Efficacy of autologous fat graft as an interpositional material in temporomandibular joint reconstruction to prevent reankylosis

Usman Qadir Khan,[1] Rashid Mahmood,[2] Rabia Khan,[2] Nadia Ambreen,[1] Saadia Nazir[1]

Abstract

Background: Temporomandibular joint reconstruction many need fat graft.

Objective: To evaluate the efficacy of autologous fat graft as an interpositional material in temporomandibular joint reconstruction to prevent reankylosis and to determine its effects on postoperative joint mobility.

Methodology: Study Design: Cross sectional study. Place and Duration of the Study: Nishtar Institute of Dentistry, Multan, Pakistan from January 2015 to December 2016. A total of 48 patients suffering from Temporomandibular joint (TMJ) ankylosis were selected in this study. All patients were aged above 5 years. Pre surgical investigations included were conventional radiography and 3-D CT imaging of TMJ. Then these Patients were divided into two groups. Group A had 24 patients who underwent arthroplasty with Autologous fat graft (AFG) harvested from abdomen placed around the reconstructed joint and Group B also has 24 patients who underwent arthroplasty without AFG graft placement around the reconstructed joint. All the patients were examined at regular intervals of three and six months follow up to monitor the reankylosis and heterotopic bone formation by measuring inter-incisal opening of jaws.

Results: Out of a total of 48 patients, most of the patients, 18 (37.5%) were between 10 to 15 years of age, 26 (54.2%) female, had unilateral ankylosis 46 (91.7%) while 38 (79.2%) patients with history of trauma as etiologic factor. Comparison of mean incisal opening at different study intervals and no statistically significant difference was found in between both the study groups (p value > 0.05).

Conclusion: Trauma was seen to be the main etiological factor for TMJ ankylosis. There was no statistically significant differences seen in TMJ arthroplasty with or without AFG on postoperative interincisal opening or reankylosis.

Keywords: Temporomandibular Joint, Reankylosis, Autologous fat graft.

Introduction

There are many disorders affecting temporomandibular joint (TMJ) and ankylosis of the joint is one of them. Union of mandibular condyle to the cranial base having partial or complete mandibular impediment is described as the TMJ ankylosis.[1] TMJ ankylosis is known to be an upsetting structural state, denying affected the virtues of usual diet and hindering normal speech abilities. Difficulties in breathing as well as sleep, and facial disfigurement enhances the overall psychological stress.[2,3]

Ankylosis is frequently linked with trauma in 13 to 100% cases, infection as 10 to 49%, systemic disease as around 10%, neoplasm, or inadequate treatment of the condyle area.[4-6] In case of trauma, intraarticular hematoma, with scarring and excessive bone formation, lead to hypo mobility of the joint.[7] Mostly infection to the TMJ is the result of contiguous spread from otitis media but it also may be the result from hematogenous spread, including tuberculosis, gonorrhea, and scarlet fever. Systemic causes of TMJ ankylosis include ankylosing spondylitis, rheumatoid arthritis, and psoriases.[7] Ankylosis of the TMJ may be classified according to location, type of tissue involved, or extent of fusion.[8] Unlike true ankylosis, mandibular hypomobility can be due to the pseudoankylosis, which involves extra-articular structures. It may be the result of muscle hyperactivity or spasm, coronoid hyperplasia or a depressed zygomatic arch fracture.[9]

The most frequently reported operations treating true ankylosis include gap arthroplasty, interpositional arthroplasty, excision and joint reconstruction with autologous or alloplastic materials.[4,10] Most frequent complications include limited range of motion as well as reankylosis due to fibrosis and heterotopic bone formation.[11-13] Various treatment option have been suggested to prevent this heterotopic bone formation and reankylosis. Interpositional Arthroplasty using alloplastic and autologous graft is

1. Department of Dental Surgery, Sheikh Zayed Medical College/Hospital, Rahim Yar Khan, Pakistan.
2. Nishtar Institute of Dentistry, Multan, Pakistan.

Correspondence: Dr. Usman Qadir Khan, Associate Professor, Department of Dental Surgery, Sheikh Zayed Medical College/Hospital, Rahim Yar Khan, Pakistan. Pakistan.

Email:drkhan381@gmail.com **Phone:**+92-300-6827037

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an option, widely used now for prevention of heterotopic bone formation and reankylosis.[11,14] Numerous authors have proposed the use of various Interpositional materials in TMJ arthroplasty, such as skin, dermis, iliac crest graft, clavicular osteochondral graft, flaps of temporal muscle fascia, costochondral graft, acrylic cylinders, silicone and Delrin condylar implants.[15-17] AFG has been used in alloplastic total temporomandibular joint prostheses with good results.[12] The rationale for placing AFG is to obliterate the dead space around the reconstructed joint, thus preventing the formation and subsequent organization of a hematoma. Current study aimed to evaluate the efficacy of autologous fat graft as an interpositional material in temporomandibular joint reconstruction to prevent reankylosis and to determine its effects on postoperative joint mobility.

Methodology

This comparative cross sectional study was carried out at Nishtar Institute of Dentistry, Multan, Pakistan from January 2015 to December 2016. A total of 48 patients suffering from TMJ ankylosis were selected in this study. All patients were aged above 5 years. Patients with severe co morbid conditions e.g. ischemic heart disease or uncontrolled diabetes mellitus, or those who were not suitable to undergo surgical procedures, or unfit to undergo general anesthesia were excluded. Complete history and clinical examination was done in all the study participants. Pre surgical investigations included conventional radiography and 3-D CT imaging of TMJ. Then these patients were divided into two groups. Group A had 24 patients who underwent arthroplasty with AFG harvested from abdomen placed around the reconstructed joint and Group B also had 24 patients who underwent arthroplasty without AFG placement around the reconstructed joint. All the treated patients were operated by the same surgeon and were subjected to a composite step by step protocol consisting of aggressive resection, ipsilateral coronoidectomy, contralateral coronoidectomy when necessary, liningof the TMJ with temporalis fascia, reconstruction of the ramus with a costochondral graft when severe facial deformity was present, vertical ramus osteotomy in case where patients were not of a growing age, rigid fixation, early mobilization and aggressive physiotherapy and postoperative orthodontic treatment. All the patients were examined at regular intervals of three and six months follow up to monitor the reankylosis and heterotopic bone formation by measuring inter-incisal opening of jaws. SPSS version 14.0 was used to analyze the study data. Qualitative variables like gender, side affected, etiology and CT findings were presented as frequencies and percentages while quantitative variables like age and maximum interincisal opening (MIO) were represented as mean and standard deviation. Chi square test was applied to compare the qualitative variables whereas "t" test was used to compare quantitative variables in between the study groups. P value less than or equal to 0.05 was considered as statistically significant.

Results

Most of the patients, 18 (37.5%) were between 10 to 15 years of age while 16 (33.3%) were less than or equal to 10 years and 14 (29.2%) above 15 years of age. The mean age of the selected patients was 12.75$\pm$4.21 years with a range from 5.5 to 20 years. There were 26 (54.2%) female and 22 (45.8%) male. Most of the patients had unilateral ankylosis 46 (91.7%) while 4 (8.3%) had a bilateral ankylosis. There were 38 (79.2%) patients with history of trauma as the etiologic factor whereas 10 (20.8%) had an unknown etiology. As far as the type of ankylosis is concerned, 34 (70.8%) patients had features consistent with bony ankylosis and 14 patients (29.2%) had fibrous ankylosis. Table I shows the comparison and distribution of gender, age, side affected, etiology and CT findings between Group A and Group B, no statistical difference was found (p value > 0.05) in between both the study groups for these variables.

All the patients had a mean Maximum Interincisal Opening (MIO) of 4.29 mm with a range from 2 to 12 mm. The mean MIO preoperatively of these patients was 4.83$\pm$2.69 mm with a range from 2 to 12 mm whereas mean per-operatively MIO was 47.17$\pm$2.59 mm with a range of 44 to 50 mm and immediate post operatively, it was 22.92$\pm$5.93 mm and at 3 months follow up it was 37.08$\pm$6.64 mm with a range of 21mm to 48 mm. At 6 months follow up, it was 38.25 mm$\pm$6.77 mm with a range from 21mm to 48 mm. Table II shows the comparison of mean MIO at different study intervals and no statistically significant difference was found in between both the study groups (p value > 0.05).

Table I: Distribution of Study Variables Amongst Both Study Groups

Study Variables		Group A (n=24)	Group B (n=24)	Total	P Value
Age (years)	≤10	8 (33.3%)	8 (33.3%)	16 (33.3%)	0.776
	>10 to 15	10 (41.7%)	8 (33.3%)	18 (37.5%)	
	>15 to 20	6 (25.0%)	8 (33.3%)	14 (29.2%)	
Gender	Male	10 (41.7%)	12 (50.0%)	22 (45.8%)	0.562
	Female	14 (58.3%)	12 (50.0%)	26 (54.2%)	
Side Distribution	Bilateral	2 (8.3%)	2 (8.3%)	4 (8.3%)	0.829
	Left	10 (41.7%)	8 (33.3%)	18 (37.5%)	
	Right	12 (50.0%	14 (58.3%)	26 (54.2%)	
Etiology	Trauma	20 (83.3%)	18 (75.0%)	38 (79.2%)	0.477
	Unknown	4 (16.7%)	6 (25.0%)	10 (20.8%)	
CT Findings	Negative	22 (91.7.3%)	20 (83.3%)	42 (87.5%)	0.383
	Positive	2 (8.3%)	4 (16.7%)	6 (12.5%)	

Table II: Mean Incisal Opening Using Visual Analouge Scale Recorded at Different Intervals Amongst Both Study Groups

Interval	Groups	Mean	Std. Dev.	P Value
Pre operative	Group A	4.83	2.69	0.080
	Group B	3.75	1.22	
Per operative	Group A	45.17	2.59	0.767
	Group B	45.42	3.20	
Immediate Post operative	Group A	22.92	5.93	0.905
	Group B	23.08	2.75	
After 3 months	Group A	37.08	6.64	0.828
	Group B	36.58	9.02	
After 6 months	Group A	38.28	6.77	0.621
	Group B	37.18	8.45	

Discussion

Successful treatment of mandibular hypomobility requires a thorough understanding of the underlying disorder. In case of TMJ ankylosis, diagnosis is not difficult and is dependent upon a careful history, clinical examination and appropriate diagnostic tests.[2,4] Recurrence is a major problem in TMJ surgery. Relapse of TMJ ankylosis is quite high. Formation of extensive fibrosis, with or without heterotopic bone formation has been shown to be cause of this reankylosis.[3]

In the present study, we had 38 (79.2%) patients with history of trauma as the etiologic factor whereas 10 (20.8%) had an unknown etiology. Trauma was seen to comprise the etiology of 71.4% of all cases in the study carried out by Lei Z,[18] Chidzonga[19] as 50% and Chandra P et al[20] as 67.8% of his cases as having trauma as the etiology behind TMJ ankylosis. In our region, Haidar Z[21] noted that all subjects (100%) in his study had a preceding episode of trauma, whereas according to Akhtar MU et al,[22] 67.8% of his subjects presented with post-traumatic ankylosis. This makes us believe that trauma is the main etiological factor behind TMJ ankylosis in the developing countries. Parents either ignore their children or proper facilities are not available in time for a proper management whereas it is seen to have a relatively less role in causing TMJ ankylosis in developed countries as it was seen to have only a 26% involvement in the study carried out by Saeed NR.[23]

Mean age of these 48 patients was 12.75 years with a range from 5.5 years to 22 years. This provides an evidence for the delayed reporting of the patients for management. It was seen that patients with more severe symptoms tended to report more than patients with milder symptoms. This was shown by the pre operative CT findings as 70.3% of the reporting patients had bony ankylosis while the rest of them i.e. had findings that were inconsistent with a bony fusion. These cases may have a fibrous union as the cause of TMJ ankylosis.

In our study, out of the 48 patients examined and managed, 26 (54.2%) were female that make a slightly larger share for the female population in TMJ ankylosis. Our findings were slightly different from Saeed NR,[24] where the male:female ratio (1:6) showed a strong predilection for females. The male:female ratio described by Lie Z[18] as 1:2.5 and Chidzonga MM[19] showing a slight male predilection of 1.5:1. Most of the cases treated for TMJ ankylosis in studies carried out in western countries had developed TMJ ankylosis due to reasons other than trauma such as autoimmune and degenerative diseases of the joint such as arthritis, which is seen to be commoner in a female population. This predisposes females to have an increased chance of ankylosis in an adult age in western countries as

opposed to our region where trauma in a pediatric population is almost solely seen to be responsible behind TMJ ankylosis.

The mean preoperative MIO in our subjects was seen to be 4.29 mm with a range from 2-12 mm. This value is strikingly low from the MIO values in TMJ ankylosis studies carried out by other researchers. Wolford LM, et al[12] reported that the mean MIO in their patients was 26.8 mm with a range of 6-45 mm. Similarly, Garrett RW et al[25] showed a preoperative mean MIO of 20.4 mm (mean 18 mm, range 3-40 mm) and Dimitroulis[26] described a mean MIO of 15.6 mm. Interestingly, some of the higher value ranges reported by these authors such as 45 mm and 40 mm160 would not qualify in our settings to be cases of ankylosis if assessed only by the mean MIO with no radiological aids. Most of the cases, as described already in our settings have a history of trauma that leads to the formation of an intracapsular hematoma or a similar episode resulting in a bony ankylosis, which is frank at times. This bony ankylosis results in a restrictive mouth opening that is so severe that there is frank involvement of even the coronoid process and it almost causes an inability to the patient to open his mouth.

The improvement in MIO as assessed of the treated patients as a total group was a mean of 37.24 mm at the 6 months follow up. A relapse in the form of re ankylosis of the treated joint was seen in 3 cases (12.5%) in total as assessed from CT images acquired at 3 months follow up period. These findings are significantly better than the findings of re ankylosis in some other studies such as Topazian RG,[27] where he noted reankylosis rates as high as 50%. This could have been possible because of an adherence to a better and more composite protocol for the management of TMJ ankylosis but a relatively short follow up period and a small sample size hamper us from reaching a conclusive result. There was a slightly more improvement in postoperative mean MIO in the Group A (fat graft placed) than Group B (no fat graft) but the difference was not statistically significant (p value > 0.05). The mean MIO in the Group A was noted to be 38.27 mm as opposed to 37.45 mm obtained in Group B P value of 0.621, which is not statistically significant. Similarly, the frequency of re ankylosis in the Group B was slightly higher (16.7%) than Group A (8.3%) but without showing any statistical significance. Opposed to our findings, Wolford et al.41 found a statistically significant difference in measured function when they compared TMJ arthroplasty with and without fat graft placement. None of the control subjects in their study had an episode of re ankylosis whereas 7 control subjects (35%) exhibited this phenomenon and required reoperation. The findings of Wolford et al.[11] are technically difficult to be compared with ours, as in our study all of the subjects had their TMJs reconstructed with autogenous tissue while Wolford et al.[11] employed alloplastic Total Joint Prostheses for TMJ reconstruction.

Long term follow up is not available in our region and the exact role and fate of the grafted fat is not known. Other limitations include donor site, morbidity hematoma and seroma formation, infection, ileus, and inadvertent peritoneal perforation. The fat graft procurement is a quick and technically easy procedure. We harvested all grafts from abdominal fat for all the subjects in our experimental group but encountered no cases of infection, peritoneal perforation or postoperative ileus. After observing hematoma formation in two patients, it was prevented in the next several patients by a postoperative pressure bandage. Seroma formation also occurred in one of our patients and was effectively managed by aspiration. Infection occurred in three patients around reconstructed joint and managed by antibiotics. Some of our patients were also instructed to wear a supportive undergarment for 10 to 14 days after surgery.

Conclusion

Trauma was seen to be the main etiological factor for TMJ ankylosis. There was no statistically significant differences seen in TMJ arthroplasty with or without fat grafts on postoperative interincisal opening or reankylosis. Further studies are warranted to evaluate the exact role of autologous fat interpositioning and its long term effect on mouth opening and prevention of reankylosis.

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