteotomy and extraction was significantly lesser for the rotary group than for the piezo group ($p<0.05$). The average duration of surgery was 18.16 minutes in group A, and 20.49 minutes in group B.
Conclusions: Significantly lesser pain, trismus, facial swelling, alveolar osteitis and a better perception of the quality of life by the patients after third molar extraction was found using the Piezotome.

Keywords: Bilateral impaction, Piezotome, Rotary handpiece

INTRODUCTION

The removal of impacted teeth is one of the most commonly performed surgical procedures by oral and maxillofacial surgeons all over the world. Impacted teeth are present in approximately 20% of the population, where mandibular third molars are most common. It has been well documented that impacted third molars, either partial or complete, are associated with several complications including pericoronitis, regional pain, trismus, distal caries, cysts, tumors and arch crowding. Depending on the complexity of the procedure, response of the patient on postoperative pain, swelling, trismus, nerve injury, bleeding, paresthesia, and dry socket varies. The most critical and important step in third molar extraction is bone cutting or osteotomy.[1]

Osteotomy can be performed by either chisel-mallet, conventional rotary bur or piezotome in which piezoelectric ultrasonic vibration is applied for bone cutting. Traditionally, impacted third molars are often removed using rotary osteotomy techniques. However, conventional rotary cutting instruments are potentially injurious because they can generate excessive high temperatures during bone drilling, which leads to marginal osteonecrosis, and can impair osseous regeneration and healing.[1] Piezosurgery is a new osteotomy technique that has been introduced as an

alternative to overcome the drawbacks related with the conventional rotating-handpiece. It is performed by means of a device that uses micro-vibration at a frequency capable of cutting bone. Its mechanism of action is based on the ability of certain ceramics and crystals to deform when an electric current is passed across them, resulting in micro-vibration at ultrasonic frequency. The main advantages of piezoelectric surgery are the precise cutting of hard tissue and protection of the soft tissue, including nerves and blood vessels, less vibration and noise, and a better view of the operative field. It has been effectively utilized for many oral and maxillofacial procedures, such as sinus lifting, harvesting of autologous bone graft, bone splinting, lateralization of the inferior alveolar nerve, and orthognathic surgeries. It also has its advantages in periodontology, endodontics, ENT and orthopedic surgeries but the system is not very effective for deeper cuts. Therefore, this study was conducted to compare the surgical outcome of third molar surgery using conventional rotary handpiece and piezotome in third molar surgery. Also, to assess the usefulness of piezotome in mandibular third molar surgery by comparing the time taken for surgical extraction of third molar using a conventional handpiece and piezotome. Additionally, to compare overall surgical outcomes such as postoperative pain, edema, trismus and incidence of alveolar osteitis following mandibular third molar surgery using conventional rotary technique and piezotome.

METHODS

This was a comparative, cross-sectional, split-mouth study conducted on 40 patients who reported to the Department of Oral and Maxillofacial Surgery of Swami Devi Dyal Hospital and Dental College, Barwala, Panchkula for the surgical extraction of impacted third molar.

The angulation, depth, ramus relationship, root morphology were assessed. A total of 40 patients with similar Pederson difficulty index for bilateral mandibular impacted third molar were selected for the study. After obtaining written informed consent, patients were scheduled for bilateral mandibular third molar surgery in two sessions, with 1 month interval in between. For the purpose of data collection, patients having bilateral impacted teeth were randomly divided as Side A comprising patients for piezotome and Side B comprising of patients for rotary bur technique.

Inclusion criteria

Patients requiring surgical removal of bilateral impacted third molars with appropriate indications for the same, patients with intraosseous impaction having similar Pederson difficulty index for bilaterally impacted third molars, patients in good physical health with no clinically significant and relevant medical history, patients understanding and willing to follow all study procedures were included.

Exclusion criteria

Patients unable or unwilling to sign the informed consent form, patients with a history of allergy to the drug given during the course of the treatment, immunocompromised individuals including those with severe debilitating diseases, patients having a past history of deep vein thrombosis or current use of anticoagulants, pregnant, lactating, or female participants taking oral contraceptives were excluded.

All subjects were informed about the nature of the study and the probable side effects from the drugs being administered. A written informed consent was obtained from all the patients. All procedures performed in this study were in accordance with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Procedure

Pre-operative preparation of patient

A detailed medical and dental history and intraoral periapical radiographs/Orthopantomogram (Figure 1) of the surgical site were taken. Preoperative antibiotic prophylaxis was given. Patient was asked to rinse with 0.2% chlorhexidine gluconate mouthwash 30 minutes prior to procedure. Patient's extra oral skin preparation was done using 5% Betadine solution. Patient was draped subsequently with sterile drapes. Local anesthesia was obtained using 2% lignocaine hydrochloride with 1:80000 adrenaline.

Surgical technique

After administering local anesthesia, a modified ward's incision was made. A mucoperiosteal flap was raised using periosteal elevator to expose the tooth and surrounding bone. Bone guttering and tooth sectioning was done using rotary bur or piezotome as planned.

For side A, piezotome was used for bone cutting (Figure 2) on the buccal and distal aspect depending on the nature of the impaction. Tooth sectioning was done if required. US1L and US1R inserts of piezoelectric device were used. The vibration frequency was maintained between 24 and 36 kHz. For side B, a conventional rotary handpiece at 35,000 rpm, a No. 8 round bur in straight handpiece was used for bone guttering (Figure 3) under copious saline irrigation. Sectioning of the tooth was done using a S-No. 8 Round, #301, 302 fissure bur when needed. After removal of the tooth, the extraction socket was debrided and irrigated using a combination of povidone-iodine and normal saline. Extraction socket was checked for any sharp edges. Sharp margins were trimmed using bone rongeur and bone file. Socket was

irrigated again and suturing was done with 3-0 silk suture. Pressure pack was given intraorally.

Post-operative care

Patients were given standard post-operative instructions and were prescribed analgesics and antibiotics for five days. Patient were recalled thereafter according to the study protocol and parameters were recorded. Patients were advised to take a soft diet for one week after surgery. The patients were followed up for one month with recall visit at 1st, 3rd and 7th day.

Statistical analysis

Data was analyzed using the statistical package SPSS 22.0 (SPSS Inc., Chicago, IL) and level of significance was set at p<0.05. Descriptive statistics was performed to assess the mean and standard deviation of the respective groups. Normality of the data was assessed using Shapiro Wilkinson test. Inferential statistics to find out the difference between and within the groups was done using Student T Test and One Way ANOVA and Tukeys Post Hoc Test. Chi Square Test was used to assess the difference in proportion.

RESULTS

The present study comprised of 40 patients, distributed equally into groups A (side A in which peizotome was used) and group B (side B in which rotary handpiece was used). The mean age was calculated to be 28.53±5.67 and 30.93±6.54 years (Graph 1a and Graph 1b) respectively. Table 1 shows the comparison of duration of surgery between the two groups. The average time of surgery was significantly lower in the bur than piezosurgery group (p<0.05). The average duration of surgery was 18.16 minutes in group A (bur), and 20.49 minutes in group B (piezosurgery) (p<0.05).

Table 1: Comparison of duration of surgery between the study groups.

	Mean±SD	P value
Group A	18.74 minutes (±5.69)	0.11*
Group B	20.16 minutes (±7.11)	

*p<0.05 is statistically significant (CHI SQUARE TEST).

Table 2, shows the comparison of pain, swelling (Table 3) and mouth opening (Table 4) between the study groups, respectively. Both Group A and Group B showed significant difference in pain (p=0.0001*), swelling (p=0.075*) and mouth opening (p=0.0001*) scores at all paired intervals (p<0.05) except 24hrs vs 72hrs (p>0.05). Percentage wise difference in pain (93.6 % vs 89.3%), swelling (0.1% vs 0.4%) and mouth opening (0.9% vs 3.5%) scores which was found to be more reported in Group A compared to Group B, respectively.

Table 2: Comparison of pain between the study groups.

		Group A	Group B	T Test	P Value
24 hr		3.45±0.71	4.85±0.82	8.163	0.0001*
72 hrs		3.27±0.87	4.85±1.05	7.32	0.0001*
7 days		1.4±0.54	2.47±0.98	6.04	0.0001*
ANOVA test (f value)		222.55	223.12		
P value		0.0001*	0.0001*		
Tukey's HSD post hoc test	24 Hrs VS 72 Hrs	0.612	1		
	24 Hrs VS 7 days	0.0001*	0.0001*		
	72 Hrs VS 7 days	0.0001*	0.0001*		
Change from the baseline		93.6%	89.3%		

*p<0.05 is statistically significant (One Way ANOVA test/T test).

Table 3: Comparison of swelling between the study groups.

		Group A	Group B	T test	P value
Pre OP		14.24±1.42	14.21±1.42	0.05	0.98
24 hr		14.65±1.45	14.7±1.44	0.15	0.87
72 hrs		14.56±1.44	14.82±1.44	0.83	0.40
7 days		14.41±1.44	14.51±1.43	0.31	0.75
ANOVA test (f value)		0.665	1.402		
P value		0.616	0.234		
Tukey's HSD post HOC test	Pre OP VS 24 hrs	0.685	0.521		
	Pre OP VS 72 hrs	0.844	0.295		
	Pre OP VS 7 days	0.981	0.873		
	24 hrs VS 72 hrs	0.998	0.995		
	24 hrs VS 7 days	0.939	0.973		

Continued.

		Group A	Group B	T test	P value
	72 hrs VS 7 days	0.989	0.859		
Change from baseline		0.1%	0.4%		

*p<0.05 is statistically significant (One Way ANOVA test/T test).

Table 4: Comparison of mouth opening between the study groups.

		Group A	Group B	T Test	P Value
Pre OP		41.82±2.85	41.82±2.85	0.01	1
24 hr		35.37±2.02	32.67±2.28	5.71	0.0001*
72 hrs		37.1±2.36	33.2±2.87	6.80	0.0001*
7 days		39.75±2.80	37.37±2.57	4.01	0.0001*
ANOVA test (F value)		44.514	101.82		
P value		0.0001*	0.0001*		
Tukey's HSD POST HOC test	PRE OP VS 24HRS	0.0001*	0.0001*		
	PRE OP VS 72 HRS	0.0001*	0.0001*		
	PRE OP VS 7 days	0.005*	0.0001*		
	24 HRS VS 72 HRS	0.030	0.890		
	24 HRS VS 7 days	0.0001*	0.0001*		
	72 HRS VS 7 days	0.0001*	0.0001*		
Change from the baseline		0.9%	3.5%		

*p<0.05 is statistically significant (One Way ANOVA test/T test).

Table 5: Comparison of alveolar osteitis between the study groups.

	Group A	Group B	Chi Square test	P value
Present	1 (2.5%)	5 (12.5%)	6.79	0.009*
Absent	39 (97.5%)	35 (87.5%)		

*p<0.05 is statistically significant (chi square test).

Table 5 shows comparison of number of alveolar osteitis cases among the groups. Both Group A and Group B showed significant difference (p=0.009*) in number of alveolar osteitis cases with lesser cases reported in Group A (p<0.05).

DISCUSSION

The adverse effects of third molar surgery on quality of life have been reported to show a threefold increase in patients who experience pain, swelling, and trismus alone or combined compared with asymptomatic patients. Regardless of the degree of difficulty, success depends primarily on correct preoperative planning, and on the careful execution that comes with extensive training and experience. Piezosurgery is a new osteotomy technique that is performed to make precise and safe osteotomies.

Peizosurgery is a new innovative technique which works on the principle of oscillation and is very helpful in performing osteotomy of mineralized tissue as it provides clean, sharp cuts of the bone. It also helps in preserving the integrity of soft tissues as its surgical action ceases with the nonmineralized tissues.

In our study, to find out the efficiency of piezosurgery over micromotor in third molar odontectomies, we evaluated three variables postoperatively, that is, pain, trismus, and swelling, and a fourth variable was the time taken to complete the entire surgical procedure.

Statistical analysis using ANOVA test within the group showed significant difference in the duration of surgery between the two groups (Table 1). Reduced duration of surgery was recorded in group B when compared to group A (p<0.05). This result is in accordance with a study conducted by Rullo et al in 2013 which concluded that the time needed to complete osteotomy and extraction was significantly greater for the piezosurgery group.[2] Statistical analysis using ANOVA test within the group showed significant difference in the pain score (Table 2), swelling (Table 3) and mouth opening (Table 4)) in which Group A showed better results than Group B (p<0.05). The results of the present study are in accordance with Srivastava et al in 2018 which concluded that operating time with peizotome was more than that of conventional rotary technique, but the postoperative responses such as pain, trismus and edema were less in peizotome.[1] Both Group A and Group B showed significant difference (p<0.05) in number of alveolar osteitis cases (Table 5). Similar results were shown in a study conducted by Arakji et al in 2016 which stated that peizotome enhances the bone quality within the extraction socket and bone quantity along the distal aspect of the mandibular second molar.[3] However, the results of our study are not in accordance with the study conducted by Sivolella et al in 2011 which revealed no

statistically significant differences between the 2 methods for postoperative pain, mouth opening and edema.[4] Sivolella et al further suggested that the non-traumatic nature of piezosurgery was apparent from the adjacent soft tissues, and the follicular sac was always intact at the end of the piezosurgical osteotomy.[4]

The extraction of an impacted lower third molar invariably causes some degree of pain, swelling, and trismus.[5,6] It thus seems reasonable to suppose that the severity of postoperative symptoms should be related to the aggressiveness of the surgery. During the procedures, evidence was seen of overheating caused during osteotomy that was sometimes a cause of discomfort for the operator and necessitated particular attention on the part of the surgical team to prevent any accidental contact between the handpiece and the patient's mouth.

Limitations of the present study includes smaller sample size, did not compare paresthesia and intraoperative bleeding. The present study considered the mean value to statistically analyze the time taken for all the procedures, no attempt was made to analyze the time taken according to the difficulty of extraction. Hence there is need for further studies with larger sample size to compare the surgical outcome of third molar surgery using conventional rotary handpiece and piezotome in third molar surgery.

CONCLUSION

Osteotomy using the piezoelectric surgical ablator makes mandibular third molar surgery significantly longer to complete than using conventional rotatory instruments. The results of the present study showed a slight improvement in the postoperative parameters of pain, swelling, trismus and lesser alveolar osteitis by the patients after third molar extraction using the piezotome. Our results suggests that apart from some inherent limitations with the piezotome, it is a valuable alternative for extraction of third molars.

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