ORIGINAL RESEARCH

Comparative Evaluation of Gap Arthroplasty and Interpositional Arthroplasty using Temporalis Fascia in the Management of Temporomandibular Joint Ankylosis

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ABSTRACT

Introduction: The ankylosis of temporomandibular Joint (TMJ) is challenging problem for both patient and surgeon. A variety of techniques for treatment of TMJ ankylosis have been described in literature. There are three basic techniques are currently employed: gap arthroplasty, interpositional arthroplasty and joint reconstruction. However, no single method has produced uniformly successful results. Limited range of motion and reankylosis are most frequently reported complication.

Aims and objectives: The purpose of this study was to evaluate and compare the two available techniques of gap arthroplasty to achieve maximum interincisal mouth opening for the treatment of ankylosis and the objective was to select postoperative regimen and better technique to minimize reankylosis.

Materials and methods: Twenty patients with TMJ ankylosis were included in this study. The age of selected patients were in ranged from 5 to 25 years and divided in two groups. In group I patients, gap arthroplasty was performed and in group II patients, interpositional arthroplasty with temporalis facias flap was performed.

Results: There is no significant difference observed in post-operative mouth opening. In group I patients treated with gap arthroplasty the postoperative mean interincisal opening after 1 year follow-up was 30.60 mm and in group II mean interincisal opening after 1 year follow-up was 32.60 mm.

Conclusion: From the result one can conclude that there is no significant difference between the patients treated with interpositional arthroplasty and gap arthroplasty. The overall outcome of the treatment depends on patient's cooperation, active physiotherapy and regular follow-up.

Keywords: Temporomandibular joint ankylosis, Gap arthroplasty, Interpositional arthroplasty.

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INTRODUCTION

Temporomandibular joint (TMJ) is a unique joint in human body where two joints work in tendon with each other. Its injuries and infections can cause many problems and complications for the patient.[1] One of these complications is ankylosis which is associated with trauma,[2-5] infection,[6] forcep delivery,[7] tumors[8] or degenerative diseases[8] (arthritis)[9,10] and as a complication of previous TMJ surgery.[11] In India, trauma to the TMJ was documented as a major etiologic factor (86% of cases) for ankylosis.[12] In the case of trauma, it is hypothesized that intra-articular hematoma, with scarring and excessive bone formation, leads to hypomobility usually coupled with age and social status of the patient.[13] Systemic causes of TMJ ankylosis include ankylosing spondilitis, rheumatoid arthritis and psoriasis.[14] This complication results in gradually decreasing mouth opening down to 5 mm or less.

The clinical manifestations of this condition depend to a large extent on the age at the time of onset, duration, anatomical location and involvement of one or both joints (unilateral or bilateral). However, it ranges from limited mouth opening to severe morphological and incapacitating anatomical alterations in the facial appearance of affected individuals.[15]

The definitive treatment of ankylosis is surgery, which sometimes is followed by relapse. One of these approaches is osteoarthrotomy which is accomplished in two ways: gap arthroplasty and interpositional arthroplasty. It is important to remember that the factors affecting the incidence of relapse are: (1) neglecting postoperative physiotherapy, (2) technique of surgery, (3) inadequate intraoperative maximum interincisal opening (< 35 mm).[1]

Currently, interpositional arthroplasty is widely accepted as the primary surgical treatment for TMJ ankylosis. The interpositional material may be alloplastic (e.g. acrylic silicone), allogenic (e.g. cartilage, dura), xenograft (bovine collagen, cartilage) and predominantly autogeneous (temporalis muscle and fascia, dermis, fat, cartilage, dermis-fat).[13] Credit for originating the interpositional arthroplasty is given to Eschmarc, who described the pterygomassetric sling technique of suturing together the masseter and medial pterygoid muscles across a divided mandibular ramus.

Verneuil described the use of temporalis muscle & fascia following gap arthroplasty of TMJ. We have chosen temporalis muscle – fascia flap as an interpositional material because of its proximity to the TMJ does not involve additional site for harvesting the graft. Moreover, this technique is well documented and easy excess to surgical site may help us in further modifying/simplifying the procedure.

AIMS AND OBJECTIVES

The purpose of this study was to evaluate and compare the two available techniques of gap arthroplasty to achieve maximum interincisal mouth opening for the treatment of ankylosis and the objective was to select postoperative regimen and better technique to minimise reankylosis.

MATERIALS AND METHODS

Twenty patients were divided into 2 groups with 10 patients in each group. In group I patients, gap arthroplasty was performed and in group II patients, interpositional arthroplasty with temporalis facia flap was performed. Subsequent follow-up was done at 1st, 2nd week, 1, 3, 6 month and 1 year postoperatively. During every follow-up patients were assessed for interincisal opening (mm), swelling, infection, facial nerve weakness, pain, wound dehiscence. Bone scintigraphy was done using ^{99m}technetium-methylene diphosphonate (^{99m}Tc-MDP) 3, 6 months postoperatively.

SURGICAL TECHNIQUE

All patients were operated under general anesthesia.

Group I

The Alkyat-Bramely incision given to expose the TMJ region another deeper incision given through superficial layer of temporalis fascia beginning from the root of zygoma at angle of 45° and length 2 cm, the intervening tissues were sharply released posteriorly along the plane of the initial incision. At this plane the flap was retracted anteriorly and the ankylotic mass was exposed. Removal of the mass was performed with burs initially and completed with osteotome.

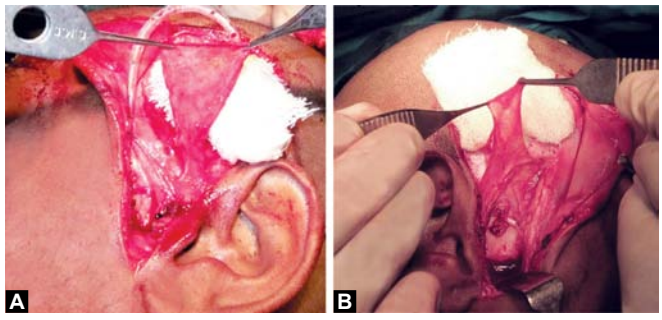
Group II

Technique for Harvesting Temporalis Myofascial Flap

The inferiorly based flap of adequate dimension was outlined on the fascia with methylene blue. The flap was extended as far superiorly as necessary to give proper length for lining the joint. The dissection was carried to the proper depth, including muscle and fascia. Only the superficial portion of the muscle was harvested to provide adequate thickness for lining the joint. The flap was extended to the level of the zygomatic arch and the flap was interpositioned between the ramus and the glenoid fossa by securing it to the arch (Figs 1A and B)

STATISTICAL TOOLS EMPLOYED

The statistical analysis was done using SPSS (Statistical Package for social sciences) version 15.0 statistical analysis software. The values were represented in number (%) and mean ± SD.



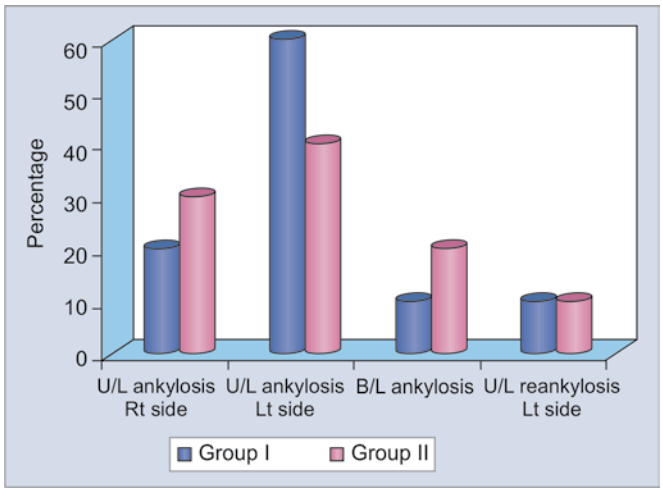
Figs 1A and B: Harvesting of temporalis fascia on left (A) and right (B) in the same patient

RESULTS

A total of 20 patients with TMJ ankylosis were enrolled in the study 10 in each group. Patient age ranged from 5 to 25 years. In both the groups, majority of patients were aged up to 15 years. Mean age of patients was 14.20 ± 6.71 years in group I and 16.10 ± 4.36 years.

Six patients were males whereas 14 were females. Male to female ratio of study subjects was 0.43:1. In group I, there were four (40%) males and six (60%) females. Male to female ratio in group I was 0.67:1. In group II, there were two (20%) males and eight (80%) females. Male to female ratio in group II was 0.25:1 (Graph 1). Majority of cases in both the groups had unilateral ankylosis. There was one (10%) case in group I and two (20%) in group II with bilateral ankylosis. There was one (10%) patient each in both the groups with U/L reankylosis at left side. Overall left side was more commonly involved (Graph 1).

Table 1 shows comparison of interincisal opening in two groups at different time intervals baseline mean interincisal opening in group II was significantly lower as compared to that in group I (p = 0.036).



Graph 1: Distribution of patients according to diagnosis

At week 1 follow-up mean pain was higher in group II as compared to group I but the difference was not significant statistically (p = 0.628). At week 2 follow-up group I had higher mean pain as compared to group II but the difference was not significant statistically (p = 0.628). At 1 month follow-up, all the patients in both the groups had pain score 2 only. From 3 months postoperative none of the patients reported pain.

All the patients showed increased radiotracer uptake on scintigraphy at 3 months in both the groups. At 6 months, all the patients in both the groups showed a decreased radiotracer uptake on scintigraphy at 6 months (Figs 2 and 3)

Table 2 shows mean time taken to achieve maximum interincisal opening was 2.50 ± 1.08 weeks in group I and 2.60 ± 1.07 weeks in group II. Though, mean time taken to achieve maximum interincisal opening was shorter in group I as compared to group II yet the difference was not significant statistically (p = 0.838).

Complete resolution of swelling took place in 2 ± 0 weeks in both the groups, thus showing no difference between group (p = 1). Similarly, time taken for complete resolution of pain was also same in both the groups (12 ± 0 weeks). None of the cases in both the groups had wound dehiscence, infection and facial nerve weakness at any time interval.

DISCUSSION

Trauma to the TMJ may become a trigger of subsequent fibrous or bony ankylosis. The TMJ disk plays an important role as a barrier preventing ankylosis.

Various treatment modalities described in literature but mainly three treatment options is common. The most frequently reported operations include:[16,17]

- Gap arthroplasty
- Interpositional arthroplasty
- Excision, and joint reconstruction with autogenous or alloplastic materials.

Advantages of gap arthroplasty are its simplicity and short operative time.

Disadvantages include:[13]

- Creation of a pseudoarticulation and a short ramus
- Failure to remove all the bony pathology
- Increased risk of reankylosis
- Complications include: [13]
- Development of an open bite in bilateral cases
- Premature occlusion on the affected side and
- Open bite on the contralateral side in unilateral cases
- Suboptimal postoperative range of motion.

For these reasons, gap arthroplasty has been largely abandoned for the treatment of TMJ ankylosis.

The present study is conducted to evaluate the better surgical technique in reference to mouth opening and low rate of reankylosis.

In our study mean age of patients was 14.20 ± 6.71 years in group I and 16.10 ± 4.36 years in group II, which support the previous study for mean age for ankylosis.

In the present study a higher preponderance in female was observed, the female to male ratio being 7:3, which is similar to the study of Behcet EROL et al[18] there was 36 female (61%) and 23 male (39%) patients. In another study it was found that girl are more subject to TMJ ankylosis than boys (Valentini et al 2002). After trauma, the combination of poverty, ignorance, and sometimes lack of early access to treatment has resulted delayed access to treatment that results in ankylosis of the TMJ.[12]

Table 1: Comparison of interincisal opening in two groups at different time intervals (mm)

S.no.	Time interval	Group I		Group II		Significance of difference	
		Mean	SD	Mean	SD	t	p
1.	Preoperative	3.90	4.48	0.50	1.58	2.262	0.036
2.	Week 1 postoperative	32.40	3.20	33.10	2.64	–0.533	0.601
3.	Week 2 postoperative	34.00	3.74	34.30	3.68	–0.181	0.859
4.	1 month postoperative	32.70	4.19	33.30	2.06	–0.406	0.689
5.	3 months postoperative	33.00	4.08	33.40	2.12	–0.275	0.786
6.	6 months postoperative	33.30	3.89	33.40	2.12	–0.071	0.944
7.	1 year postoperative	33.30	3.89	33.40	2.12	–0.071	0.944

Table 2: Summary findings

Variable	Group I	Group II	Significance of difference
Mean time taken to achieve maximum interincisal opening (weeks)	2.50 ± 1.08	2.60 ± 1.07	t = 0.208; p = 0.838
Mean time taken for complete resolution of swelling (weeks)	2 ± 0	2 ± 0	t = 0; p = 1
Mean time taken for complete resolution of pain (weeks)	12 ± 0	12 ± 0	t = 0; p = 1
No. of cases with wound dehiscence at any time interval	0	0	χ^2 = 0; p = 1
No. of cases with infection at any time interval	0	0	χ^2 = 0; p = 1
No. of cases with facial nerve weakness at any time interval	0	0	χ^2 = 0; p = 1

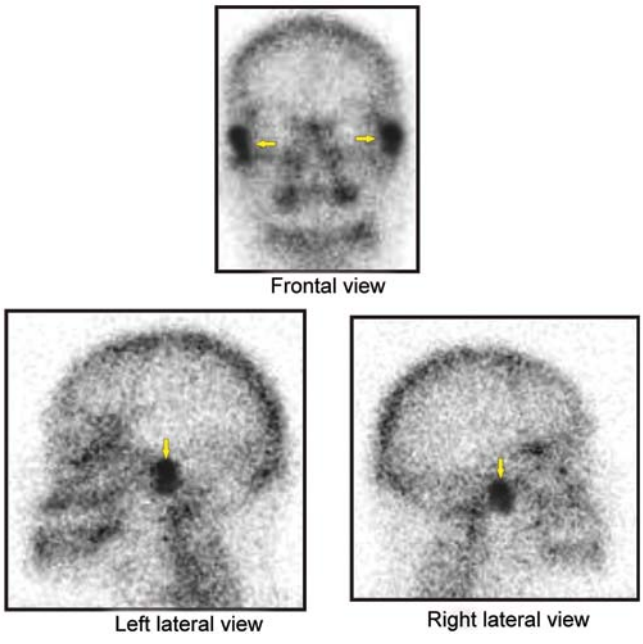


Fig. 2: ^{99m}Tc-MDP bone scintigraphy at 3 months postoperative. Arrows indicate areas of radio tracer uptake in TMJ region

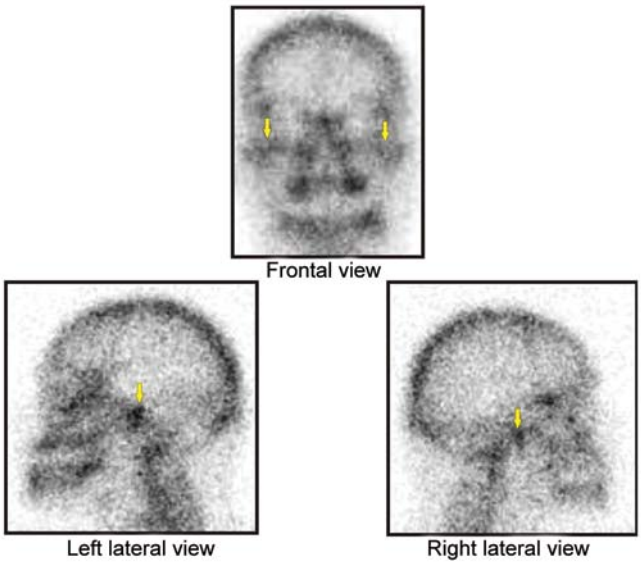


Fig. 3: ^{99m}Tc-MDP bone scintigraphy at 6 months postoperative. Arrows indicate areas of radio tracer uptake in TMJ region

Restoration of normal motion and function in patients with TMJ ankylosis has been a difficult goal to achieve. Many operative techniques have been described in the literature, but results have been variable and often less than satisfactory.

The various autogenous materials that can be used for reconstruction of the joint are:[13,19,20]

- Costochondral graft rib graft
- Second metatarsal, fourth metatarsal
- Sternoclavicular joint
- Ulnar head
- Clavicular bone
- Fibula and iliac bone.

In present study, gap arthroplasty was performed because of its simplicity and patients' unwillingness toward reconstruction of the joint. In present study, group I patients was operated with gap arthroplasty, there were very few studies in the literature comparing gap arthroplasty with other treatment modalities for the treatment of ankylosis. In patients treated with gap arthroplasty the postoperative mean interincisal opening after 1 year follow-up was 33.30 mm. The results were satisfactory and similar to the study of Danda AK et al which was 32 mm.

In present study, interpositional arthroplasty was performed with a temporalis fascia flap in 10 patients of group II. The mean interincisal opening after 1 year follow-up was 33.40 mm similar to result of Danda AK et al. [21]

The reasons for choosing a temporalis myofascial flap as an interpositional material were:[21]

- Its close proximity to the surgical site(it can be harvested at the same surgical site)
- No additional access is required
- Esthetically acceptable.

Damage to the facial nerve is a well-recognized risk of TMJ surgery regardless of the surgical approach. The actual reported incidence of damage, however, varies among authors. House et al. used a modified preauricular approach with a 5 cm hockey stick incision and reported a 15% incidence of facial nerve weakness.

Pogrel, in his study of 16 patients, came across 0% infection and hemorrhage, permanent weakness of the temporal branch of facial nerve in one patient, and temporary weakness of temporal branch of facial nerve in three cases. In all cases of present study, access to the ankylotic mass was achieved through Alkayat Bramley's incision. There was no infection in any patients and weakness in the temporal branch of the facial nerve.

In present study six patient out of 20 patients necessitated ipsilateral coronoidectomy, (in one patient it was performed extraorally), and in two patients contralateral coronoidectomy.

Bone scintigraphy was done using ^{99m}technetium-methylene diphosphonate (^{99m}Tc-MDP) after surgery. Bone scintigraphy was done at two different stages of surgical wound healing. First bone scintigraphy was done after 3 months of surgery, and second after 6 months of surgery. In bone scintigraphy after 3 months, there was an increased uptake of ^{99m}technetium-methylene diphosphonate in the TMJ of the side treated surgically, which was due to the ongoing healing process (increased vascularity and increased bone formation) at the site. After 6 months there was a decreased uptake of ^{99m}technetium-methylene diphosphonate in the TMJ of the side treated surgically, which was due to the healing process being completed (normal vascularity and normal bone formation) at the site. The increased uptake at the third month indicated bone formation, and normal uptake at the 6 month indicated halt of bone formation, were a sign of healed surgical site and no further bone is forming and possibility of reankylosis was ruled out.

It is important to note that early postoperative opening exercise, active postoperative physiotherapy, and strict follow-up are essential to prevent postoperative adhesions. Chidzonga reported that the main cause of relapse was failure to carry out jaw-opening exercises. Therefore, postoperative exercises play a crucial role in ensuring lasting success.

In present study After 24 hours intensive physiotherapy was started using Heister mouth gag and wooden spatula as well as patient was advised for chewing gum. The exercises were done 4 times daily for 3 to 5 minutes. The patients of both the group were advised to continue daily exercise for a minimum of 1 year.

CONCLUSION

There is no significant difference between the patients treated with interpositional arthroplasty and gap arthroplasty. The overall outcome of the treatment depends on patient cooperation, active physiotherapy, and regular follow-up.

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