

Gap Arthroplasty or Interpositional Arthroplasty for the Management of TMJ Ankylosis? A Prospective Randomized Comparative Multicenter Clinical Trial

Shallu Bansal¹ · Dinesh Kumar Verma¹ · Manjunath Rai² · Abhinay Sorake³ · Charanpreet Kaur¹

Received: 26 April 2018 / Accepted: 30 August 2018 / Published online: 6 September 2018
© The Association of Oral and Maxillofacial Surgeons of India 2018

Abstract

Aim The main aim of this study is to compare the gap arthroplasty with interpositional gap arthroplasty for the management of TMJ ankylosis.

Methodology A prospective randomized multicenter clinical trial had been performed, on 60 patients diagnosed with TMJ ankylosis from August 2005 to June 2015. Patients were equally divided into two groups: Group I patients were treated with gap arthroplasty, while patients in Group II were treated with interpositional arthroplasty.

Results The mean age in Group I was 27.9 years and in Group II was 25.6 years. Trauma was the common etiological factor in both the groups. The mean postoperative mouth opening after 1 month, 6 months and 24 months was found to be better in Group II. Open bite after 24 months was present in six patients in Group I and in one case in Group II. Permanent facial nerve palsy was present in one patient in both the groups. Frey's syndrome was present in one patient from Group I and none from Group II. Reoccurrence occurred in eight cases from Group I (26.6%) and none from Group II.

Conclusion This study concluded that interpositional arthroplasty is better than gap arthroplasty in terms of mouth opening and reankylosis.

Keywords TMJ ankylosis · Gap arthroplasty · Interpositional gap arthroplasty · Reankylosis · Reoccurrence

Introduction

Temporomandibular joint (TMJ) ankylosis is a disorder that leads to a restriction of the mouth opening from partial reduction to complete immobility of the lower jaw. It may be classified by location (intra- or extra-articular), type of tissue formed between two surfaces (bony, fibrous or fibro-osseous) and extent of fusion (complete or incomplete) [1, 2].

TMJ ankylosis is causing problems in mastication, speech, appearance and oral hygiene [3]. In growing patients, deformities of the mandible and maxilla may occur together with malocclusion [4, 5].

There is no consensus in the existing literature regarding the best treatment for TMJ ankylosis. Several authors studied and developed different techniques and approaches, but recurrence still remains the major problem when treating TMJ ankylosis [3, 6–8].

Multiple operative procedures are used to manage TMJ ankylosis, but none have been universally accepted. The operative procedures include gap arthroplasty, interpositional arthroplasty and resection of the ankylotic mass followed by reconstruction of the ramus–condyle unit with autogenous or alloplastic grafts [1, 6, 8–14].

The present study was undertaken to compare gap arthroplasty (GA) and interpositional arthroplasty (IPA) with temporalis myofascial flap for the management of TMJ ankylosis.

✉ Shallu Bansal
drshallu23@yahoo.com

¹ Department of Oral and Maxillofacial Surgery, Surendera Dental College and Research Institute, H. H. Garden, Power House Road, Sriganganagar, Rajasthan 335001, India

² Department of Oral and Maxillofacial Surgery, AJ Institute of Dental Sciences, Mangalore, Karnataka, India

³ Department of Orthodontics and Dentofacial Orthopedics, AJ Institute of Dental Sciences, Mangalore, Karnataka, India

Materials and Methods

A prospective randomized multicenter study was conducted on 64 patients at two centers, presenting with TMJ ankylosis from August 2005 to June 2015. Patients were divided randomly into two groups at each center. Group I patients were treated with gap arthroplasty (GA), while patients in Group II were treated with interpositional arthroplasty (IPA). Two patients from each group were lost to follow-up and were not included in the study. At center one ($N = 22$), ten patients were done with gap arthroplasty, while twelve patients were interpositional arthroplasty, and at center two ($N = 38$), twenty patients were done with gap arthroplasty and eighteen were done with interpositional arthroplasty.

All the patients were evaluated with history, physical and radiological examinations (panoramic and CT scans). Informed consent was obtained from all the patients. Preoperative temporal shave was performed for all the patients. Amoxicillin 1000 mg + clavulanic acid 200 mg [Inj. Moxclav 1.2gm, i.v. Sun pharmaceutical Ind. Ltd., Andheri (E), Mumbai, India] was given preoperatively for all the patients. All the patients with growth potential were considered for TMJ reconstruction with costochondral graft following gap arthroplasty.

Surgical Technique

All the cases were done under GA (under aseptic condition); Al-Kayat and Bramley approach was used in all the patients. In Group I, gap arthroplasty of 15–20 mm was done. In Group II, interpositional arthroplasty with temporalis myofascial flap was done after creating a gap of 15–20 mm.

In both the groups, arthroplasty was followed by ipsilateral coronoidectomy. Contralateral coronoidectomy was performed when necessary. Layered closure of the wounds was done with 3–0 vicryl and 4–0 silk after placing suction drains. Mouth-opening exercises were initiated from third postoperative day under supervision. Unsupervised mouth-opening exercises were continued after 7 days, for 3 weeks, with weekly follow-up and for 6 months with monthly follow-up.

All the patients were followed up for a period of 24 months. Two patients from Group I and two patients from Group II were lost to follow-up and therefore were not included in the study.

T test and p values were used to compare the outcome variables. Statistical significance was established at the $p \leq 0.05$ level.

Results

A total of 30 patients with 51 TMJ's (21 bilateral and 9 unilateral; type I = 8, II = 29, III = 12, IV = 2) were operated in Group I, and 30 patients with 48 TMJ's (18 bilateral and 12 unilateral; type I = 9, II = 21, III = 18) were operated in Group II.

Age and Gender

The mean age in Group I was 27.9 years (10–47 years); 63.33% patients were in between age group of 21–40 years; out of thirty patients 18 were female and 12 were male.

The mean age in Group II was 25.6 years (9–46 years); 56.66% patients were in between age group of 21–40 years; out of thirty patients 13 were female and 17 were male.

Etiology

In Group I, 20 (66.66%) patients reported with history of trauma (fall = 11, RTA = 7, landslide = 2), two patients with ear infection, one patient with forceps delivery and in seven patients etiology was unknown (Fig. 1).

In Group II, 21 (70%) patients reported with history of trauma (fall = 12, RTA = 8, landslide = 1), two patients with ear infection, one patient with history of rheumatoid arthritis and in six patients etiology was unknown (Fig. 2).

Preoperative Interincisal Mouth Opening (Table 1)

The mean preoperative mouth opening in Group I was 10.3 mm and in Group II was 11 mm. The difference between the two groups was not statistically significant. (t value was 0.3531 and the p value was 0.7253.)

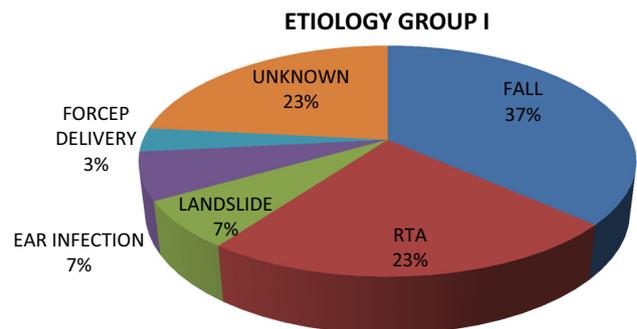


Fig. 1 Etiological factors distribution in Group I

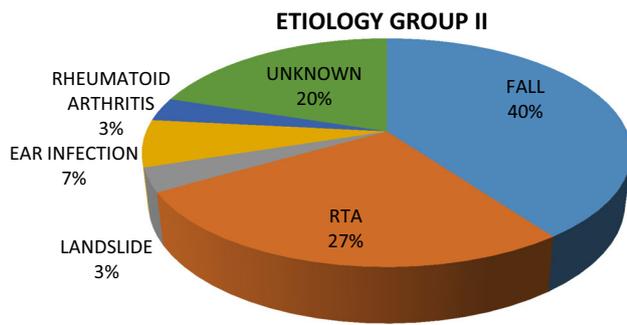


Fig. 2 Etiological factors distribution in Group II

Intraoperative Interincisal Mouth Opening (Table 1)

The mean intraoperative mouth opening in Group I was 29.58 mm and in Group II was 30.11 mm, and the difference between the two groups was found to be significant.

Coronoidectomy

Eight unilateral and 22 bilateral coronoidectomies were done in Group I, compared to nine unilateral and 21 bilateral in Group II.

Operating Time (Table 1)

The difference in the mean operating time was not significant ($p = 0.5982$) with 4.092 ± 1.573 h in Group I and 4.29 ± 1.309 h in Group II (Table 1).

Postoperative Interincisal Mouth Opening (Table 1)

The postoperative mouth opening after 1 month was significantly better in Group II (29.94 mm) in comparison with Group I (25.96 mm) with $p = 0.0009$.

The mean postoperative mouth opening after 6 months in Group I was 24.40 mm and in Group II was 29.95 mm. The t value is 0.3.8659, the p value is 0.0003, and the difference between the two groups is significant.

The mean postoperative mouth opening after 24 months in Group I was 22.94 mm and in Group II was 30.04 mm. The t value is 3.9904 and the p value is 0.0002, and the difference between the two groups is again significant.

Postoperative Complications

Open Bite

Open bite in the first 2 weeks was present in 23 patients in Group I and in 18 cases in Group II. Open bite in the first month was present in 16 patients in Group I and in six cases in Group II. Open bite in the first 6 months was present in eight patients in Group I and in two cases in Group II. Open bite after 24 months was present in six patients in Group I and in one case in Group II.

Facial Nerve Palsy

Temporary facial nerve palsy was present in five patients in Group I and in two patients in Group II.

Permanent facial nerve palsy was present in one patient in both the groups.

Table 1 Correlation of preoperative mouth opening, intraoperative mouth opening, operating time, postoperative mouth opening after 1 month, postoperative mouth opening after 6 months and postoperative mouth opening after 24 months between two groups

	Group I (GA)	Group II (IPA)	t value	p value
Preoperative mouth opening	10.3 mm	11 mm	0.3531	0.7253 Nonsignificant
Intraoperative mouth opening	29.58 mm	30.11 mm	2.238	0.0291 Significant
Operating time	4.092 ± 1.573 h	4.29 h	0.5299	0.5982 Nonsignificant
Postoperative mouth opening after 1 month	25.9633 mm	29.9366	3.5069	0.0009 Nonsignificant
Postoperative mouth opening after 6 months	24.4033	29.95	3.8659	0.0003 Significant
Postoperative mouth opening after 24 months	22.9466	30.0466	3.9904	0.0002 Significant

Frey's Syndrome

It was present in one patient from Group I and none from Group II.

Infection

Infection was found in two cases in Group I and one case in Group II in the first week postoperatively which was resolved after drainage and antibiotic coverage.

Recurrence

Recurrence occurred in eight cases from Group I and none from Group II.

Discussion

Restoration of normal function, prevention of reankylosis and correction of dentofacial deformities are the main goals for the treatment of TMJ ankylosis. Various etiological factors are known to produce this debilitating condition like trauma, local or systemic condition/diseases, prolonged maxillomandibular fixation and various degenerative diseases [7, 15]. In our study, trauma was the main etiology of ankylosis, which is similar to published literature. Fall constituted 56% of trauma followed by road traffic accidents (36%).

Most of the patients were in between the age group 21–40 in both the groups, which is slightly higher than the previous published data [16]. Most patients presented late probably because of ignorance, poverty and lack of easy access to treatment.

In our study, females were affected more than males (51% female and 49% male), which is similar to the study published by Erol et al. [16]. In our study, bilateral cases were more than the unilateral ones, which is similar to the published hospital-based data [17]. However, some studies have reported more unilateral than bilateral cases [16, 18]. Type II was found to be most common (51.5%) followed by type III (30.3%) and type I (16.6%). Only one case of bilateral TMJ ankylosis in Group I was of type IV in our study.

The main surgical techniques to manage TMJ ankylosis are: (1) gap arthroplasty, (2) interpositional arthroplasty and (3) reconstruction of the joint using autogenous and alloplastic materials. However, there is no consensus as to which technique is superior.

Gap arthroplasty is the most commonly done procedure due to its simplicity but has disadvantages of short ramus height, pseudoarticulation, anterior open bite (especially in bilateral cases), premature occlusion on the affected side

and open bite on the contralateral side in unilateral cases, decreased postoperative range of motion, and increased risk of reankylosis [7, 19, 20]. Many surgeons have abandoned gap arthroplasty [7, 21].

The rationale for the use of interpositional material had been to prevent TMJ reankylosis and to maintain ramus height. Various autogenous and allogenic materials have been tried with varying success rates. Pedicled temporalis myofascial flap was advocated by Feinberg and Larsen [12] with advantage of close proximity to the TMJ without involving an additional surgical site, esthetically acceptable with adequate blood supply, autogenous origin and maintenance of attachment to the coronoid process which provides movement of the flap during function, simulating physiologic action of the disk. Its proximity to the joint allows for a pedicled transfer of vascularized tissue into the joint area and avoids the need for surgically reducing the thickness of the zygomatic arch, as suggested by Pogrel and Kaban [14], when rotating the muscle over the arch [6].

Umeda et al. [22] have demonstrated that the flaps remained viable and that the tissue signal on MRI was compatible with vital muscle and/or fat as opposed to tissue scarring.

The mean operating time of Group II (4.29 h) was slightly higher than Group I (4.092 h) in our study, but the difference was not statistically significant.

There was no statistically significant difference between the two groups regarding preoperative mouth opening and intraoperative mouth opening. But the difference was significant at 1-month, 6-month and 24-month follow-up in favor of interpositional arthroplasty.

Open bite is most frequently found in bilateral arthroplasty, especially with gap arthroplasty, and can be minimized with interpositional arthroplasty. Open bite was present in 76.6% of patients from Group I and 60% from Group II immediately postoperatively. Functional elastics were given after aggressive physiotherapy for 3–4 weeks for neuromuscular adaptation. It was observed that 6 cases (20%) from Group I and one case (3.3%) from Group II showed open bite after 24-month follow-up.

Damage to facial nerve is a well-known complication of TMJ surgery regardless of the approach used. Pogrel and Kaban [14] in their study showed temporary weakness of facial nerve in 18% and permanent in 6% of cases. In our study, five patients (16%) from Group I and 2 (6.66%) patients from Group II had temporary nerve paralysis which resolved within 3–6 months without any treatment, and one case each from both the groups had permanent facial nerve paralysis (overall 3.33%) which matches with the previous results [14].

In the present study, infection of surgical site was seen in two cases in Group I and one case in Group II in the first postoperative week, which resolved after drainage and

antibiotic coverage. Postoperative hemorrhage was not encountered in any of the groups.

Prevention of the recurrence is the main goal in treating TMJ ankylosis, and recurrence rate has been reported to be as high as 50% [22]. Though many studies have shown no difference in recurrence rate between the two techniques [20], our study had a higher recurrence rate in Group I (26.6%) than in Group II (none).

Studies have reported a low correlation between the sex, occupation, etiology and side affected in terms of outcome of surgery, while there is a high correlation between the patient compliance and aggressive physiotherapy [20]. But this study was unable to correlate the outcome of surgery with patient compliance and aggressive physiotherapy as the patient with poor compliance was excluded from the study.

Although the sample size was small in our study and the number of patients in different age-groups were not the same in both the groups, our study suggests that interpositional arthroplasty is better than gap arthroplasty in terms of mouth opening and recurrence.

Conclusion

The present study suggests that IPA is better than GA in terms of mouth opening and reankylosis.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

- Rowe NL (1982) Ankylosis of the temporomandibular joint. *J R Coll Surg Edinb* 27(2):67–79
- Kazanjian VH (1955) Temporomandibular joint ankylosis with mandibular retrusion. *Am J Surg* 90(6):905–910
- Roychoudhury A, Parkash H, Trikha A (1999) Functional restoration by gap arthroplasty in temporomandibular joint ankylosis: a report of 50 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 87(2):166–169
- Miyamoto H, Kurita K, Ogi N, Ishimaru JI, Goss AN (1999) The role of the disk in sheep temporomandibular joint ankylosis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 88(2):151–158
- Raveh J, Vuillemin T, Lădrach K, Sutter F (1989) Temporomandibular joint ankylosis: surgical treatment and long-term results. *J Oral Maxillofac Surg* 47(9):900–906
- Kaban LB, Perrott DH, Fisher K (1990) A protocol for management of temporomandibular joint ankylosis. *J Oral Maxillofac Surg* 48(11):1145–1151
- Manganello-Souza LC, Mariani PB (2003) Temporomandibular joint ankylosis: report of 14 cases. *Int J Oral Maxillofac Surg* 32(1):24–29
- Chossegros C, Guyot L, Cheynet F, Blanc JL, Cannoni P (1999) Full-thickness skin graft interposition after temporomandibular joint ankylosis surgery: a study of 31 cases. *Int J Oral Maxillofac Surg* 28(5):330–334
- Rajgopal A, Banerji PK, Batura V, Sural A (1983) Temporomandibular ankylosis: a report of 15 cases. *J Maxillofac Surg* 11(1):37–41
- Mehrotra D, Pradhan R, Mohammad S, Jaiswara C (2008) 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* 46(7):521–526
- Omura S, Fujita K (1996) Modification of the temporalis muscle and fascia flap for the management of ankylosis of the temporomandibular joint. *J Oral Maxillofac Surg* 54(6):794–795
- Feinberg SE, Larsen PE (1989) The use of pedicled temporalis muscle-pericranial flap for replacement of the TMJ disc: preliminary report. *J Oral Maxillofac Surg* 47(2):142–146
- Su-Gwan K (2001) Treatment of temporomandibular ankylosis with temporalis muscle and fascia flap. *Int J Oral Maxillofac Surg* 30(3):189–193
- Pogrel MA, Kaban LB (1990) The role of a temporalis fascia and muscle flap in temporomandibular joint surgery. *J Oral Maxillofac Surg* 48(1):14–19
- Garcia-Aparicio L, Parri FJ, Sancho MA, Sarget R, Morales L (2000) Temporomandibular joint ankylosis (TMA) in children. *Cir Pediatr* 13(2):62–63
- Erol B, Tanrikulu R, Gorgun B (2006) A clinical study on ankylosis of temporomandibular joint. *J Craniomax surg* 34(2):100–106
- Qudah MA, Qudeimat MA, Al-Maaita J (2005) Treatment of TMJ ankylosis in Jordanian children—a comparison of two surgical techniques. *J Craniomaxillofac Surg* 33(1):30–36
- Kumar N, Shekhar C, Kumar P, Kundu AS (2007) Kuppuswamy's socioeconomic status scale-updating for 2007. *Indian J Pediatr* 74(12):1131–1132
- Vasconcelos BC, Bessa-Nogueira RV, Cypriano RV (2006) Treatment of temporomandibular joint ankylosis by gap arthroplasty. *Med Oral Patol Oral Cir Bucal* 11(1):E66–E69
- Danda AK, Ramkumar S, Chinnaswami R (2009) Comparison of gap arthroplasty with or without a temporalis muscle flap for the treatment of ankylosis. *J Oral Maxillofac Surg* 67(7):1425–1431
- Mastuura H, Miyamoto H, Ogi N, Kurita K, Goss AN (2001) The effect of gap arthroplasty on temporomandibular joint ankylosis—an experimental study. *Int J Oral Maxillofac Surg* 30(5):431–437
- Umeda H, Kaban LB, Pogrel MA, Stren M (1993) Long-term viability of temporalis muscle/fascia flap used for temporomandibular reconstruction. *J Oral Maxillofac Surg* 51(5):530–534