

Comparative Evaluation of Surgical Treatment of Post-traumatic Ankylosis of Temporomandibular Joint Using Conventional Rotary Bur technique and Piezosurgery Unit

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ABSTRACT

Introduction: The temporomandibular joint (TMJ) is the most active joint of the body. Limitations of the mouth opening can be caused by bony or fibrous ankylosis of the TMJ as a sequelae to trauma, infection, autoimmune disease or failed surgery. A significant effect of TMJ ankylosis is obstructive sleep apnea (OSA) which can progressively worsen and the symptoms associated with OSA can dominate sidelining the primary disorder itself.

Aim/Objectives: The purpose of this study was to investigate and compare the use of conventional rotary bur technique and piezosurgery unit for gap arthroplasty in TMJ ankylosis.

Method Used: Twenty patients were examined clinically and radiologically for the treatment. Out of the twenty patients, ten patients were operated using conventional rotary bur technique (Group A) and the remaining ten patients were operated using piezosurgery unit (Group B). Two major parameters that is blood loss and duration of surgery were evaluated intraoperatively and other parameters like pain, mouth opening, swelling and paraesthesia were evaluated on Post Operative Day (POD)-1, 5, 10, 15.

Result: We observed that there was a significant reduction in the blood loss intraoperatively with the piezosurgery unit though the operating time was prolonged. Post-operative physiotherapy had increased the inter-incisal distance in both the groups. Pain levels and swelling were significantly higher in Group A. Other complications like paresthesia were not observed in either of the groups.

Conclusion: This comparative study suggests piezosurgery can be a valuable alternative method to the bur technique due to its efficacy in the evaluated parameters.

Key Words: Gap arthroplasty, Piezosurgery, Temporomandibular joint ankylosis, Rotary bur technique

INTRODUCTION

The temporomandibular joint (TMJ) is the most active joint of the body.¹ Limitations of the mouth opening can be caused by bony or fibrous ankylosis of the TMJ as a sequelae to trauma, infection, autoimmune disease or failed surgery. A significant effect of TMJ ankylosis is obstructive sleep apnea (OSA) which can progressively worsen and the symptoms associated with OSA can dominate sidelining the primary disorder itself. Post traumatic ankylosis can be caused by different pathogenic mechanisms such as organization and ossification of hematoma, maltreated facial fractures, systemic diseases such as ankylosing spondylitis, rheumatoid

arthritis, psoriasis and autoimmune disease that increases the effects of micro trauma.² It is a disabling condition of the masticatory system that alters eating habits and speech ability.^{3,4,5} Another result of the TMJ ankylosis is facial asymmetry, poor oral hygiene which can lead to halitosis and other dental problems. The absence of an intact disc and articular surface damage are believed to be the most important factors in the development of TMJ ankylosis. It is confirmed that the presence of the disc prevents development of fibrous intra-articular ankylosis of the TMJ.⁶ Various surgical techniques have been described as more or less successful for treatment. While traditional gap arthroplasty is done with chisel/osteotomes and rotary burs, the risk of inadvertent injury to vital

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structures can be a limiting factor in the use of these instruments.^{7,8} Recently, with pain staking research and application of advanced principles of physics, newer instruments have sought to decrease the difficulty and rates of complications in bone cutting. One such innovation is piezosurgery or the application of piezoelectric ultrasonic vibrations to perform precise and safe osteotomies.⁹ The piezotome delivers an extremely micrometric and selective cut. While working only on mineralized tissues, it spares soft tissues and their blood supply, thus, preventing collateral damage. An additional advantage is the 'cavitation effect' which is created by interaction between the irrigant solution and the oscillating tip leading to implosion of gas bull into blood vessels during bone cutting which produces haemostatic effect to optimize intra-operative visibility and reduce blood loss.^{10,11} However some drawbacks of piezosurgery have been cited in literature

like slow cutting rate leading to increased duration of surgery, high expense and breakage of the surgical tips.¹² In this comparative study gap arthroplasty was done using conventional rotary bur technique and piezosurgery units. (Satelec)

MATERIALS AND METHODS

The surgical operations and follow-up were carried out on twenty patients, aged between 19 and 34 years old. Out of the twenty patients ten alternative patients were treated using conventional rotary bur technique (Group A), while the remaining ten were operated using piezosurgery unit (Group B). All surgical procedures were performed at Saraswathi Institute of Medical Sciences, Uttar Pradesh from 2015 to 2016.

Table 1: Master table (Details of the patient)

Patient t No. Group A	Age (years)	Gender	Etiology	Preoperative e Mouth opening	Type of ankylosis (Sawhney classification, ¹⁹⁸⁶)	Ankylosis
1	32	Male	Trauma	8mm	II	Unilateral
3	22	Male	Trauma	10mm	II	Unilateral
5	25	Male	Trauma	4mm	III	Bilateral
7	20	Male	Trauma	7mm	III	Unilateral
9	33	Female	Trauma	6mm	III	Unilateral
11	19	Male	Trauma	12mm	II	Unilateral
13	22	Male	Trauma	14mm	II	Unilateral
15	24	Male	Trauma	10mm	III	Unilateral
17	24	Male	Trauma	9mm	II	Unilateral
19	30	Male	Trauma	6mm	III	Unilateral
GROUP B						
2	30	Female	Trauma	4mm	III	Bilateral
4	31	Male	Trauma	10mm	II	Unilateral
6	33	Male	Trauma	13mm	III	Unilateral
8	23	Male	Trauma	8mm	II	Unilateral
10	27	Male	Trauma	12mm	III	Unilateral
12	20	Male	Trauma	8mm	II	Unilateral
14	31	Male	Trauma	11.5mm	III	Unilateral
16	28	Male	Trauma	9mm	II	Unilateral
18	29	Male	Trauma	12mm	II	Unilateral
20	21	Male	Trauma	11mm	III	Unilateral

Two female and eighteen male patients were operated for TMJ ankylosis. All patients had past history of trauma to mandible which led to decrease in mouth opening leading to ankylosis progressively out of which patients 2,5,6,8,12,14 had ankylosis due to condylar fractures. Patient's major complaint was limited mouth opening. Eighteen patients had unilateral ankylosis and two patients had bilateral ankylosis. Bilateral ankylosis patients were equally divided between both the groups. Patients 1 and 5 had been previously operated at other medical centers and visited our OPD with a relapse after 3 years of surgery. All patients were evaluated before surgery using conventional radiographs and CT scans. All the 20 patients were classified using Sawhney classification (1986).

All operations were performed under general anesthesia using fibre-optic assisted nasotracheal intubation. Exposure of the TMJ was done by the pre auricular approach. After exposure and identification of the site of ankylosis, aggressive excision of the bony mass was carried out with round carbide bur no. 8 and straight fissure carbide bur no.702 and 703 in Group A and piezosurgery kit was used in Group B until the mandibular movements were achieved and satisfactory mouth opening of 35 mm or more was achieved. Re-contouring of the glenoid fossa was done wherever required. For all the cases drains were inserted to reduce post-operative swelling and edema. No significant postoperative complications were noted. Mouth opening exercises were carried out regularly on a follow-up basis to achieve mouth opening of at least 25-30 mm, and all patients were followed up for at least one year. Preoperative and postoperative inter-incisal distances were remarkably different, and the long-term follow-up results were satisfying. This study was approved by the Ethics Committee at the Saraswathi Institute of Medical Sciences, Uttar Pradesh and was conducted in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).



Figure 1: Excision of bony mass using Piezotome.

RESULTS

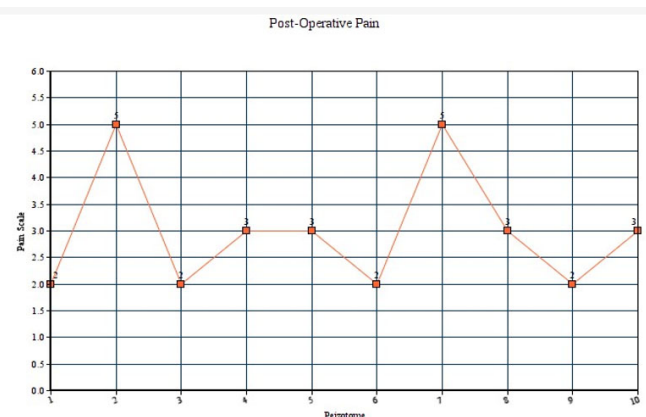
Twenty patients who underwent gap arthroplasty were included in this study. Ten patients were allocated to Group A in which rotary bur technique was used and the remaining ten patients were included in Group B in which piezosurgery unit was used for the surgery.

The mean time required for bone cutting using rotary instruments (round bur no.8 and straight fissure bur no. 702,703) was 90 minutes whereas with the piezotome was 120 minutes. The difference between the groups was statistically significant.

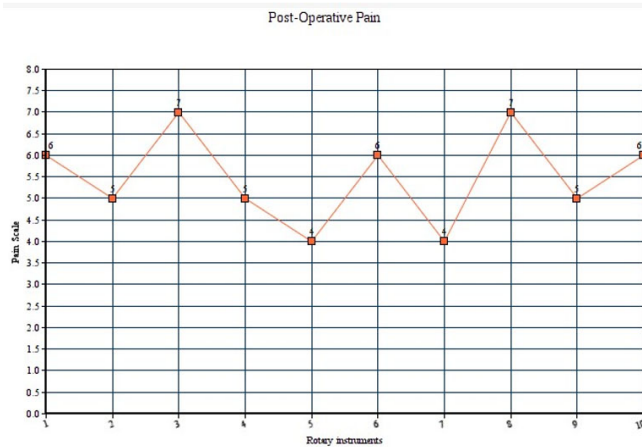
The blood loss was measured for both the group of patients by measuring the gauze pieces on a measuring scale and evaluating the suction jar. Average blood loss in Group A was around 70 ml and in Group B was 40 ml, thus blood loss was comparatively higher in Group A when compared to Group B.

Patients were examined on the first, fifth, tenth and fifteenth day for pain, mouth opening, swelling and paraesthesia. There was no significant difference in the mean maximal incisal opening (MIO) post-operatively, a minimum mouth opening of 25-30 mm was achieved in both the groups with regular mouth opening exercises. Graph-1 shows post-operative pain suffered by the patients in the Piezotome group which was significantly less than the rotary group shown in Graph 2. Post-operative swelling was present in both the groups.

There was no incidence of paraesthesia/altered nerve sensations in either of the groups in the post operative follow up period.



Graph 1: Post-operative pain evaluated in test group.



Graph 2: Post-operative pain evaluated in control group.

DISCUSSION

The main cause of TMJ ankylosis are trauma and infection.^{13,14} Estimates of traumatic origin range from 26% to 75% and the infection from 44% to 68 %.¹³ In the present study the main cause was trauma.

TMJ ankylosis is a common condition, and its management involves several stages of treatment. Also, outcome of the treatment depends on the compliance of the patient and follow-up. The most frequently reported operations for TMJ ankylosis includes gap arthroplasty and it can be combined with inter-positional grafting or joint reconstruction using autogenous or alloplastic material.^{13,14,15}

Gap arthroplasty alone gives rise to a gap between the articular cavity and ramus of the mandible and has an advantage of simplicity and short operating time.¹⁴ In our prospective study gap arthroplasty was done with the rotary bur technique and piezosurgery unit was performed and various parameters were compared.

In our prospective study, the comparison between the two techniques was analysed from clinical as well as patients' perspective.

According to Pederson and Oikarinen, the duration of surgery has significant correlation with pain and blood loss. Our study revealed that despite prolonged surgery time, post-operative pain and blood loss was comparatively less in the Group B.

Inter-incisal mouth opening was evaluated in centimeters. There was no significant difference in the mean inter-incisal mouth opening (MIO) in both the groups. The intensity of the pain was assessed during the postoperative period based on the VAS (Visual Analogue Scale) scores. The VAS score was significantly higher in Group A. Postoperative swelling increased in both the groups. It was significantly higher in the Group A.

One of the alternatives to preserve facial nerve while doing TMJ surgery is using piezosurgery unit as it cuts only the mineralized tissue and also helps in hemostasis because of cavitation phenomenon. So, while doing surgery with piezotome there is no risk of soft tissue injury. In our study we compared the two groups and there was no incidence of paraesthesia/altered nerve sensations in either of the groups in the post operative follow up.

The piezotome delivers an extremely micrometrical cut involving minimum surface area, this is one of the factors that contribute to the positive results obtained in our study. The main advantage of the piezosurgery is its selective cut that recognizes tissue hardness and works only on the mineralized structures, sparing the soft tissues (nerves and vessels). During surgery, piezotome allows easy control of cutting thus increasing tactile control and cutting precision.¹⁷

Comparing the overall outcome, we can conclude that piezotome is a valuable alternative method of replacing conventional rotary handpiece in TMJ surgeries.

CONCLUSION

Various techniques are used for removing bone to release ankylosis out of which piezosurgery is associated with minimal bleeding intra-operatively thus decreasing the chances of hematoma formation post-operatively which in turn minimizes the swelling and pain associated with it. It also avoids injury to soft tissue and facial nerve because of its selective cutting which is not seen in other techniques. We believe that piezosurgery allows one to achieve better results with less complications compared to other methods. This study concludes that piezotome provides precise cutting compared to rotary instruments and also post-operative complications are less compared to rotary instruments.

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