Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jobcr

Original Article

Silicone vs temporalis fascia interposition in TMJ ankylosis: A comparison

Sumit Gupta^{a,*}, Hemant Gupta^a, Shadab Mohammad^b, Hemant Mehra^a,
Subodh Shankar Natu^a, Niharika Gupta^a

^aDepartment of Oral & Maxillofacial Surgery, BBD College of Dental Sciences, Lucknow, UP, India

^bDepartment of Oral & Maxillofacial Surgery, Faculty of Dental Sciences, KGMU, Lucknow, UP, India

ARTICLE INFO

Article history:

Received 13 September 2015

Accepted 17 November 2015

Available online 28 February 2016

Keywords:

Silicone

Temporalis fascia

TMJ ankylosis

Interposition arthroplasty

ABSTRACT

Objective: Temporomandibular joint ankylosis (TMJa) is a distressing condition, but can be surgically managed by gap or interpositional arthroplasty, with an aim to restore joint function and prevent re-ankylosis. The aim of this paper is to compare two interposition materials used in management of TMJ ankylosis.

Methods: 15 patients with TMJa were randomly allocated to two groups: group A ($n = 6$), interposition material used was medical-grade silicon elastomer, and group B ($n = 9$) where the interposition material used was temporalis fascia. Patients were followed up at regular intervals of 1 and 2 weeks, 1 month, 3 months, and 6 months and were assessed on following parameters: pain by VAS Scale, maximal mouth opening (MMO), implant rejection, and recurrence.

Results: The results showed a loss of 4.6% and 7.9% in maximal interincisal mouth opening at 3rd and 6th months in Group A while Group B had a mean loss of 9% and 10% at 3rd and 6th months respectively without any significant difference. None of our cases showed recurrence or implant rejection.

Conclusion: We conclude that silicone is comparable to temporalis fascia in terms of stability, surgical ease, and adaptability. It not only restores the function of mandible and ensures good maximum interincisal opening but also maintains the vertical ramal height. Also, it requires less operating time and is easy to handle but is not economical. It might be an effective way to restore function and prevent re-ankylosis.

© 2016 Published by Elsevier B.V. on behalf of Craniofacial Research Foundation.

1. Introduction

Temporomandibular joint is a ginglymoarthroidial joint with both translational and rotational capabilities. The internal arrangement and the architecture of this joint allows this

complex motion. Temporomandibular joint ankylosis (TMJa) is a very distressing structural condition that denies the benefit of a normal diet and opportunities in careers that require normal speech ability. It also causes severe facial disfigurement that aggravates psychological stress. TMJa, if developed during early childhood, may lead to serious difficulties in

* Corresponding author.

E-mail addresses: sarikgmc@yahoo.co.in (S. Gupta), drhemantg@gmail.com (H. Gupta), shadab31aug@yahoo.com (S. Mohammad), hemantmehra121@gmail.com (H. Mehra), subodh_natu@rediffmail.com (S.S. Natu), dmiharikagupta26@gmail.com (N. Gupta).
<http://dx.doi.org/10.1016/j.jobcr.2015.11.006>

2212-4268/© 2016 Published by Elsevier B.V. on behalf of Craniofacial Research Foundation.

eating and breathing during sleep, and disturbances in growth, causing facial asymmetry. TMJa may be caused by various factors, including trauma, systemic and local inflammatory conditions, or neoplasm in the joint.

Management of TMJa is mainly through surgical intervention: resection of ankylosed bone, restoration of form and function, and prevention of recurrence.^{1,2} A variety of interposition materials have been used, including temporalis muscle and fascia, dermis, auricular cartilage, fascia lata, fat, lyo-dura, silastic, silicone, and various metals. Walker was the first to describe the use of silicone in surgery of ankylosis.³ The autogenous materials are known to cause donor site morbidity and have an unpredictable resorption rate. On the other hand, artificial materials do not cause a donor site morbidity but carry a higher risk of infection and extrusion.

2. Material and methods

This study comprised 15 patients presenting with TMJa, who reported to the Outpatient Department of Oral & Maxillofacial Surgery, King George's University of Dental Sciences, Lucknow. The patients were selected randomly regardless of age, sex, and socio-economic status. A detailed preoperative assessment comprising a detailed history, a thorough clinical assessment, and radiological and hematological investigations was carried out. Written informed consent was taken from all patients. Patients were randomly divided into two groups:

Group A: Interposition material used was medical-grade silicon elastomer (6 patients). The silicone piece used was taken from a silicone block thoroughly brushed with a clean, soft sponge or soft bristled brush in a hot water soap solution to remove skin oils deposited during handling and possible surface contaminants. The piece was then rinsed copiously in hot water followed by a thorough rinse in distilled water or normal saline (Fig. 1). Silicon block was then wrapped in a piece of gauze and kept in a perforated stainless steel autoclavable box and autoclaved.

Group B: Interposition material used was temporalis fascia (9 patients). In all cases, access to the temporomandibular joint was accomplished via the Al Kayat Bramley incision. A rosehead bur, chisel, and mallet or the oscillating saw, AO Stryker

Fig. 1 – Silicone.

Fig. 2 – Silicone interposed.

Fig. 3 – Temporalis fascia interposed.

command series, were used to perform osteoarthectomy with creation of 1–2 cm of gap. Care was taken to avoid injury to the internal maxillary artery, branches of the facial nerve, and auriculotemporal nerve. Following osteoarthectomy, interposition of the graft was done. In group A, 1 × 1 cm silicon piece with approximately 5 mm thickness was placed in the gap and fixed with 3–0 prolene (Fig. 2), while in Group B temporalis fascia was interposed. A balloon-shaped incision, approximately 3 × 2 cm, was made on the temporalis fascia (Fig. 3). This was then reflected with the help of Molt's periosteal elevator/Howarth periosteal elevator and interposed in the gap and fixed with 3–0 prolene suture. Layered closure was done. A suction drain was placed and a pressure dressing was given.

One-day post-interpositional arthroplasty, aggressive physiotherapy was advocated to all, irrespective of their group. Patients were followed up at regular intervals of 1 week, 2 weeks, 1 month, 3 months, and 6 months and were assessed on following parameters: pain by VAS Scale, maximal mouth opening (MMO), implant rejection, and recurrence. Data were statistically analyzed using SPSS system.

3. Results

The present study comprised of 15 cases; out of these, 6 cases with total of 10 Joints were operated using silicone as the

Table 1 – Mean pain score.

Duration	Group A (Mean $\pm$ SD) n = 6	Group B (Mean $\pm$ SD) n = 9
Immediate post-operative	6.17 $\pm$ 0.98	6.22 $\pm$ 1.39
1st Week	2.67 $\pm$ 1.37	3.11 $\pm$ 1.27
2nd Week	0.33 $\pm$ 0.82	0.22 $\pm$ 0.67
1st Month	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00
3rd Month	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00
6th Month	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00

interposition material and 9 with total of 10 Joints were operated using temporalis fascia as the interposition material. The age of patients ranged from 6 to 35 years with trauma as the main etiological factor. Both groups had similar postoperative pain score at 1st day, 1st week and 2nd week follow up with no episodes of pain at subsequent follow-ups (Table 1). The mean interincisal opening was in millimeters and percentage improvement/loss of mouth opening was at the end of 3rd month and 6th month follow-up (Table 2). In Group A, at 3rd month and 6th month, the mean interincisal opening showed a relapse of 4.6% and 7.9%, respectively, when compared with the immediate postoperative mouth opening while Group B had a mean loss of 9% and 10% mouth opening at 3 and 6 months respectively.

Table 3 shows the comparison of the interincisal mouth opening of Group A and Group B at preoperative, immediate post-operative, follow-up at 1st week, 2nd week and 1st month. No significant difference in mouth opening was found on comparing the interincisal mouth opening of group A and Group B at preoperative, immediate postoperative, 3rd month, and 6th month follow-up. None of our cases showed recurrence or implant rejection in either of the two groups at follow-up.

Table 2 – Intergroup comparison of interincisal opening at immediate postoperative and follow-up at 3rd month and 6th month.

Comparison A vs. B	't'	'p'
Preoperative	0.898	>0.05(NS)
Immediate postoperative	0.788	>0.05(NS)
3rd Month	1.075	>0.05(NS)
6th Month	0.89	>0.05(NS)

Table 3 – Intergroup comparison of interincisal opening at immediate postoperative and follow-up at 1st week, 2nd week, and 1st month.

Comparison A vs. B	't'	'p'
Preoperative	0.898	>0.05(NS)
Immediate postoperative	0.788	>0.05(NS)
1st Week	1.114	>0.05(NS)
2nd Week	1.069	>0.05(NS)
1st Month	0.853	>0.05(NS)

4. Discussion

Clinical studies carried out by Young concluded that the majority of cases become established before the age of 10 years.⁴ In our study too, 13 patients had TMJ ankylosis in their first decade of life. This can be attributed to the fact that young individuals are more prone to trauma, as they are very active, so their probability of getting traumatized is higher. This is the reason why trauma is primarily a leading factor particularly during the first decade of life. Their failure to realize the severity of trauma and delay in receiving treatment lead to this condition. By the time they turn up for treatment, it is generally very late and ankylosis has already set in.

Trauma and infection are the two main causes of TMJ ankylosis as indicated by various authors. Incidence of trauma as etiologic factor ranges from 26% to 75% and infection ranges from 44% to 68%.^{5–7} In our study, trauma was the etiology for all cases in Group A and Group B, except for 1 case in Group B, which developed ankylosis postinfection. It is evident that over the years with better medical facility and broad-spectrum antibiotics, the incidence of ankylosis due to middle ear infection or otitis media has reduced considerably.

Poswillo⁸ has put forward the views that earlier the onset and longer the duration of TMJa, greater will be the facial deformity and functional impairment. Mandibular condyle, being the growth center, maintains active role by cartilaginous proliferation against the glenoid fossa, thereby pushing the mandible downward and forward and this is lost as the ankylosis develops before the growth is completed. In our study, 11 cases showed marked facial asymmetry while the remaining 4 cases showed only mild facial asymmetry.

Various surgical methods like gap arthroplasty,⁹ interposition arthroplasty with temporalis fascia,¹⁰ reconstruction using costochondral graft,¹⁰ sternoclavicular graft,¹¹ chondro-osseous graft, auricular cartilage, dermal fat graft,¹² whole joint replacement, Sliding osteotomy, and Distraction osteogenesis^{13,14} have been used in the management of TMJa. Kaban's 7-step protocol consisted of aggressive excision of the ankylotic mass, coronoidectomy on the affected side, and if needed, contralateral side, lining of the TMJ with a temporalis myofascial flap or the native disk, if it can be salvaged, reconstruction of the ramus condyle unit with either distraction osteogenesis or costochondral graft and rigid fixation, and early mobilization of the jaw.¹⁰

Chossegras et al.¹ and Habel¹⁵ stated that the most commonly used interposition material at present is temporalis fascia. The advantages of temporalis fascia are its autogenous nature, resilience, adequate blood supply, and proximity to the joint. Since this material is one of the most widely used and popular materials, it was used as a control group in the study. In our study, we found silicon as a better interposition material than temporalis fascia in terms of surgical ease owing to its biocompatibility, flexibility, better adaptability to bone, reduced operating time, and easier handling of material without donor site morbidity. Silicon is available as preformed molds or can be custom carved. It provides substantial volume, is stable, resists deformity, and can be removed, reshaped, and replaced easily as compared to autogenous graft.

In our study, postoperatively, pain was assessed by using VAS (Visual Analog Scale) at regular follow-ups and it was found that mean pain score of patients of Group A was comparable to Group B.

Normally, mouth opening is related to the duration of ankylosis, as with increased duration there is varying degree of muscle atrophy. Loss of function of lateral pterygoid muscle causes limited opening ability and the patient depends on the suprahyoid group of muscles to open. In our study, in 11 cases, mean mouth opening was greater than 2.5 cm at 6 months postoperatively, while in four cases it was less than 2.5 cm. In two cases, 3.5 cm maximum mouth opening was achieved in the immediate postoperative stage.

In our study, the mean mouth opening in Group A was comparable to Group B. After a follow-up of 3 and 6 months, Group A showed a mean loss of 4.6% and 7.9%, respectively in maximum interincisal mouth opening, while in Group B the mean loss at 3 months and 6 months was 9% and 10%, respectively. However, this was statistically not significant.

In our study, none of the cases in either group showed infection, nerve damage, or recurrence postoperatively till 6 months follow-up. On radiographic assessment using Orthopantomograph and CT Scan, there was no evidence of displacement of silicone implant material. The possible explanation could be that the body's reaction to solid silicon elastomer is to create a pseudosynovial membrane or a fibrous capsule, which often develops as the sequelae to a hematoma surrounding the implant, thereby stabilizing the graft.

5. Conclusion

We conclude that silicone is comparable to temporalis fascia in terms of stability, surgical ease, and adaptability. It not only restores the function of mandible and ensures good maximum interincisal opening but also maintains the vertical ramal height. Also, it requires less operating time and is ease to handle, but is not economical. It might be an effective way to restore function and prevent re-ankylosis.

Conflicts of interest

The authors have none to declare.

REFERENCES

1. Chossegros C, Guyton L, Cheynet F, Blanc JL, Gola R, Bourezak Z, Conrath J. Comparison of different materials for joint ankylosis surgery: long term follow-up in 25 cases. *Br J Oral Maxillofac Surg.* 1997;17:157–160.
2. Raveh J, Vuillemin T, Ladrach K, Sutter F. Temporomandibular joint ankylosis: surgical treatment and long term results. *J Oral Maxillofac Surg.* 1989;47:900–906.
3. Walker RV. Arthroplasty of the ankylosis of the temporomandibular joint. *Am Surg.* 1958;24:6–15.
4. Young AH. Follow up of 12 cases of ankylosis of the mandibular joint treated by condylectomy. *Br J Plast Surg.* 1963;16:75–78.
5. Topazian, et al. Ankylosis of the TMJ. *Ind J Surg.* 1961;23:69–71.
6. Brandy F, Sanders B. Traumatic ankylosis of the temporomandibular joint. *Clin Otolaryngol.* 1978;3:127–131.
7. Kanzanjian VH. Ankylosis of the temporomandibular joint. *Am J Orthod.* 1938;24:1181–1184.
8. Poswillo D. Experimental reconstruction of the temporomandibular joint. *Int J Oral Surg.* 1974;3:500–503.
9. Roychoudhury A, Parkash H, Trikha A. Functional restoration by gap arthroplasty in temporomandibular joint ankylosis: a report of 50 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999;87(2):166–169.
10. Kaban LB, Bouchard C, Troulis MJ. A protocol for management of temporomandibular joint ankylosis in children. *J Oral Maxillofac Surg.* 2009;67(9):1966–1978.
11. Mehrotra D, Pradhan R, Mohammad S, Kumar S. Complications associated with different surgical modalities for management of temporomandibular ankylosis in a series of 791 cases. *As J Oral Maxillofac Surg.* 2011;23:122–127.
12. Mehrotra D, Pradhan R, Mohammad S, Jaiswara C. Random control trial of dermis-fat graft and interposition of temporalis fascia in the management of temporomandibular ankylosis in children. *Br J Oral Maxillofac Surg.* 2008;46(7):521–526.
13. Mehrotra D, Chellappa A, Gupta C, Passi D. Reconstruction of ramus-condyle unit with transport distraction osteogenesis: report of eight cases and review of literature. *J Oral Biol Craniofac Res.* 2012;2(3):144–148.
14. Mehrotra D, Dhasmana S, Kumar S. Management of temporomandibular ankylosis with temporal fascia interposition arthroplasty and distraction osteogenesis: report of 30 cases. *J Long Term Effects Medical Implants.* 2009;19(2):139–148.
15. Habel G, Hensher R. The versatility of temporalis muscle flap in reconstructive surgery. *Br J Oral Maxillofac Surg.* 1986;24:96–101.