



Sternoclavicular Grafting a Paradigm Shift in the Management of TMJ Ankylosis

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Abstract

Introduction: *The management of TMJ ankylosis poses a great challenge due to high recurrence rate. A no. of inter positional materials let it be alloplastic or autogenous tissues have been used. The adaptive centre is preferred rather than growth centre as given in literature. SCG is presumed to be more suitable inter positional material after TMJ arthroplasty.*

The Aim of this article is to report that SCG is more similar developmentally, morphologically, anatomically and show less recurrence that CCG.

Material and Method: *This prospective study included 15 patients of unilateral TMJ ankylosis. Age of patients 8 – 18 years, duration of ankylosis presented from 5 to 10 years. 12 patients had history of trauma in childhood, 3 patients had ear infection. After diagnosis patient were divided in 2 groups Group A sternoclavicular graft, Group B – Costochondral graft.*

Results: *In group A – Mouth opening at 6 months was 35.4 mm. Significant growth of mandible as compared with group B. Follow up at 5 years and there was no recurrence or any reunion was reported. In group B – 2 Patients had recurrence and reported after 3 years.*

Conclusion: *Reconstruction of TMJ with sternoclavicular graft was more effective with regard in interincisal mouth opening, recurrence, growth of mandible and articular function.*

Introduction

Temporomandibular joint ankylosis (TMA) is a highly disabling condition in which the space between the glenoid fossa and the mandibular condyle gets replaced with the scar tissue in the form of bony or fibrous adhesions. TMA restricts the range of mandibular motion like protrusion, lateral excursion. This distressing condition causes impairment of speech, difficulty with the chewing of food, improper oral hygiene, and

disfigurement of face, psychological trauma. Most frequent cause associated with TMA is trauma, but local or systemic infection, tumors, degenerative diseases, intra-articular injection of corticoid, forceps delivery, and complication of previous TMJ surgery have also been implicated.^{1,2,3}

When bilateral ankylosis occurs before facial growth is completed, it produces hypoplastic mandible. Deviation of the mandible to the

affected side occurs when it is unilateral. Kazanian classified ankylosis as true and false⁴. It can also be classified using a combination of location (intra-articular or extra-articular); type of tissue involved (bone, fibrous, or fibro-osseous); and extent of fusion (complete or incomplete)⁵. The treatment of ankylosis can be really challenging and difficult due to high chances of recurrence. Lot of techniques have been described in the literature for the treatment of ankylosis. However, no single method of treatment has shown uniformly successful results^{6,7,8}. The three basic techniques of treatment are Gaparthroplasty which involves removal of the bony mass between the glenoid fossa and mandibular condyle, without interpositional material; second is, Interpositional arthroplasty: Creation of gap by removing the bony tissue followed by interposition of a biological (e.g. temporal muscle flap^{9,10,11}) or non-biological material (acrylic^{12,13}, silastic^{14,15}). Among the biological tissues the most commonly used for reconstruction of TMJ is costochondral graft, which may allow an additional growth as well but there are numerous complications associated with it like unpredictable growth, pneumothorax, different growth characteristics. Other biological material which is used less commonly for reconstruction is sternoclavicular graft. The objective of the study is to present our experience after comparing the harvesting of non vascularised free graft from sternoclavicular joint and costochondral graft for the reconstruction of TMJ after gap arthroplasty.

Material and Method

This study was conducted by analyzing 15 cases of unilateral temporomandibular joint ankylosis (10 males, 5 female) in children aged from 8 to 18 years. The duration of ankylosis at the time of the presentation ranged from 5 to 10 years. 10 of them gave a history trauma and 5 gave history of local infection like otitis media and pre auricular abscess. A consistent finding in most of the patients was asymmetry of the face with fullness

of the affected side and flattening of the normal side, deviation of midline of the chin to the side of ankylosis and the prominence of antegonial notch on the affected side. The diagnosis of ankylosis was made after doing orthopantomogram and cone beam computed tomography. Patients were divided in two groups group A and group B. Out of 15 patients 8 patients were operated with sternoclavicular grafting (Group A) and 7 were operated with costochondral grafting (Group B). General anesthesia with endotracheal tube passed by blind intubation technique was used in 13 cases and tracheostomy was done in 2 cases. In all the cases the joint was reached by a alkayatbramley incision with deep subfascial approach. The ankylosed TMJ was exposed. In all cases osteoarthrectomy was done using a bur. The lower cut was made first, followed by the superior cut. The bony mass was then detached of its muscle attachments and removed. A minimum length of 1.5 cm of length was removed in all the cases. In 10 cases mouth opening of 35 mm was achieved by gap arthroplasty and ipsilateral condylectomy. In other 5 cases contralateral condylectomy was done to achieve mouth opening as per kabans protocol followed by reconstruction of temporomandibular joint using sternoclavicular graft in 8 patients. The graft was harvested using the infra clavicular incision. sternoclavicular joint is a synovial joint separated into two cavities by an intervening disc of fibrocartilage. The graft was shaped in the shape of condyle and cartilage was preserved and it was secured with the help of one lag screw on the lateral side of ramus. postoperatively patients were given a figure of eight bandage for the sternoclavicular joint and were asked not to lift anything heavy. Patients were followed for a period of 1 year. In 7 of the patients reconstruction was done by using costochondral graft.

Surgery at the donor site consisted of harvesting the 6th or the 7th rib with one cm of its attached costal cartilage. Graft was harvested

subperiosteally Length of the rib varied in all the cases depending on the correction of the vertical height of the ramus. The cartilage was shaped so that the mediolateral dimension was more than the anteroposterior dimension so as to mimic the original condyle of the mandible.

Access to and preparation of the recipient site for the rib graft was made through a submandibular approach. Decortication of the posterior border and lower border of the mandible was then carried out. The rib was tightly fixed to the recipient site using bone plates. The wound was then irrigated with normal saline and closed in layers

GROUP A



Marking of Incision



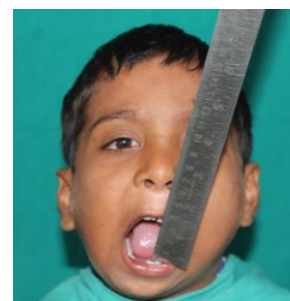
Exposure of Ankylosed Joint



Harvesting of Graft

Group A was operated by gap arthroplasty using sternoclavicular grafting and Group B was operated using costochondral grafting. The mean age of the patients was 12.5 years. Trauma was the main cause of ankylosis in 12 patients and 3 patients gave history of ear infection. The range of movement was assessed by MIO, protrusion and lateral excursions. The range of movement was assessed by MIO. In Group A MIO at 6 months follow up was 35.4 (range 32-40mm), greater than MIO achieved in immediate postoperatively {30.4mm (range 30-35mm)} When comparison of MIO were made preoperatively and immediate postoperatively and preoperative and postoperative 6 months follow up, the results were statistically significant at the level of 1% (P values are highly significant). In Group B MIO Postoperatively was 33.4 mean and p value was statistically significant at the level of 1%.

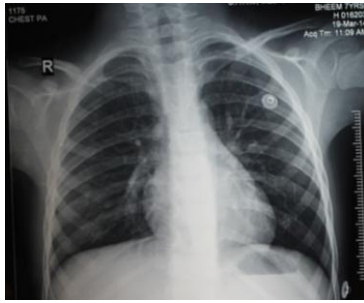
Preoperative and postoperative cephalograms were taken in all the cases and analysed. The increase in ramus length and mandibular body length all show linear growth of mandible on the side where sternoclavicular grafting was done. Whereas in Group B in 5 cases over growth of ramus was seen. In Group A only in one case recurrence was seen that too because the patient left mouth opening exercises. In Group B in 2 cases recurrence was seen. In Group A there was no donor site morbidity. In Group B complications like pneumothorax and bronchiectasis were seen in 2 cases.



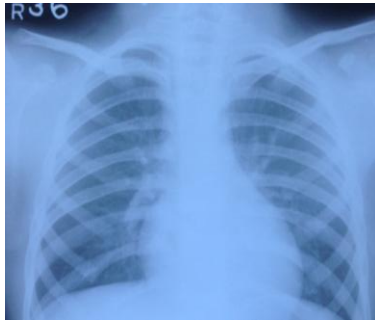
Post op mouth opening after 1 year

Result

This study comprised of total 15 cases out of which 10 were males and 5 were females. Group



Chest xray after graft harvesting



Regeneration of clavicle after 1 year

Pre Operative OPG



Post operative OPG



Discussion

Management of TMJ ankylosis is difficult. Several procedures can be used. Rowe (1982)¹⁶ laid down certain criteria for restoration of ankylosed TMJ. The primary objective was release of ankylosis by removing 1.5- 2 cm of ankylotic mass thus achieving a functional articulation with adequate mouth opening. He further emphasized that lost capability of growth can be restored in young children with use of autogenous graft with growth potential, improving existing facial deformity. In spite of implanting growth centre the remnant facial deformity must be corrected by orthosurgical procedures. Because of the characteristics similar to the mandibular condyle, the costochondral graft was the most versatile autologous tissue to reconstruct the TMJ. The biggest drawbacks with CCGs are unpredictable growth, flexibility and elasticity of the bone, warpage with continuous loading causing occlusal changes and fracture. This demands careful precautions to be taken such as avoid splitting and to take care during immediate mobilization following grafting. So due to these problems with most traditionally accepted graft have created a background of dissatisfaction and need for an alternative to overcome these drawbacks. In a study on children, Ko and Huang¹⁷ observed hyper-growth in 7 of the 10 patients studied. Other authors, such as Lata et al. and Siavosh et al.^{18,19}, also refer to cases of excessive growth of the graft. In a study of 26 patients, Perrot et al.²⁰ observed three cases of lateral overgrowth.

So to overcome these drawbacks sternoclavicular graft was tried. SCG in humans appears to be similar to the TMJ both anatomically and physiologically (snyder et al 1971)²¹ The head of clavicle is composed of cartilage that is ontogenetically, phylogenetically, histologically and embryologically similar to cartilage of mandibular condyle (Gardner 1968; Ellis and Carlson 1986)²²

SCG articulation has a growth centre and interarticular fibro cartilaginous articular disc and

stron fibrous capsule resembling TMJ. Complete regeneration at clavicle as in present study has been reported

Occlusion

The tmj management has been one of the greatest challenge over decades. It is wise to think that the ideal choice of graft is one that serves its function in a manner similar to the original tissue. The sternoclavicular graft consists of an autogenous material that has an articular cartilage surface that can resemble the mandibular condyle, and it has the ability to adapt and remold itself according to joint function. In this study, we found postoperative results with MIO greater than 35 mm, the ability to make excursive movements, minimal to no pain during function, resumption of a normal diet and nil pain at donor and recipient site at 5 year follow up. Our results indicate the stability and adaptability of the SCG. On the basis of promising results of SCG it may be a viable alternative to the traditional costochondral junction in restoring the mechanics of mandible, thus providing near normal function and a possibly growth centre. So in terms of clinico-radiographic findings we recommend routine use of this technique for TMJ reconstruction in TMJ ankylosis.

References

1. Chossegros C, Guyot L, Cheynet F, Blanc JL, Gola R, Bourezak Z, Conrath J. Comparison of different materials for interposition arthroplasty in treatment of temporomandibular joint ankylosis surgery: long-term follow-up in 25 cases. *Br J Oral Maxillofac Surg* 1997;35:157-60.
2. Manganello-Souza LC, Mariani PB. Temporomandibular joint ankylosis: report of 14 cases. *Int J Oral Maxillofac Surg* 2003; 32:24-9.
3. Toyama M, Kurita K, Koga K, Ogi N. Ankylosis of the temporomandibular joint developing shortly after multiple facial fractures. *Int J Oral Maxillofac Surg* 2003; 32:360-2.
4. Kazanzian VH. Temporomandibular joint ankylosis. *Am J Surg* 1955; 90: 905.
5. Chidzonga MM. Temporomandibular joint ankylosis: review of thirty-two cases. *Br J Oral Maxillofac Surg* 1999;37:123-6.
6. 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 Feb;87(2):166-9.
7. Kaban LB, Perrott DH, Fisher K. A protocol for management of temporomandibular joint ankylosis. *J Oral Maxillofac Surg.* 1990 Nov;48(11):1145-51.
8. Erdem E, Alkan A. The use of acrylic marbles for interposition arthroplasty in the treatment of temporomandibular joint ankylosis: follow-up of 47 cases. *Int J Oral Maxillofac Surg.* 2001 Feb;30(1):32-6.
9. Smith JA, Sandler NA, Okazi WH, Braun TW. Subjective and objective assessment of the temporal myofascial flap in previously operated temporomandibular joints. *J Oral Maxillofac Surg* 1999; 57: 1058–1065.
10. Su gwan K. Treatment of temporomandibular joint ankylosis with temporalis muscle and fascia flap. *Int J Oral Maxillofac Surg* 2001; 30: 189–193.
11. Pogrel MA, Kaban LB. The role of a temporalis fascia and muscle flap in temporomandibular joint surgery. *J Oral Maxillofac Surg* 1990; 48: 14–19.
12. Karaca C, Baructu A, Menderes A. Inverted, T-shaped silicone implant for the treatment of temporomandibular joint ankylosis. *J Craniofac Surg* 1998; 9: 539–542.
13. Salins PC. New perspectives in the management of craniomandibular ankylosis. *Int J Oral Maxillofac Surg* 2000; 29: 337–340.

14. Dechamplain RW, Gallagher CS, Marshall ET. Autopolymerizing silastic for interpositional arthroplasty. *J Oral Maxillofac Surg* 1988; 46: 522–525.
15. Kalamchi S, Walker RV. Silastic implant as a part of temporomandibular joint arthroplasty. Evaluation of its efficacy. *Br J Oral Maxillofac Surg* 1987; 25: 227–236.
16. Rowe NL. Ankylosis of the temporomandibular joint. Parts 1, 2 and 3. *J R Coll Surg Edinb* 1982;27:67-79,167-1731.
17. Ko EW, Huang CS, Chen YR. Temporomandibular joint reconstruction in children using costochondral grafts. *J Oral Maxillofac Surg*. 1999;57:789-98.
18. Lata J, Kapila BK. Overgrowth of a costochondral graft in temporomandibular joint reconstructive surgery: an uncommon complication. *Quintessence Int*. 2000;31:412-4. 16.
19. Siavosh S, Ali M. Overgrowth of a costochondral graft in a case of temporomandibular joint ankylosis. *J Craniofac Surg*. 2007;18:1488-91.
20. Perrott DH, Umeda H, Kaban LB. Costochondral graft construction/reconstruction of the ramus/condyle unit: long-term follow-up. *Int J Oral Maxillofac Surg*. 1994;23:321-8.
21. Snyder CC, Levine GA, Dingmen DL. Trial of a sternoclavicular whole joint graft as a substitute for the temporomandibular joint. *Plast Reconstr Surg* 1971;48:447-452
22. Ellis E III, Carlson DS. Histologic comparison of costochondral, sternoclavicular and temporomandibular joints during growth in maccacamulatta. *J Oral Maxillofac Surg* 1986;44:312-321