Use of T.M.J. Disc as a Soft Tissue Interpositional Graft Material for Functional Rehabilitation of Ankylosed T.M. Joint

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Abstract

Introduction Many surgical techniques have been described for the treatment of TMJ ankylosis, but no strategy has been uniformly agreed upon underscoring the difficulty of the problem. Despite new guidelines and updated methods, treating patients with TMJ Ankylosis remains a challenge as the incidence of recurrence after treatment is soaring. This study exemplifies our experience in using an unsullied method to treat TMJ Ankylosis to restore the structure of TMJ in conjunction with convalescing secondary maxillofacial deformity.

Materials and Methods A total of 56 cases of unilateral bony TMJ ankylosis were included in the study, and postoperative results of T.M.J disc as a soft tissue interposition graft was evaluated. The operative protocol comprised of (1) resection of ankylotic mass, (2) intraoral ipsilateral coronoidectomy or contralateral coronoidectomy

when needed, (4) interpositioning disc as soft tissue graft, (5) interposing and fixing sternoclavicular or costochondral graft with lag screws and (6) early mobilization, aggressive physiotherapy.

Results The study assessed patients with regular follow-up checks for a period of 3 years. The average preoperative mouth opening was found to be 5.46 mm (range 2–10 mm). Mean post-operative mouth opening was 33.05 mm (range 24–43 mm), while 3 years post operative mouth opening (mean) was 39.75 mm. No cases of reankylosis were reported during this period suggesting it as a viable and satisfactory approach.

Conclusion The use of TMJ disc as a soft tissue interpositional graft material is an effectual method for functional rehabilitation of ankylosis cases and serves as an effective means of preventing recurrence.

Keywords TMJ Ankylosis · T.M.J disc · Soft tissue interposition graft

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Introduction

It has rightly been said that a child learns to explore his world through his mouth. Any pathology that affects the temporomandibular joint and restricts mouth opening carries a mental stigma that outweighs the physical disability posed by the problem in growing children. Furthermore, it can have a profoundly negative influence on the psychosocial development of the patient because of the obvious facial deformity, which worsens with growth. The temporomandibular joint (TMJ) plays a critical role in speech, mastication, and swallowing [1, 2]. This bilateral, diarthrodial, and ginglymoid joint is not exempt to injury. The structures that can be damaged include the bony

components (the condyle and the glenoid fossa) and their associated fibrocartilage articular surfaces, the articular disk, and the synovial lining of the superior and inferior joint space.

Temporomandibular joint (TMJ) ankylosis is an intracapsularfibrous adhesion or bony union of the disc-condyle complex to the temporal articular surface that restricts mandibular movements between condyle, disc, glenoid fossa, and eminence [3].

Temporomandibular ankylosis has been principally classified into four types (I, II, III and IV). This classification was based on the anatomical relationship as shown by joint tomography. Ankylosis Type I is characterized by fibrous adhesions being formed around the joint, which presents with reduced intra-articular space causing restricted condylar sliding with consequent limitation of mandibular movement. The formation of a bony bridge between the condyle and the glenoid fossa in the lateral aspect of the joint is termed type II ankylosis. The type III ankylosis usually involves a detachment from the medial condyle resulted from an untreated or inadequately treated fracture in which the displaced stump is ankylosed to the condylar fossa through a bone bridge. In type IV ankylosis, the TMJ architecture gets disorganised and is replaced by bone in a fusion between all its structures [4, 5].

It is a consequence of trauma, infection, and inadequate surgical treatment of the TMJ region. Cases of congenital ankylosis are rare. It is a condition noticed soon after birth, with no known causal factor, but may be associated with a traumatic sequela caused during delivery. This change goes unnoticed until the child begins to perform jaw movements in an attempt to chew food. Such patients endure limited opening of the mouth, speech impairment, and difficulty in mastication along with poor oral hygiene. Moreover it is frequently associated with residual deformity in the form of facial asymmetry, mandibular micrognathia and deviation of the midline which significantly increases during function. Disturbances of facial and mandibular growth and acute compromise of the airway invariably result in physical and psychological disability [6]. This extremely disabling affliction hindering the integrity of craniofacial skeleton calls for a unique approach towards its rehabilitation. Many surgical techniques have been described for the treatment of TMJ ankylosis but no strategy has been uniformly agreed upon underscoring the difficulty of the problem. Despite new guidelines and updated methods, treating patients with TMJ ankylosis remains a challenge as the incidence of recurrence after treatment is high. This study exemplifies our experience in using an unsullied method to treat TMJ ankylosis to restore the structure of TMJ in conjunction with convalescing secondary maxillofacial deformity.

Aims and Objective

The study primarily advocates the use of TMJ disc as a soft tissue interpositional graft material for functional rehabilitation of ankylosis cases. It focuses on assessing the efficacy of interpositioning as an effectual means of preventing recurrence.

Materials and Methods

Cases of temporomandibular joint ankylosis attending Oral and Maxillofacial Surgery outpatients department were included. In a 3 year period, patients with unilateral bony TMJ ankylosis and cases with minimum 30 months post operative follow-up were incorporated. A total of 56 cases of unilateral bony TMJ ankylosis were selected, investigated and taken up for surgery under general anesthesia. All patients underwent preoperative clinical and radiographic examination. Clinic examination included facial appearance, maximal mouth opening, and occlusion. The surgical findings were compared with the imaging features and computed tomography (Figs. 1, 2).

Patients were kept fasting overnight. Intravenous antibiotics and corticosteroids were started 12 h before surgery and were continued for 72 h post-operatively. Blind or fibroptic nasotracheal intubation was done.

Gauze was placed gently in the external auditory meatus. An extended preauricular/al-kayatbramley's incision was used to approach the ankylosed temporomandibular joint and deepened to the superficial temporal fascia by using blunt or sharp separation through the front auricular cartilage (Figs. 3, 4) [7, 8].

A skin flap was elevated and the superficial temporal vessels were retracted anteriorly. The ankylosed mass was exposed and resected as radically as possible until the

Fig. 1 Photograph showing mouth opening pre-operatively

Fig. 2 Photograph showing three dimensional CT reconstruction of affected TMJ

Fig. 4 Photograph showing the ankylotic block in the temporo-mandibular joint

Fig. 3 Photograph showing extended preauricular incision used to approach the ankylosed temporomandibular joint and deepened to the superficial temporal

Fig. 5 Photograph showing resected ankylosed mass

mandible could be moved freely without resistance and a minimum gap of 1.5 cm was created (Figs. 5, 6).

Ipsilateral and at times contralateral coronoidectomy was done if found necessary in accordance with Kaban's protocol [9]. By extending the field of blunt dissection TMJ disc was searched, which was usually found attached to the medially displaced condyles. The disc was used as soft tissue interposition graft to cover the raw surface of temporal bone before restoration of ramal height (Fig. 7).

Sternoclavicular or costochondral autogenous graft was interposed and fixed with the help of screws. Wound was flushed copiously with saline and closed in layers. Pressure bandage was applied (Figs. 8, 9, 10, 11)

Jaw physiotherapy was initiated from the day following surgery with its gradual increase in intensity according to patient's tolerance and cooperation. All patients were then kept at regular follow up sessions (Figs. 12, 13).

Fig. 6 Intraoperative interincisal opening of 31 mm achieved

Fig. 7 Following blunt dissection TMJ disc was searched and was used as soft tissue interposition graft to cover the raw surface of temporal

Fig. 10 Costochondral autogenous graft interposed and fixed with the help of screws

Fig. 8 Rib exposed for obtaining costochondral graft

Fig. 11 Suturing and closure of wound done in layers

Fig. 9 The excised costochondral graft

Fig. 12 Post-operative three dimensional CT reconstruction of the treated temporomandibular joint

Fig. 13 Photograph showing inter-incisal post-operatively of the same patient as shown in Fig. 1

Results

Out of 56 patients (Males–21; Females–35), disc could be identified in 33 patients which accounted to 58.93 %. The mean age of patient was 13.8 years and most frequent age group was 9–17.5 years. Aetiologically, trauma could be traced in 19 cases in males and 33 cases amongst females. Infection was reported in just two cases amidst females while one in case of males along with one case of unknown etiology found in males. Average preoperative mouth opening was around 5.46 mm (range 2–10 mm). The postoperative maximal mouth opening was 33.05 mm. (range 24–43 mm), revealing significant change in maximal mouth opening postoperatively. Three years post operative mouth opening (mean) was 39.75 mm. Postoperatively, all patients displayed uneventful healing without complications such as postoperative haemorrhage or infection. Average post-op follow up was 36.58 months. In one case there was post operative infection and the costochondral graft was removed. No case reported with reankylosis over a period of three years.

Discussion

Trauma remains the key aetiology behind TMJ ankylosis, followed by infection. In a retrospective analysis by Roychoudhury et al. [10] studying 50 cases of TMJ ankylosis, trauma was documented as a primary etiologic factor in 86 % of cases. This has been attributed predominantly to deferred treatment or non treatment of condylar fractures due to various reasons including deprived awareness, unavailability of surgical expertise along with non diagnosis or misdiagnosis. Moreover prolonged non usage of

the joint consequent to injury, owing to fear of pain in children often facilitates ankylosis.

The diagnosis of ankylosis can be done by history, physical examination and imaging. A CT scan is a great method for evaluation of bone lesions, having the disadvantage of having high cost. Conventional radiographs when used, must be carefully taken, as they have the disadvantage of image distortion, loss of contour, plus overlapping image. In our case, imaging examinations used were plain radiographs and computed tomography for better diagnosis and completion of treatment plan, as supported by the literature.

The treatment of TMJ ankylosis remains an uphill battle because of technical difficulties and a high incidence of recurrence. TMJ ankylosis protocols throughout the world suggest timely intervention, elaborate resection, early mobilization and aggressive physiotherapy for at least 6 months postoperatively. The goals of surgical interventions are complete release of ankylosis ensuring definitive reconstitution of form and function.

Diverse surgical techniques have been described including gap arthroplasty, interpositional arthroplasty, joint reconstruction, and so on, but the results have been capricious [11].

Sufficient amount of bone should be removed to create at least 1.5 cm gap. Ipsilateral and at times contralateral coronoidectomy should be performed to achieve good mouth opening. Raw surface of created glenoid fossa should be covered with soft tissue. The TMJ disc may be intact and can be used for this purpose. Based on our experience, the disc may exist outside the ankylotic fibrous and bony mass in traumatogenic TMJ ankylosis.

Laskin, in 1978, emphasized the role of the disc in preventing posttraumatic TMJ ankylosis [12].

Kirk and Ferra [13] have reported good results with the release of postinfection ankylosis in the TMJ, associated with preservation of the condyle and disc.

Chuong and Piper [14] reported that the TMJ disc was predictably dislocated in the same direction as the condylar head, and reduction and repair of the dislocated disc simultaneously with fixation of the fracture was recommended. Miyamoto et al. [15] confirmed that the presence of the disc prevented the development of fibrous intra-articular ankylosis of the TMJ in a sheep model for TMJ ankylosis.

Long term physiotherapy and follow up is must. Orthognathic surgery/distraction osteogenesis should be performed to correct facial asymmetry either simultaneously or at suitable time thereafter.

A study on animal models by Matsuura et al. [16] focusing on the anatomic and functional changes after gap arthroplasty demonstrated that gap arthroplasty for TMJ

did not restore its functions and histology to its pre-existing states.

Interpositioning is a good means of limiting resection and preventing recurrence and this particular aspect of the treatment has been the subject of numerous discussions. [17, 18]

Chossegras et al. [19] stated that during interpositioning the extent of bony resection depended on the size of the ankylosis but never exceeded 1 cm to avoid excessive shortening of the ramus.

When interpositional arthroplasty is used, one must take into account the risk of a foreign body reaction (alloplastic materials) and donor site morbidity (autogenous materials). With this method, 3 years post operative mouth opening (mean)—39.75 mm was noted.

In a comparative study, Topazian observed a recurrence rate of 53 % in patients who underwent extensive resection without interposition versus 0 % in patients who underwent limited resection with interposition [20].

Varied interposition materials have been advocated intending to avert recurrence in the treatment of TMJ ankylosis including temporalis muscle, skin, homologous cartilage, silicon sheet, etc. Interpositional arthroplasty is assumed to curtail the reduction in vertical height of the ramus along with the risk of relapse [21]. In our case, after the completion of the arthroplasty and removal of ankylotic mass and after tissue manipulation, the articular disc was detected in the medial portion of the articular cavity with its integrity preserved, and it was used as interpositional material of choice.

The nature of disc serves as an ideal interpositional graft material [22]. Its thickness and resilience is adequate to support the masticatory load. The size of the disc is sufficient to cover the raw surface of glenoid fossa. Disc being a natural inhabitant of the region, fear of rejection is negligible. The attachment to Lateral Pterygoid is retained therefore good functional rehabilitation is ensured. As blood supply is partially retained chances of avascular necrosis and subsequent infection are minimal. Furthermore the procedure saves time, is economical and avoids morbidity associated with an extra surgical site.

As disadvantages, there is the possibility that the articular disc is present structurally compromised, perforated or even nonexistent, and the difficulty in maintaining this disc in the correct position and without tension.

Conclusion

In summary, the results suggest that disc repositioning in the treatment of TMJ ankylosis is a feasible and effective approach. By restoring the normal structure of the TMJ and preservation of disc recurrence of TMJ

ankylosis and facial deformity in younger patients can be prevented.

Compliance with Ethical Standards

Conflict of interest All authors declare there is no conflict of interest.

Ethical Approval As this article contain studies with human participants ethical approval was taken.

Informed Consent Obtained.

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