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"A COMPARATIVE EVALUATION OF ULTRASONIC AND CONVENTIONAL SURGICAL TECHNIQUES FOR ENUCLEATING JAW CYSTS"

Dental Science

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ABSTRACT

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 peizosurgey 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.

KEYWORDS

Ultrasonic and Conventional Surgical Techniques, Enucleating Jaw Cysts

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.[5] 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.[7] 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.[8]

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.[9]

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.[10]

This piezo effect is based on physical interactions and phenomena of basic electric and mechanical dimensions such as electric field strength, polarization, tension, and extension in the crystalline field, which states that deformation in crystals on passing electric current results in oscillations of ultrasonic frequency. The vibrations obtained are amplified and transferred to a vibration tip which when applied with slight pressure on bone tissue results in cavitation phenomena, which is a cutting effect exclusively on mineralized tissue.[11] When this series of vibrations are conducted through a piezoelectric transducer higher efficiency is obtained The piezoelectric unit operates at frequency of 25-50 KHz. The resultant vibration produces the tip movement that is primarily linear in direction and generally allows only two sides of the tip to be active at any time. The device uses a specifically engineered surgical instrument characterized by a surgical power that is 3-times higher than normal ultrasonic instruments.[12] The key novelty of clinically applied ultrasonic surgery devices is their precise and selective cutting properties. Ultrasonic surgery cuts mineralized tissues such as bone with micron accuracy, yet do not cut soft tissues such as blood vessels and nerves. It can minimize sinus perforation rates during sinus bone grafting.[13]

Piezosurgery is a promising, meticulous and soft tissue- sparing system for bone cutting, based on ultrasonic microvibrations.[14]

Other advantages of piezosurgery include reduction of overheating resulting from the generation of a cavitation effect and better visibility of the surgical area due to less bleeding.[15] The benefits of ultrasonic piezo surgery compared to conventional procedures, with particular attention to highlight any neurologic complications (neurapraxia, axonotmesis and neurotmesis), its symptoms (paresthesia, anesthesia, dysesthesia), and the pain symptoms, resulting in most cases by use of the rotating instruments.

MATERIALS & METHODS:

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 BIDSH, 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. Patient was categorized into two groups.

· Group-A (n-10) Patient in which cyst enucleation was done using piezosurgery.

· Group-B (n-10) Patients in which cyst enucleation was done using theconventional surgical technique.

Inclusion Criteria:

- All maxillary and mandibular cysts
- Patients aged between 15-65 years

Exclusion Criteria:
- Suspected or diagnosed malignant lesions
- Systemic diseases that contraindicate surgical treatment

Preoperative Procedure
A full medical history was taken for all patients, as well as the presence or absence of a history of trauma related to the affected site. An orthopantomogram followed by aspiration of the cystic fluid was done to confirm the diagnosis.

A cone beam computerized tomography scan (CBCT) was also performed pre-operatively to measure the exact size and extension of the lesion and to detect the approximation of the lesion to the inferior alveolar canal the mental nerve and the maxillary sinus.

Patients were divided randomly in 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.

Operative Procedure
The oral mucosa was painted and swabbed thoroughly with antiseptic solution.All surgical procedures were done under local anesthesia consisting of 2% lidocaine hydrochloride with 1: 100000 adrenaline. At the beginning the time was recorded by stop watch and incision, bone cutting, enucleation and the suturing time was recorded.

Mucoperiosteal incision was given, with sufficient size to access the area with one tooth mesial and one distal to the cystic area using BP blade no .15. The flap was reflected with the help of periosteal elevator. **(Group A)** – The bone cutting was performed using piezosurgery. A window was designed and marked using insert OT7 – OT2 then bone was removed using insert OT6 and cyst was enucleated. The frequency was adjusted between 28 and 36 kHz with the micro vibration amplitude between 30 and 60 um/s. The cystic cavity was curetted using OP3 - OP7 with irrigation by cold sterile saline solution.

(Group B) – The bone cutting was performed using a number 6 carbide round bur mounted on a straight hand piece at 35,000 rpm under copious irrigation. Cyst was enucleated using surgical curettes. In many cases the teeth involved with the cystic lesion were also extracted along with the removal of cystic lining.

In both sites after enucleation was carried out the cystic cavity was debided, irrigated with 0.9% normal saline and closed with 3/0 black silk suture.

In mandibular cyst cases nerve was carefully protected during the surgical procedure and vital structure were also taken care of.

In maxillary cyst cases maxillary sinus was carefully protected during surgical procedures.

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.[8]

Follow-Up Phase
Pain, trismus, and swelling were evaluated on 3rd day, 8thday, 1month, 3 month and 6 month postoperatively.

Postoperative pain was assessed using a visual analogue scale (VAS).

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).

Furthermore, postoperative swelling was measured using a tape by taking the mean of the
(a) The distance between mandibular angles to the lateral corner of mouth,
(b) The distance from the mandibular angle to the nasal alar curvature,
(c) The distance from the mandibular angle to the lateral canthus of the eye,
(d) The distance from tragus to the soft tissue pogonion,
(e) The distance from the tragus to the lateral corner of the mouth.
The facial measurement mean was calculated (a+b+c+d+e)/5.

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. In Our Study out of 20 patients,80% corresponded to the age group of 15-30 years, 50% were male and 50% were female. There was 5 male and 5 female in conventional group and 5 male and 5 female in piezo surgery group I.

Table 1: Comparison Among Both The Group With Respect To Incision, Bone Cutting, Enucleation, And 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

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

DISCUSSION
In the present study the mean age of patients was 27.50 ± 10.34 inpiezosurgery and 25.30 ±11.96 in conventional surgical technique which is in accordance with study conducted by Z.YAMAN et al (2013)[8]. In the present study there was 50%male and 50% female in both the groups. The majority were in third decade.

SABRINA PAPPALARDO et al (2014))[16] in their study randomly subdivided patient into two groups: the ultrasonic group (comprising 40 patients, mean age 43.2 years, range 21- 67 years) in which the osteotomy for access was implemented with piezosurgery technique and the conventional group (composed of 40 patients, mean age 41.4 years; range 20-66years), in which theosteotomywas made with surgical micromotor .YASMINE et al (2016)[17]study group involved 7 patients:4 male patients (57.1%) and 3 female patients (42.9%). Their ages ranged between 16 and 43 years with mean age of 27.86±11.19 years. The conventional group involved 7 patients: 2 male patients (28.6%) and 5 female patients (71.4%). Their ages ranged between 23 and 47 years with mean age of 36.57 ± 10.0 years. ANTONIA BARONE et al (2010) selected 26 patients (12 women and 14 men) for their study; the mean age was 31.2 years (range 24-45 years). [18]

The result of this study revealed3rdday, 8thday & 1 monthpostoperative mean pain value comparable 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).

PRITIKA SRIVASTAVA et al (2019)in their study found, there was highlysignificant (P < 0.001) decrease in postoperative pain from1st, 3rd, and 7th day with piezosurgerywhen compared toconventional rotary instruments. Pain gradually decreasedin both the surgeries, but values noted for conventional were higher than that of piezosurgery. Pain was absent orminimized on the 7th day postoperatively in piezosurgeryside.[19]

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.

(Conventional –12.49 + 0.99; piezo surgery – 11.99 + 1.36). After1 month swelling was comparable in both the groups (conventional – 12.09 + 1.01; piezo surgery – 11.72 + 1.29).

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 of51 mm, at 72 h ±1 h of 48 mm and after one week of 17 mm. Thefacial edema of the patients face undergoing piezosurgery resultedin a swelling at 24 h ±1 h post-surgery of 18 mm, 48 h ±1 h of18 mm, 72 h ±1 h of 13 mm and after one week of 11 mm, with asignificant (p < 0.05) reduction of swelling compared to the procedurewith rotary instruments. QIAN JIANG et al (2015)meta-analysis indicated thatpatients in the piezosurgery group had significantly reduced facial swelling than those in the rotary group on all postoperative days (all Ps ≤ 0.023).[20]

In present study on 3rdpost operative day the mean mouth opening value was nonsignificant 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 &nonsignificant. 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 metaanalysis did not indicate a significant difference in mouth opening between the piezosurgery 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 valuesfor 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 ofmouth opening was greater in the ultrasonic group than inthe rotary group, (ultrasonic group-36.2+3.7; rotary group- 34.0+4.1; P >.05) even though a level of significantdifference was not reached.

In present studyPreoperatively the parasthesia was absent in both the groups. However, after 8thpost 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.[21]

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 ± 3.27min ,bone cutting -13.00 ± 2.58min,enucleation- 11.50 ± 3.38min ; piezo surgery group- incision-13.50 ± 2.42min, bone cutting-23.40 ± 5.78min, enucleation-16.50 ± 4.12)min showing a statistically significant difference respectively (P = 0.0002,P < 0.000 1,P = 0.0082).where as we observed non-significant difference in suturing time between conventional and piezo surgery group.

This study accoradance 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 between the conventional and Piezo surgery group of cyst enucleation. On 3rd postoperative day 1 patient in both the groups had wound dehiscence.

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, afterpostoperative visit pus discharge was absent in both the groups.This study accoradance with other studies conducted by NAIYA PATHAK et al (2019).

CONCLUSION

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.

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