

ORIGINAL RESEARCH

A prospective comparative study of two techniques: Conventional surgery and piezosurgery for jaw cyst enucleation

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ABSTRACT

Aim: Comparative evaluation to assess and compare the surgical efficacy of ultrasonic surgery with conventional techniques in jaw cyst enucleation, to assess any complication associated with the use of piezosurgery and conventional surgical technique, to assess the bone healing and bone density using CBCT and to assess any postoperative complications.

Materials and method: This study was conducted on 20 patients diagnosed with maxillary and/or mandibular cysts, aged between 15 and 65 years. Patients were randomly divided into two groups of 10 each. Group-A (n-10) Patients underwent cyst enucleation with piezosurgery, Group-B (n-10) Patients underwent enucleation by the conventional surgical technique.

Results: Data was entered in Microsoft excel and Student T test and Chi-square test was analyzed by using statistical analysis software Graph pad Prism (Version 5), 80% of the patients were aged between 15 years and 30 years, 50% were male and 50% were female. Patients who were operated using a piezosurgery unit showed less post-operative pain reduced post-operative swelling and reduced trismus. However bone cutting was significantly faster in conventional surgery.

Conclusion: To conclude there are certain pros and cons in using Piezo electric unit for the management of cysts of oral and maxillofacial region. From our study using we could derive the following advantages of using a piezo unit, less post operation pain, trismus and swelling, thereby, enabling a faster recovery of the patient, however the prominent drawback of using a piezo is the prolonged time spent on bone cutting thereby prolonging the duration of the surgery, the piezo tips are only effective in bone cutting and cannot be used in soft tissue procedures and lastly the piezo unit is expensive and can hamper its widespread use.

Key words: Piezosurgery, conventional surgical, mandibular & maxillary cyst, enucleation

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INTRODUCTION

Cystic lesions are the most common clinical presentation involved the oral and maxillofacial region.¹ A cyst is a pathological cavity in the bone or soft tissue with an outer wall of connective tissue and inner wall composed of epithelium.² Cystic lesions may be epithelial or non-epithelial, odontogenic or non odontogenic, developmental or inflammatory in origin.³ The cystic lesions are the major factor causing jaw destructions and are quite common in the practice of oral and maxillofacial surgeon.⁴ Cysts located in the jaws are one of the most frequently observed pathologic findings in the oral region.⁵ The most common forms of cysts are inflammatory radicular and residual cysts.⁶

Treatment of cysts present in jaws depends on patient age, cyst dimensions, and proximity of the cyst to critical anatomic structures and usually involves enucleation or marsupialization. Because odontogenic cysts develop intraosseously, they may remain undetected until they reach massive sizes. Moreover, inflammatory cysts may not be recognized by a patient until suppuration occurs and pain arises following necrosis of the related tooth. Once the cyst epithelium has destroyed the vestibule compact bone, the patient may become aware of the cyst as related swelling becomes visible in the oral cavity.

The main principle in treating cysts is to completely remove the cystic epithelium and all its contents without damaging its integrity. Depending on the type

of cyst, additional procedures such as apicoectomy or extraction of teeth associated with the cyst epithelium may be required. Cyst epithelium usually extends to the interdental septa of adjacent teeth. In these areas, the cyst epithelium becomes thinner, making it difficult to fully enucleate the cyst without leaving any content behind. Enucleation may also be made more difficult and time-consuming as a result of manipulation problems and the need to protect nearby anatomic structures.⁷

The surgical treatment of jaw cysts may include one of the following four basic methods: enucleation, marsupialization, staged combination of marsupialization and enucleation, or enucleation with curettage. Enucleation of the lesions and primary closure of the defects called-“cystectomy” has evolved as the treatment of choice. The conventional treatment of odontogenic cysts usually involves enucleation of the cyst using rotary and manual instruments, such procedures can cause trauma to the cystic epithelium or soft tissues in the region, such as sinus membrane perforation or nerve damage.⁸

Ultrasonic surgery has recently emerged as a potentially safer alternative approach to using the mechanical instruments and motor-driven devices traditionally used in bone-related procedures in oral and maxillofacial surgery. The use of ultrasonic surgery may reduce the risk of damage to soft tissues.⁹ Ultrasonics are branch of acoustics concerned with sound vibrations in frequency ranges above audible level that is greater than about 20 KHz.¹⁰

MATERIALS & METHODS

STUDY DESIGN

This study was conducted on 20 patients and their ages ranged between 15 and 65 years. The diagnosis was based on clinical and radiographic examinations. All patients were treated in the Oral and Maxillofacial

Surgery Department of BIDS, Patna this study was approved by the institutional review board, and an informed consent was obtained from all patients before their inclusion in the study. Patient with cystic lesions in maxillofacial region reported to the OPD of Department of Oral & Maxillofacial Surgery of Buddha Institute of Dental Sciences & Hospital.

This study was conducted on 20 patients with clinical and radiological evidence of the cystic lesion/radiolucencies in maxilla- mandibular region. Patient were categorized into two groups.

- Group-A (n-10) Patients in which cyst enucleation was done using piezosurgery.
- Group-B (n-10) Patients in which cyst enucleation was done using the conventional surgical technique.

POSTOPERATIVE PROCEDURE

All patients were advised to apply cold packs extra orally intermittently and avoid hot food on the 1st day. Antibiotics were prescribed to all patients in the form of Amoxicillin and Clavulanate potassium twice a day for five days post-operatively and non-steroidal anti-inflammatory drug in the form of Ibuprofen three times daily after meals for four days and chlorhexidine gluconate solution as a mouth rinse for a period of five days.

FOLLOW-UP PHASE

Pain, trismus and swelling were evaluated on 3rd day, 8th day, 1 month, 3 month and 6 month postoperatively. Postoperative pain was assessed using a visual analogue scale (VAS).¹¹ Trismus was evaluated by measuring the maximum inter incisal distance between the incisal edge of the upper and lower central incisors using a scale at maximum mouth opening (cm).



Fig 1: Measurement of swelling



Fig 2 Measurement of swelling

Group (A) Piezosurgery



Fig 3: Intraoral preoperative of cyst with Piezosurgery

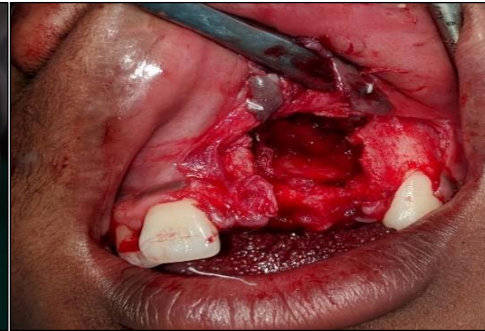


Fig 4: Intraoperative enucleation



Fig 5: Suturing after enucleation of cyst with piezosurgery



Fig 6: Intraoral Postoperative

Group (B) Conventional surgery



Fig 7: Intraoral Preoperative



Fig 8: Intraoperative conventional surgical enucleation of cyst



Fig 9: Suturing after enucleation of cyst



Fig 10: Intraoral Postoperative

RESULTS

Patients were randomly divided into 2 equals groups of 10 patients each. Group A patients in which cyst enucleation was done using piezosurgery. Group B patients in which cyst enucleation was done using the conventional surgical technique.

STATISTICAL ANALYSIS: Data was entered in Microsoft excel and Student T test and Chi-square test was analyzed by using statistical analysis software Graph pad Prism (Version 5). The categorical data were presented as percentage and numerical data as Mean±SD. 'p' value of less than 0.05 was accepted as indicating significance.

Table 1: Demographic details

		Cyst	
		Conventional	Piezo surgery
Gender	Male	5 (50%)	5 (50%)
	Female	5 (50%)	5 (50%)
Age (Years)	Min	18	15
	Max	49	55
Mean Age		25.30±11.96	27.50±10.34

Table 2: Preoperative clinical examination of Group I and Group II patients with respect to Pain, Mouth opening, Swelling

Preoperative	Conventional	Piezo surgery	P value
Pain	1.50±1.08	2.60±0.97	0.0274
Mouth opening	40.00±7.07	44.00±6.99	0.2196
Swelling	12.40±1.35	12.85±1.74	0.525

Table 3: Preoperative clinical examination of Group I and Group II patients with respect to Paresthesia, Pus discharge

Preoperative		Conventional	Piezo surgery	P value
Paresthesia	Present	0 (0.00%)	0 (0.00%)	NA
	Absent	10 (100%)	10 (100%)	
Pus discharge	Present	3 (30%)	7 (70.00%)	0.0736
	Absent	7 (70.00%)	3 (30%)	

Table 4: Comparison among both the group with respect to paresthesia at 3rd day, 8th day, 1 month, 3 month, 6 month

Post-Operative	Paresthesia				
	3rd day	8th day	1 month	3 month	6 month
Conventional	4 (40%)	4 (40%)	1 (10%)	0 (0%)	0 (0%)
Piezo surgery	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
P value	0.0867	0.0867	1	NA	NA

Table 5: Comparison among both the group with respect to pus discharge at 3rd day, 8th day, 1 month, 3 month, 6 month

Post-Operative	Pus discharge				
	3rd day	8th day	1 month	3 month	6 month
Conventional	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Piezo surgery	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
P value	NA	NA	NA	NA	NA

Table 6: Comparison among both the group with respect to incision, bone cutting, enucleation, suturing time

Intraoperative	Conventional	Piezo surgery	P value
Incision (min)	7.60±3.27	13.50±2.42	0.0002
Bone cutting (min)	13.00±2.58	23.40±5.78	<0.0001
Enucleation (min)	11.50±3.38	16.50±4.12	0.0082
Suturing time (min)	13.50±2.42	14.00±2.11	0.6278

Table 7: Comparison among both the group with respect to wound dehiscence at 3rd day, 8th day, 1st month, 3rd month, 6th month

Post-Operative	Wound Dehiscence				
	3rd day	8th day	1 month	3 month	6 month
Conventional	1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Piezo surgery	1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
P value	1	NA	NA	NA	NA

DISCUSSION

A cyst is a pathological cavity in the bone or soft tissue with an outer wall of connective tissue and inner wall composed of epithelium. Cystic lesions may be epithelial or non-epithelial, odontogenic or non odontogenic, developmental or inflammatory in origin.

The main principle in treating cysts is to completely remove the cystic epithelium and all its contents without damaging its integrity. Depending on the type of cyst, additional procedures such as apicoectomy or extraction of teeth associated with the cyst epithelium may be required. Cyst epithelium usually extends to the interdental septa of adjacent teeth. In these areas, the cyst epithelium becomes thinner, making it difficult to fully enucleate the cyst without leaving any content behind. Enucleation may also be made more difficult and time-consuming as a result of manipulation problems and the need to protect nearby anatomic structures.

The conventional treatment of odontogenic cysts usually involves enucleation of the cyst using rotary and manual instruments, such procedures can cause trauma to the cystic epithelium or soft tissues in the region, such as sinus membrane perforation or nerve damage.

Ultrasonic surgery has recently emerged as a potentially safer alternative approach to using the mechanical instruments and motor-driven devices traditionally used in bone-related procedures in oral and maxillofacial surgery. The use of ultrasonic surgery may reduce the risk of damage to soft tissues. Ultrasonics are branch of acoustics concerned with sound vibrations in frequency ranges above audible level that is greater than about 20 KHz.

Piezosurgery is a novel technique that has been introduced as a viable alternative to overcome the disadvantages associated with the conventional rotating bone cutting instruments.

Piezosurgery is based on the piezoelectric effect, first described by Jean and Marie Curie in 1880, who stated that certain ceramics and crystals deform when an electric current is passed across them, resulting in oscillations of ultrasonic frequency.

Piezosurgery is a promising, meticulous, and soft tissue sparing system for bone cutting based on ultrasonic microvibrations.

AGE & GENDER

In the present study the mean age of patients was 27.50 + 10.34 in piezosurgery and 25.30 +11.96 in conventional surgical technique which is in

accordance with study conducted by Z.YAMAN *et al.* (2013). In the present study there was 50% male and 50% female in both the groups. The majority were in third decade.

PAIN

The result of this study revealed 3rd day, 8th day & 1 month postoperativemean pain valuecomparable in both the groups. On 3rd postoperative day the mean pain value was insignificantly higher in the conventional group (conventional – 2.7 + 0.82; piezo surgery – 2.4 + 0.7). On 8th postoperative day mean pain value was comparable in both the groups (conventional – 1.8 + 0.63; piezo surgery – 1.7 + 0.95). However on 1 postoperative month the mean pain value was insignificantly higher in the conventional group (p value= 0.1373).

On subsequent follow up visits the mean pain value gradually subsides to nil in both the groups.

This is in agreement with the study of YASMINE A. IBRAHIM (2016) where Piezo group, Pain index recorded had its highest mean of 3.43±0.98 on the 1st postoperative day, on the 2nd postoperative day it decreased with mean of 2.14±1.07 and on the 1st postoperative week the pain subsided completely. In Conventional group, on the 1st postoperative day the visual analogue scale recorded its highest mean of 7.71±0.95, on the 2nd postoperative day it decreased with mean of 5.86±1.46 and on the 1st postoperative week it decreased with mean of 2 ± 1.41.

QIAN JIANG (2015) meta-analysis indicated that there was no statistically significant difference in pain between the piezosurgery group and the rotary group on any of the postoperative days. However, in the first few days after surgery, there was a trend of less pain in the piezosurgery group than in the rotator group; the difference was nominal, but not statistically significant (day 1: Standardized mean difference-0.61, 95% Confidence interval -1.29 to 0.07, P¼0.078; day 3: Standardized mean differenced -0.85, 95% Confidence interval-1.71 to 0.006, P¼0.052). The difference between the groups was not statistically significant. The level of pain felt by the patients was higher in the rotary group when compared with the ultrasonic group;(rotary group- 1st day 5.3+1.5,3rdday 4.1+1.9,5thday 3.5 +1.0, 7thday 1.7+1.1 P > .05 ; ultrasonic group- 1stday 5.1+1.4,3rdday 3.8 + 1.8, 5thday 3.8+1.1, 7th day 1.6 + 0.7 P >.05) however, the statistical comparison showed no significant differences between the two groups.

SWELLING

In the present study the swelling was the swelling percentage on 3rd postoperative day was insignificantly higher in conventional group ($p > 0.05$). However, on 8th postoperative day the mean percentage swelling value was non significantly in both the groups.

The results were accordance with study conducted by SABRINA PAPPALARDO *et al.* (2014) The facial edema of the patient undergoing surgery with rotating instruments had swelling value 24 h + 1 h post-surgery of 46 mm, at 48 h +1 h of 51 mm, at 72 h +1 h of 48 mm and after one week of 17 mm. The facial edema of the patients face undergoing piezo surgery resulted in a swelling at 24 h +1 h post-surgery of 18 mm, 48 h +1 h of 18 mm, 72 h +1 h of 13 mm and after one week of 11 mm, with a significant ($p < 0.05$) reduction of swelling compared to the procedure with rotary instruments. QIAN JIANG *et al.* (2015) meta-analysis indicated that patients in the piezosurgery group had significantly reduced facial swelling than those in the rotary group on all postoperative days (all $P_s < 0.023$).

MOUTH OPENING (INTER INCISIAL DISTANCE)

In present study on 3rd post-operative day the mean mouth opening value was non-significant in both the groups (P value 0.6813). On further postoperative follow up visits the mean mouth opening value was comparable in both the groups & non-significant. At 6th month follow up mean mouth opening value was: conventional group – 42 ± 4.22 ; piezo surgery group – 43.5 ± 7.09 and was satisfactory in both the groups.

The results were accordance with studies conducted by QIAN JIANG *et al.* (2015) their meta-analysis did not indicate a significant difference in mouth opening between the piezo surgery group and the rotary group on any of the postoperative days. ANTONIA BARONE *et al.* (2010) compared. The interincisal distance and found that it was significantly reduced for both groups after surgery: the comparison between the rotary group and the ultrasonic group showed significantly higher values for the ultrasonic group at the first-, third-, and seventh-day (rotary group- 20.5 ± 3.3 , 19.3 ± 3.9 , 35.6 ± 4.5 ; ultrasonic group- 24.8 ± 4.5 , 23.3 ± 5.3 , 38.5 ± 3.7 ; $P < .05$). At the fifth-day visit, the degree of mouth opening was greater in the ultrasonic group than in the rotary group, (ultrasonic group- 36.2 ± 3.7 ; rotary group- 34.0 ± 4.1 ; $P > .05$) even though a level of significant difference was not reached.

PARESTHESIA

In present study preoperatively the parasthesia was absent in both the groups. However, after 8th post-operative visit four patients in conventional group reported parasthesia which was insignificant on comparing both the groups (P value -0.0867). This study was in accordance with other studies conducted

by PRITIKA SRIVASTAVA *et al.* (2019). SABRINA PAPPALARDO *et al.* (2013) reported 2 of 40 patients in the rotary group with the presence of paresthesia while nothing was observed on the piezo group.

INTRAOPERATIVE INCISION, BONE CUTTING, ENUCLEATION, SUTURING

In present study we observed that incision, bone cutting and enucleation during conventional method took significantly less time than piezo surgery group (conventional group- incision - 7.60 ± 3.27 min, bone cutting - 13.00 ± 2.58 min, enucleation- 11.50 ± 3.38 min; piezo surgery group- incision- 13.50 ± 2.42 min, bone cutting- 23.40 ± 5.78 min, enucleation- 16.50 ± 4.12 min) showing a statistically significant difference respectively ($P = 0.0002$, $P < 0.0001$, $P = 0.0082$). Where as we observed non-significant difference in suturing time between conventional and piezo surgery group. This study accordance with other studies conducted by Z. YAMAN *et al.* (2013) Operation times were extremely variable, ranging from 26 to 143 min (mean 51.0 ± 27.9 min) in the ultrasonic surgery group and from 23 to 72 min (mean 36.0 ± 15.3 min) in the conventional surgery group. Operation times were significantly longer in the ultrasonic surgery group compared to the conventional surgery group ($P < 0.001$) and ($P = 0.03$). BHARAT BHATI *et al.* (2017) reported mean surgical time was longer for piezo surgery group (51.40 ± 17.9) min compared to the conventional rotatory group with a mean of (37.33 ± 15.5) min showing a statistically significant difference ($P = 0.002$). PRITIKA SRIVASTAVA *et al.* (2019) found the operating time was significantly higher in piezo surgery group than that of rotary group. The mean operating time was 48.13 min in piezo surgery group and 32.90 min in conventional group which was statistically significant ($P < 0.001$). NAIYA PATHAK *et al.* (2019) reported no statistically significant difference in the time required for bone cutting or surgery in the two groups ($p = 0.09$ and $p = 0.83$ respectively).

PUS DISCHARGE

In present study preoperatively the pus discharge was reported in three patients in conventional group and seven patients in piezo surgery group ($P 0.0736$). However, after postoperative visit pus discharge was absent in both the groups. This study accordance with other studies conducted by NAIYA PATHAK *et al.* (2019).

CONCLUSION

This study was conducted in the dept. of oral and maxillofacial surgery, BIDSH, Patna. Based on the observations by using piezosurgery, there was less postoperative pain on 3rd day as compared to conventional surgery. Similarly, there was less trismus and less postoperative swelling experienced

by the patient. The main disadvantage observed in this study is duration of bone cutting procedure is more in piezosurgery as compared to conventional surgery.

Within the limitation of this study it can be concluded that piezo surgery reduces postoperative pain, trismus, and swelling and enhances the postsurgical quality of life as per our study. In piezo surgery group patients experienced less postoperative pain, swelling and complication like trismus. The only disadvantage is the bone cutting time which was more in piezosurgery group.

Thus we can say that Piezosurgery is a new surgical technique for bone surgery with many clinical applications in dentistry. Piezosurgery is an advanced, conservative device and is effective in cyst enucleation compared to conventional procedures with burs. It provides less intraoperative complications with clear visibility of the operative field, also it reduces postoperative complications. From the present study and based on a retrospective evaluation it can be concluded that: piezosurgery enhances and accelerates bone healing because of its precise and selective action without heat generation. It was atraumatic and safer to use in the area of vicinity of maxillary sinus and inferior alveolar canal.

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