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# Functional Restoration by Interpositional Arthroplasty with Temporalis Myofascial Flap in Temporomandibular Joint Ankylosis - A Clinical Study.

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## ABSTRACT

**Background:** Purpose: The purpose of this clinical study was to evaluate the functional restoration by interpositional arthroplasty with temporalis myofascial flap in temporomandibular joint ankylosis. **Methods:** After obtaining consent, the procedure were explained to the patient and each of the patients who met the inclusion criteria of the present study were randomly selected. Preoperatively all required investigations were done, fitness opinion for surgery and general anaesthesia was obtained, preoperative mouth opening / interincisal distance was measured with calliper, occlusion recorded, and midline shift was assessed. Surgical procedure (interpositional arthroplasty with temporalis myofascial flap) was carried out under general anaesthesia with endotracheal intubation. And patient was followed for about six months and following parameters were recorded. Mouth opening / interincisal distance, occlusion, Midline shift, Pain and Diet (solid/liquid). **Results:** In the present study, the temporalis myofascial flap was evaluated to be efficient in preventing the reankylosis. Preoperatively the mean interincisal opening was 6.93mm and post-operatively after a period of 6 months follow-up it remained as 34.93mm. **Conclusion:** The temporalis myofascial flap is an efficient interpositional material. It is a biologic, autogenous tissue, so there is no question of any rejection. The results of this study indicate that the use of temporalis muscle and fascia flap is effective in treating TMJ ankylosis.

***Keywords:*** Temporalis Myofascial Flap, Temporomandibular Joint Ankylosis.

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## 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 jaw.[1] The TMJ ankylosis is an extremely disabling affliction that causes problems in mastication, digestion, speech, appearance, and hygiene. In growing patients, deformities of mandible and maxilla may occur together with malocclusion1. Temporomandibular joint (TMJ) ankylosis is a very distressing structural condition that denies the victim the benefit of a normal diet and opportunities in careers that require normal speech ability. It also causes severe facial disfigurement that aggravates psychological stress. Temporomandibular joint ankylosis during early childhood may lead to disturbances in growth, or cause asymmetry and serious difficulties in eating and breathing during sleep.[4]

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This ailment is caused by various factors including trauma, systemic and local inflammatory conditions, as well as neoplasm in the TMJ area.[4] Intraarticular ankylosis most commonly occurs after trauma or infection, whereas extra articular type can occurs by a large variety of disorders including myogenic, neurogenic and inflammatory processes, bone and soft tissue tumors.[6] Post-traumatic TMJ ankylosis may have several causative factors. Among these, disc displacement may be one of the most prevalent.[9] The clinical presentation of the patient with TMJ ankylosis is well documented.[2] TMJ ankylosis is classified into true or intraarticular and false or extra articular types.

Ankylosis may be classified according to location (intra-articular vs. extra-articular), type of tissue involved (bony, fibrous, or mixed), and extent of fusion (complete vs. incomplete). True ankylosis is caused by either fibrous or bony fusion of the structures contained within the TMJ capsule and, in its most severe state, is characterized by a bony union of the condyle to the glenoid fossa.

True ankylosis has been further classified into subtypes depending on the anatomic Positioning of the condyle and the extent of bridging bone. False ankylosis (pseudoankylosis), describes limited mobility based on extra-articular Factors such as

fibrosis, mechanical obstruction (e.g., zygomatic arch fracture), muscle spasm, or other pathologies.

Kazanjian (1938) classified TMJ ankylosis according to the site involved into true (intracapsular) and false (extracapsular) ankylosis. Intracapsular ankylosis refers to fibrous or bony ankylosis that occurs between the condylar head of the mandible and the mandibular fossa of the temporal bone. While extracapsular ankylosis refers to restriction of mandibular movement that occurs as result of pathology or physical obstruction that is outside the TMJ.[14]

**Topazian proposed a three-stage classification to grade complete ankylosis as follows:**

Stage I, ankylotic bone limited to the condylar process

Stage II, ankylotic bone extending to the sigmoid notch

Stage III, ankylotic bone extending to the coronoid process.[12]

In 1985, Sawhney classified TMJ ankylosis into four types according to severity. This classification is supported by tomographic observations.

TYPE I: Fibrous adhesion around the TMJ, inter-articular space reduction causing condylar displacement restriction.

TYPE II: Bone bridge formation between the condyle and glenoid fossa.

TYPE III: When a fracture of condylar process presents and the condyle (head and neck) suffers ankylosis to the glenoid fossa.

TYPE IV: The whole TMJ architecture is replaced by a bone fusion of condyle, sigmoid notch and coronoid process to the glenoid cavity.[13]

Management of TMJ ankylosis is mainly through surgical intervention4. Various procedures have described for the treatment of TMJ ankylosis in the literature. These include gap arthroplasty, interpositional arthroplasty and total joint reconstruction using alloplastic or autogenous materials.[6]

The goal for the release of the ankylosed mass and creation of a gap to mobilize the joint is to achieve normal facial growth and correction of deformity in children, improve functional movement of the mandible, prevent relapse, relieve airway obstruction if present, restore occlusion and facial symmetry in adults facilitates maintenance of good oral hygiene.[2]

The displacement of the disc causes the absence of a barrier, which would normally hinder the establishment of a bony bridge triggered by the post-traumatic responses. On the basis of this concept, various modified interposition arthroplasties using synthetic material have been used in the surgical management of TMJ ankylosis.[9]

It is necessary to use an interpositional material to prevent TMJ re-ankylosis after arthroplasty, and this particular aspect of the treatment has been the subject of numerous discussions.[4]

Since 1893, interpositional arthroplasty has been an advocated treatment method in which an autogenous tissue or alloplastic material is inserted into the gap, separating the bone ends.[6]

Numerous materials have been interposed between the resected bone surface and articular fossa at the base of the skull. Alloplastic materials such as silicone, silastic, proplast, Teflon, rubber prosthesis, metals, methyl methacrylate; and autogenous material such as full thickness skin, dermis, fascia, auricular cartilage, fat, Lyodura, costochondral graft, metatarsals, metacarpophalangeal joint transfer, sternoclavicular joint transfer and temporalis muscle and fascia have been used.[3]

Non-biologic materials like acrylic though cost effective and less time consuming present the risk of foreign body reactions, hypersensitivity and slippage. Silicone also has a tendency to slip from the implanted position. Lyodura is abandoned due to the possible transmission of Creutzfeldt-Jakob disease. Autogenous materials present problem of a second surgical site.[3] Whatsoever may be the type, early surgical correction of the deformity soon followed by jaw mobility exercises should be encouraged in order to get good results out of surgery and also prevent future reankylosis.

Surgical intervention by resection of the ankylotic mass through gap arthroplasty alone resulted in reankylosis. Attempts have been made to prevent such reankylosis with interpositional arthroplasty.[3] Temporalis Myofascial flap due to its proximity to the joint and high vascular supply has been considered as one of the best interpositioning materials used.[3] The present study has been designed to assess functional restoration by interpositional arthroplasty with temporalis myofascial flap in temporomandibular joint ankylosis. TMJ development takes place mostly between the 7th and 20th week of intrauterine life and a particularly sensitive period is morphogenesis between the 7th and 11th week. A particular feature of TMJ development compared to other joints in the human body is mutual approximation of the initial condylar and temporal base (blastemal). There are three stages in TMJ development: blastemic stage (7th-8th week; development of the condyles, articular fossa, articular disk and capsule), cavitation (9th-11th week; beginning of lower joint space development and condylar chondrogenesis), and maturation stage (after the 12th week). The tiny eminences on the ascending ramus of the mandible are the bases of the condylar and the coronoid processes.

In the period of the 11th and 12th week, the articular fossa can be concave, convex or completely flat. Due to the forming of articular spaces, the articular disk is thinner in the middle section, which later creates a characteristic biconcave shape. From the 12th week, it is in its permanent position between the temporal bone and the condyle. Its cartilaginous

structure is clearly visible between the 15th and 20th week. In the 11th week, the capsule is positioned between the zygomatic arch of the temporal bone and the condyle and it is attached to the outer portion of the articular disk. The secondary TMJ is fully developed after the 14th week of intrauterine growth, anteriorly from the otic capsule, and after the 16th week it assumes the primary joint function. The ossified parts of the primary joint (malleus and incus) become part of the middle ear.[11]

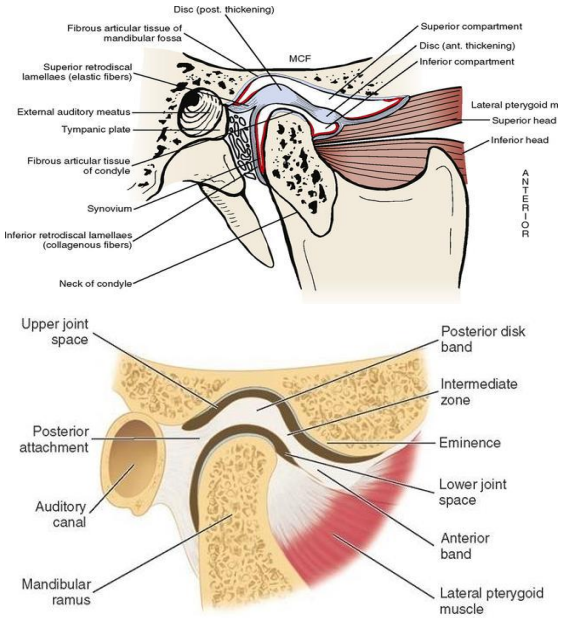


**Figure 1 & 2: Showing Anatomy of TMJ.[16]**

**Anatomy of The Temporalis Muscle Flap**

A description of pertinent structure for clarity and consistency of terminology and a detailed review of the vascular anatomy of the temporal muscle flap are necessary because of the variation in anatomic terms that are used in this area of the body. The temporalis fascia, often referred to as the deep temporal fascia, is a strong fibrous aponeurotic sheath that covers the temporalis muscle and gives origin to some of its fibres. It is attached superiorly to the entire extent of the superior temporal line and extends below to the zygomatic arch it is the most cranial extension of the deep fascia that eventually blends into the pericranium. It is covered by the skin, temporal parietal fascia, and loose areolar tissue from superficial to deep; the orbicularis oculi muscle anteriorly; and the superficial temporal vessels and the auriculotemporal nerve posteriorly. Its superior portion is a thin single sheet that becomes thickened inferiorly where it splits approximately 2 cm above the malar arch into two layers of temporalis fascia that attach to the medial and lateral aspect of the zygomatic.

A small quantity of fat, the zygomatic-orbital branch of the superficial temporal artery, and the zygomaticotemporal branch of the maxillary nerve are contained between these two layers of temporal fascia. At the level of the malar arch, the periosteum blends superiorly with the inner and outer layers of temporal fascia and inferiorly with the masseteric fascia. The temporal muscle is a bipennate muscle that occupies the temporal fossa of the side of the head, an area outlined by the superotemporal line and the zygomatic arch. The superficial muscle fibre arises from the periosteum (pericranium) of the temporal fossa and from overlying temporal fascia. The deep fascia of the temporal muscle arise from roof of the infratemporal fossa and the infra temporal crest. The thickness of the muscle varies from 15 mm at the level of the zygomatic arch to 5 mm at its peripheral boundary. The thin peripheral muscle fibres converge as they descend inferiorly to form a thick tendon, which passes medial to the arch and insert onto the anterior border and medial surface of coronoid process of the mandible, continuing inferiorly and anteriorly to the last molar.

Maintenance of the blood supply to the flap is critical to maintaining its viability; therefore, a clear understanding of its vascular supply and distribution is paramount to its success. These arteries originate from the second portion of the internal maxillary artery and the superficial temporal artery. The anterior deep temporal artery, a branch off the internal maxillary artery, enters the deep side of the temporalis at its anteroinferior aspect, inferior to the superior edge of the zygomatic arch. The posterior deep temporal artery, the remaining branch off the internal maxillary artery, enters the middle portion of the muscle at its inferomedial aspect and runs upward to the cephalic part of the muscle oblique to the arrangement of the muscle fibers.

The middle temporal artery, a branch derived from the superficial temporal artery, enters the posterior portion of the muscle from its lateral aspect as the superficial temporal runs in a cephalic direction. The veins and venules generally run closely with the corresponding arteries and arterioles.

Innervation of the temporalis muscle is derived from the anterior and posterior deep temporal nerves, which are branches of the anterior division of the mandibular branch of the trigeminal nerve.[7]

## MATERIALS & METHODS

**Study Design:** The study design was a prospective clinical study.

**Sampling Method:** Convenient sampling method were used to select the sample group as per the inclusion and exclusion criteria after obtaining the required consent.

**Sample Size:** in our study we took a sample size of 15 cases.

**Procedure**

After obtaining consent, the procedure was explained to the patient and each of the patients who met the above said criteria were randomly selected.

Preoperatively all required investigations were done, fitness opinion for surgery and general anaesthesia was obtained. A diagnosis of unilateral / bilateral TMJ ankylosis was mainly obtained with the help of extra oral and intraoral examinations and OPG. Rarely PA view and special views like submentovertex (SMV) were used to assess coronoid. CT scan (axial and coronal views, 3D-CT) was done in all patients in order to know the medial extent of the ankylotic mass. The parameter taken was Maximum Interincisal Opening (MIO) & midline shift taken at different periods measured in millimetres, i.e. preoperative, immediate post-operative, 6 month postoperative. Preoperative occlusion & post-operative occlusion recorded. Pain was measured on the basis of grades using Verbal rating scales15 No pain = 0, mild pain = 1, moderate pain =2, severe pain =3. Diet (solid/liquid) pre operatively and post operatively noted. Pre-operative and post-operative photographic record was maintained.

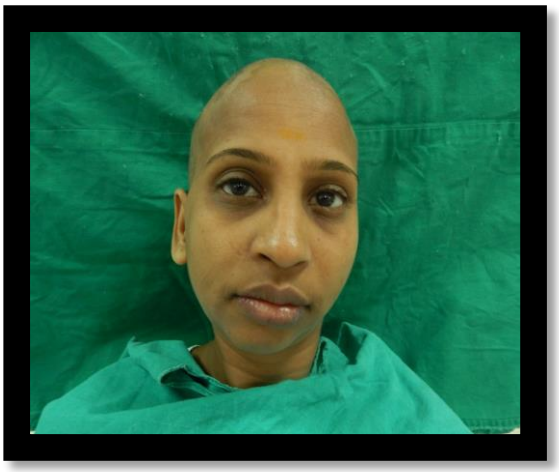

**Figure 3: Shows Pre -Operative Facial Profile.**

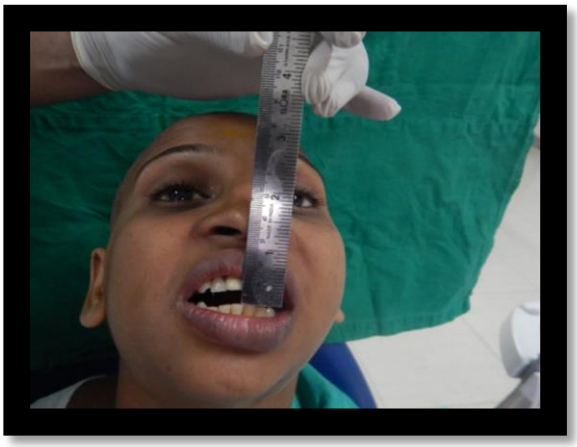

**Figure 4: Pre-Op Maximum Interincisal Opening (Mouth Opening).**

Informed consent for difficult intubation and emergency tracheostomy was obtained from all patients/guardians in case of minors. All procedures were performed under general anaesthesia with nasotracheal intubation or tracheotomy if mouth opening was severely limited. Since the advent of the fibro scope, the need for tracheotomy has become rare. The patient was scrubbed, painted and draped according to standard surgical protocol. The external auditory canal was lightly packed with Vaseline gauze. After an Al-Kayat and P Bramley incision, the temporalis muscle was lifted from the infratemporal fossa towards the anterior at the pericranial level, while the zygomatic root was uncovered. An avascular tissue plane along the cartilaginous meatus was established using surgical scissors. The ankylosed TMJ was palpable and an incision was made directly onto the bone, exposing the ankylosed TMJ. Excision of the fibrous tissue and ankylotic bony mass was carried out using drill and saw. The TMJ was lined with a temporalis muscle and fascia flap rotated over the arch into the joint. The flap was sutured medially, anteriorly, and posteriorly with 4-0 Vicryl. Postoperative pain medications, vigorous postoperative physiotherapy and continuous passive motion (CPM) therapy were performed to maintain the mobility obtained during surgery and to prevent postsurgical hypo mobility secondary to fibrous adhesions. A nonsteroidal anti-inflammatory drug (NSAID) was used for approximately 2–4 weeks after the Operation. The patients were started on a soft diet and jaw-opening exercises using stacked tongue depressors and bilateral rachet mouth props.

Intensive physiotherapy, at a rate of six sessions a day, was begun as early as possible with the goal of obtaining the same joint mobility as during the operation (opening, forward movement, lateral movement) as quickly as possible. Physiotherapy was continued for several months until no further progress could be achieved. Follow-up consisted of regular clinical examination with measurement of the interincisal opening distance. Panoramic radiographs and CT scan were performed at pre-defined intervals.

## RESULTS & DISCUSSION

The purpose of this study was to evaluate functional restoration by interpositional arthroplasty with temporalis myofascial flap in temporomandibular joint ankylosis, by clinically evaluating maximum interincisal opening / mouth opening, midline shift, occlusion, pain, diet.

There was no marked difference between males and females in the incidence of temporomandibular joint ankylosis. The condition almost equally in both sexes, being slightly more common in males. In the present study of 15 patients, eight (53.3%) were males and seven (46.7%) were females.

The reported age distribution in the present study of 15 patients, about 17-21 years age group 6

(40%)patients, 22-26years age group 4 (26.7%) patients, 27-31years age group 2 (13.3%) patients, 32-36 years age group 3 (20%) patients reported the onset of ankylosis respectively.

**Figure 5: AL-Kayat and Bramley Incision.**

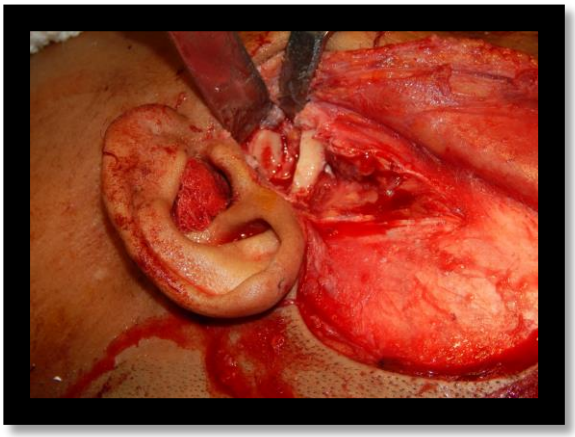

**Figure 6: Gap Arthroplasty.**

**Figure 7: Interpostional Arthroplasty with Temporalis Myofascial Flap.**

The main causes of TMJ ankylosis are trauma and infection. In the present study cause of TMJ ankylosis are trauma 12 patients (80%) and infection 3 patients (20%). TMJ ankylosis was unilateral in 8 patients (53.3%) and bilateral in 7 patients (46.7%). The administration of anaesthesia to patients with TMJ ankylosis is a challenge in as much as securing the airway can be very difficult. However, in the present study in seven patients intubation was via tracheostomy and fibre optic intubation was done in eight patients.

**Figure 8: Post Operative Maximum Interincisal Opening (Mouth Opening).**

All patients had positive post-operative MIO, outcome between 26-44mm ($p<0.001$) 6 month post operatively. The results were statistically significant using One Way ANOVA test. Mean difference of 28.00 mm ($p<0.001$) between preoperative and post-operative interincisal opening after a period of 6 month follow up. The results were statistically significant using Pair wise comparison between the visits using tukey test.

The outcome of midline shift 6 months post operatively was mean 0.53mm ($p<0.001$). The results were statistically significant using One Way ANOVA test. Mean difference of 4.66 mm ($p<0.001$) between preoperative and post-operative midline shift after a period of 6 month follow up. The results were statistically significant using Pair wise comparison between the visits using tukey test.

The outcome of occlusion 6 months post operatively, chi square value = 1.49 ($p<0.960$). The results were statistically not significant using Chi Square test.

The outcome of pain 6 months post operatively,chi square value = 45.00 ($p<0.001$). The results were statistically significant using Chi Square test.

All patients had liquid diet pre operatively (n=15) 100 % and 6 months post operatively all patients (n=15) 100% had solid diet.

## CONCLUSION

The temporalis myofascial flap is an efficient interpositional material. It is a biologic, autogenous tissue, so there is no question of any rejection. It is a pedicled flap, so it maintains its viability. It can be procured by the same incision used for exposure of the joint. It is easily mobilized and made to cover the complete area of the glenoid fossa. Thus it acts as a barrier and prevents the chances of reankylosis to a greater extent. The results of this study indicate that

the use of temporalis myofascial flap is effective in treating TMJ ankylosis.

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