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Piezosurgery Versus Conventional Surgery in the Management of Enucleation of Mandibular Cyst: A Comparative Study

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ABSTRACT

Background: To compare piezoelectric with conventional rotary surgical technique for mandibular cyst enucleation in relation to wound dehiscence, infection, pain, paraesthesia, bone density and duration.

Patients and methods: We conducted a parallel arm double blind control trial on a convenience sample of 24 patients. Piezosurgery for the study group and curettage for the control group were performed. Both the groups were compared for post-operative wound dehiscence, infection, pain, paraesthesia, bone density and duration of procedure.

Results: The two groups did not differ in their demographic characteristics. While pain on 3rd post-operative day (t= -5.17, p=0.00) was significantly greater in the control group, bone density at six months (1576 HU vs 1363 HU, t= 4.17, p=0.00) and duration of procedures (107 min vs 60 min, t= 6.14, p=0.00) was significantly higher for the study group. There was no significant difference in wound dehiscence (p= 0.21,3rd post-operative day), paraesthesia (p= 0.47, 45th post-operative day) and infection (p=0.21, 7th post-operative day) between the groups.

Conclusion: All the results except duration, were in favour of piezo-surgery thus making it a safer alternative to conventional rotary surgery. The associated advantages cover up for the longer duration.

Keywords: Piezo surgery, rotary surgery, curettage, mandibular cysts, enucleation.

INTRODUCTION

Cysts (pathological fluid filled cavities [1], are frequent in the Oro-maxillofacial region. Odontogenic cysts manifest as- dentigerous, primordial, gingival, inflammatory, radicular or keratocytes [2] whose treatment depends mainly on cystic dimensions. In addition to the three approaches-enucleation, marsupialization and curettage-extraction of damaged teeth and use of supplementary bone grafts might be necessary [3,4]. However, enucleation is still the best choice [5][6].

Motorised instruments, despite being efficient, suffer from serious drawbacks- cystic perforations, soft tissues necrosis, dreading noise and over cutting [7]. Piezoelectric devices are hence being explored for cystic enucleations, osteotomies and autogenous grafting [8] [9].

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Apart from being useful for sensitive manipulation, these devices also enhance the visibility of the operative field through cavitation [10] thus leading to low morbidity [11]. The "selective cutting" prevents damage of vital structures [12, 13], favouring a satisfactory wound healing [14]. A better inflammatory control and induction of bone morphogenic proteins are additional advantages [15].

The literature comparing piezoelectric surgery with conventional rotary surgical techniques for cystic enucleation is scarce. We hypothesised to compare the two techniques with respect to- wound dehiscence; infection; pain; paraesthesia; bone density and duration of surgery.

MATERIALS AND METHODS

This was a double blinded, parallel clinical trial, with 1:1 allocation ratio, on a sample of 24 patients that reported to MNR Dental College, for two years from March 2017 to May 2019. Our objective was to compare the piezo and conventional rotary surgeries.

Patients diagnosed with mandibular cysts and indicated for enucleation; age varying between 15-60 years; and who consented for participation were included. Patients with a smoking history; drug allergies; systemic diseases; being treated with bisphosphonates; and pregnant women were excluded.

Using computer generated random sequence the patients were allocated to two groups, by a professor in the department. The allocation sequence was concealed from the surgeon and the participants through sequentially numbered opaque, sealed envelopes, opened only before surgery. The study and control group patients was treated by piezo and rotary surgery respectively. Both the participants and the person assessing the outcome were blinded to the treatment.

Mectron Piezo surgery Device (Fig 1&2) with a hand piece and three main inserts- OT7S4, OT7 and OP3wereused. Power of the hand piece was set at 15-50 W and frequency at 30-60 MHZ for type D2 bone and 60-100 MHZ for type D1 bone, under saline at 4^0C.Conventional surgical armamentarium consisted of round and fissured rotary burs, a micro motor hand piece and curettes for cyst enucleation, used under continuous saline irrigation.

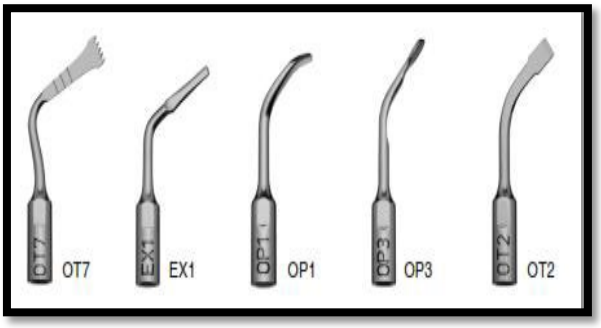


Fig 1: Inserts of piezo surgical device.

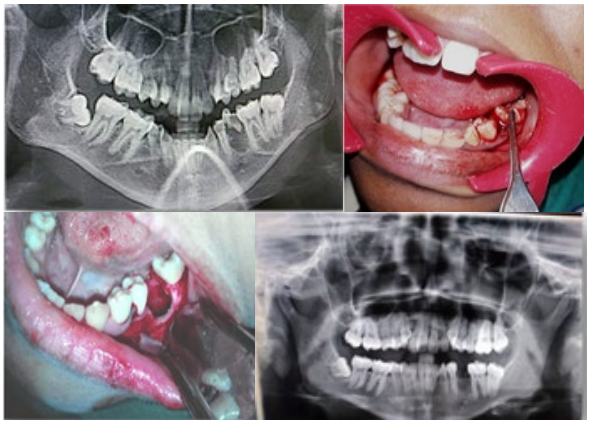
Fig 2: Conventional surgical armamentarium.

Surgical procedure

After rendering the surgical field sterile with10% povidone iodine antiseptic solution a full thickness mucoperiosteal flap of sufficient size was designed to access the area, using BP blade number 15.For the study group, insert 0T7 for marking a window, insert 0T7S4 for bone removal and insert 0P3 for cyst wall enucleation were used. In the control group, round and fissure burs for cystic removaland surgical curettes for cyst epithelium elevation were used.

In all cases surgical wounds were primarily closed with 3.0 silk following haemorrhage control. Extra oral ice pack applications, antibiotics, NSAIDS and antiseptic mouth wash for 5 days were prescribed for all patients

Piezo-surgery (left to right) Fig 3: preoperative OPG; Fig 4,5: Piezo electric enucleation; Fig 6 Postoperative OPG



Rotary surgery (left to right) Fig 7 Preoperative OPG; Fig 8,9Rotary surgical excision; Fig10 Postoperative OPG,

We visually evaluated the presence or absence of *Wound dehiscence*. *Infection* was recorded as present if any one of the following – swelling, redness or pus discharge was present. *Pain* was rated using visual analogue scale (VAS). *Paraesthesia* was assessed using 'Cotton wisp test' (Blind folded patients were asked if they felt cotton brush strokes) and '2 point discrimination test' (discrimination between two points on lower lip mucosa, lower lip skin and cheek skin). It was noted to be absent if either of them gave negative values. *Bone density* was evaluated through CBCT radiographs and *duration* for the surgery was calculated from the commencement of the incision until wound closure.

Statistical analysis

The results were analysed using IBM SPSS version 24. Fischer Exact test for ordinal variables and t test for quantitative variables were used for between-groups comparison. p value was set at ≤ 0.05.

RESULTS

Demographic variables did not vary between the two groups with almost equal number of males and females (**Table1).** Post-operative wound dehiscence and infection were present in 1-3 patients within the control (conventional surgery) group, and none among the study group (piezo surgery)(**Tables2,3)**.

Post-operative pain significantly improved in both the groups with greater improvement in the study group (**Table 4).** Paraesthesia was reported only in two control group patients (**Table 5).**

Pre-operative mean bone density was greater in the study group. However, an improvement was seen in both the groups, significantly greater in the study group (**Table 6).** The two groups differed considerably in relation to duration for procedures. Piezoelectric surgery on an average consumed 47 minutes more (**Table 7).**

DISCUSSION

Jaw cysts enlarge due to osmotic pressure [16] and release of growth factors and prostaglandins. Complete excision is important to prevent recurrence. Lack of speed control and inaccurate depth estimation with rotary instruments, not only precludes complete cystic removal but also jeopardizes the vital structures underneath. As piezoelectric devices cut selectively, we were interested in comparing the piezoelectric and rotary surgeries.

In our study, as opposed to several other studies, there was a slight female predilection (females: males= 1.81:1) towards mandibular cysts, probably due to smaller sample. Jones et al, Daley and Wysocki; and Killey and Browne [17] derived a male preponderance.

Table 1: Distribution of demographics.

Demographics		Study group	Control group	p value
Mean age (in years)		30.92	29.33	0.77
Gender	Male	6 (50%)	5 (42%)	0.68
	Female	6(50%)	7 (58%)	
No of patients with dentigerous cyst		7(58.3%)	5(41.7%)	0.41
No of patients with radicular cyst		5(41.7%)	7(58.3%)	

Table 2: Comparison of wound dehiscence at 1st, 3rd and 7th POD using Fischer Exact test.

Time of measurement	Group	Dehiscence		P value
		Present (%)	Absent (%)	
1st POD	Study	0 (0%)	12 (100%)	0.47
	Control	2 (16.7%)	10 (83.3%)	
3rd POD	Study	0 (0%)	12 (100%)	0.21
	Control	3 (25%)	9 (75%)	
7th POD	Study	0 (0%)	12 (100%)	1
	Control	1 (8.3%)	11 (91.7%)	

Table 3: Comparison of infection at 1st , 7th POD and 1st POM using Fischer Exact test.

Time of measurement	Group	Dehiscence		P value
		Present (%)	Absent (%)	
1st POD	Study	0 (0%)	12 (100%)	1
	Control	1 (8.3%)	11 (91.7%)	
7th POD	Study	0 (0%)	12 (100%)	0.21
	Control	3 (25%)	9 (75%)	
1st POM	Study	0 (0%)	12 (100%)	1
	Control	0 (0%)	12 (100%)	

Table 4: Comparison of pain (VAS) scores at 1st, 3rd and 7th POD, using t test. (N= Number of patients; SD=Standard deviation; MD=Mean difference)

Time of measurement	Group	N	Mean	S.D	M.D	t value	P Value
1st POD	Study	12	4.92	1.00	-2.33	-6.47	0.00**
	Control	12	7.25	0.75			
3rd POD	Study	12	2.67	1.23	-2.58	-5.17	0.00**
	Control	12	5.25	1.22			
7th POD	Study	12	0.58	1.24	-2.42	-4.34	0.00**
	Control	12	3.00	1.48			

*p < 0.05 significant, **<0.01 highly significant

Table 5: Comparison of paraesthesia pre-operatively, on 45th POD and 6th POM using Fischer Exact test

Time of measurement	Group	Paraesthesia		P value
		Present (%)	Absent (%)	
Pre-operative	Study	3 (25%)	9 (75%)	0.61
	Control	2 (16.6%)	10 (83.4%)	
45th POD	Study	0 (0%)	12 (100%)	0.47
	Control	2 (16.6%)	10 (83.4%)	
6th POM	Study	0 (0%)	12 (100%)	1
	Control	0 (0%)	12 (100%)	

Table 6: Comparison of bone density (HU) pre-operative and 6th POM, using t test. (N= Number of patients; SD=Standard deviation; MD=Mean difference)

Time of measurement	Group	N	Mean	S.D	M.D	t value	P Value
Preoperative	Study	12	707.54	175.74	-60.16	1.03	0.31
	Control	12	647.38	97.03			
6th POM	Study	12	1576.53	82.63	-213.50	4.17	0.00**
	Control	12	1363.64	155.99			

*p < 0.05 significant, **<0.01 highly significant

Table 7: Comparison of duration of both techniques using t test.

Group	N	Mean time in minutes	S.D	t value	P value
Study	12	107	13.10	6.14	0.000**
Control	12	60	23.03		

*p < 0.05 significant , **<0.01 highly significant

The study group did not report any wound dehiscence, while in the control group it was found in 16.66%, 25%8.33% on 1st, 3rd and 7thpostoperative days. This is in agreement with kocyigit et al and Crosetti et al because the torsional and rotational power required for dense bone removal in rotary instruments damages the soft tissues.

Infection was reported only in the rotary group on the 1st and 7th post-operative days. The cavitation in piezosurgery fragments the bacterial cell wall thereby causing lesser infection. Moreover, piezoelectric device avoids collateral damage and results in better healing and negligible infection [18].

There was higher post-operative pain among controls, probablydue to aggressive cutting of rotary burs.Ibrahim et al 2016 and Jiang et al [19]found that the patients undergoing piezo surgery experience less pain and trismus compared to rotary procedures. Stubinger et al [20] stated that piezo surgery being devoid of the typical macro vibrations of rotary instruments is much comfortable to the patients.

Paraesthesia was reported only among controls. The precise cutting and soft tissue sparing action of the piezo surgery was responsible for this. A systematic review revealed a significant neurosensory benefit for piezoelectric devices [21].Schaeren et al [22] supported that even a direct exposure of nerve to piezo surgery causes only slight structural or functional damage. The nerve has the ability to regenerate with the perineural sheath intact mostly.

Bone density was assessed using CBCT as it provides adequate image quality for maxillofacial imaging while delivering effective doses of radiation [23,24].There was an improvement in bone density for both groups, with a greater improvement in the study group. This was analogous to Yasmin et.al. Piezosurgery promoted quicker bone morphogenetic protein formation, and better inflammatorycontrolleading to bone remodelling within 56 days.

The mean duration of Piezo-surgery was significantly greater (107 min vs 60 min) due to less efficacious cutting by low frequency ultrasonic macro vibrations similar to Sortino's study [25].

Limitations

Despite results favouring piezosurgery, the generalisation of results is doubtful due to smaller sample.Large studies are recommended for a better external validity.

CONCLUSION

Surgeries are spine-chilling and additional iatrogenic issues like the loud noise and speed of instruments just worsen it. Patients prefer procedures devoid of such complications. In view of fewer postoperative complications, piezosurgery can be used as a safer alternative over rotary surgery.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interest regarding this article

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