TMJ ANKYLOSIS: A MULTI PROBLEMATIC DISORDER OF TEMPOROMANDIBULAR JOINT

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ABSTRACT

Temporomandibular joint ankylosis results in multiple problems in development of an individual both physically and psychologically. Severe facial disfigurement or asymmetry in TMJ ankylosis is very distressing that can cause difficulty in breathing (dyspnea), eating (dysphagia), speech (dysarthric) and social reciprocation. Early ankylosis of TMJ in children deteriorates normal mandibular growth. Henceforth, early diagnosis along with immediate surgical intervention and management of TMJ ankylosis should be the necessity of the hour. True ankylosis is osseous or fibrous adhesion between the TMJ surfaces, limited within the articular capsule. Meanwhile, false ankylosis may be caused by conditions not directly related to the joint but due to factors like enlargement of the coronoid process, post surgical scars, irradiation, infection, etc. Formation of a bony mass replacing the articulation is archetypal pathology of TMJ ankylosis ensuing restricted mandibular movements. Consequently, its management emphasises on sufficient removal of bony mass and interpositioning some material between the left over ramus and skull base to allow free movement of the condyle. Interposition materials used can either be autogenous grafts (temporalis muscle and fascia, dermis, auricular cartilage, fascia lata, fat, and lyodura) or alloplastic materials (silastic, silicone, and various metals). Management of TMJ ankylosis requires an amalgamation of surgery and early physiotherapy to restore mandibular function and to prevent recurrence. Two critical issues ensuring successful results are the extent of bone resection and the choice of material if interposition is performed.

KEYWORDS: Temporomandibular joint, autogenous grafts, TMJ ankylosis.

INTRODUCTION

Ankylosis can be described as the stiffening (immobility) or fixation (fusion) of the joint manifesting as a chronic and painless condition with limited movements. Temporomandibular joint (TMJ) ankylosis is a structural disorder resulting in severe facial disfigurement causing facial asymmetry along with difficulty in eating, breathing, and speech. Ankylosis especially bilateral occurring before completion of facial growth can produce micrognathia. The term (TMJ) ankylosis refers to bony or fibrous adhesion of the anatomic joint components ensuing loss of their function.1 It is a very distressing structural condition aggravating psychological stress because of severe facial disfigurement and alters the patient's eating habits and speech ability. TMJ ankylosis occurs in children and adults. Early ankylosis of TMJ in children can deteriorate normal mandibular growth. Therefore, early diagnosis of TMJ ankylosis along with immediate surgical intervention and management should be the need of the hour.

Kazanjian classified TMJ ankylosis as either intra-articular (true) or extra-articular (false) ankylosis.

True ankylosis results in osseous or fibrous adhesion between the TMJ surfaces, limited within the articular capsule. It is one of the most distressed articular pathosis of TMJ, ensuing various physical and psychological disturbances. Any disturbance in the Condylar region (growth centre of the mandible) can provoke retardation in growth of the mandible resulting in impaired facial development. Bilateral true ankylosis of TMJ inhibits movement of mandible completely, creating difficulties in speech, mastication and swallowing. It results in bird face appearance due to micrognathia of mandible. Unilateral TMJ true ankylosis causes lateral deviation of jaw to the unaffected side, due to normal growth on this side. This deviation causes a pronounced deformity on the normal side with deficiency on the affected side resulting in a noticeable facial asymmetry.

False ankylosis may be caused by conditions not directly related to the joint such as: depressed fracture of the
zygomatic arch, enlargement of the coronoid process, post surgical scars, irradiation, infection, etc.\textsuperscript{[2]}

Management of TMJ ankylosis is mainly performed through surgical intervention.\textsuperscript{[1,3,5]} Literature describes various techniques for the management, with no solo technique proving entirely satisfactory. Formation of a bony mass replacing the articulation is characteristic pathology of ankylosis that results in restricted mandibular movements. Therefore, treatment of TMJ ankylosis emphasises on removal of sufficient bony mass to allow free movement of the condyle and interposing some material between the left over ramus and skull base. Necessary use of an interpositional material to prevent TMJ reankylosis after arthroplasty or condylectomy has been the subdued point of numerous discussions. Use of allogenic interpositional materials may lead to serious complications like foreign body reaction and migration. Homografts like skin, temporalis muscle, or fascia lata, are the present material of choice for interposition.\textsuperscript{[3]} TMJ surgeries of near recent years advocated pedicled temporalis myofascial or temporalis fascia flap to treat the TMJ ankylosis. Close proximity to the TMJ without involving an additional surgical site, adequate blood supply, autogenous origin, and maintenance of attachment to the coronoid process provides movement of the flap during function. Simulating physiologic activity of the disc is the meritorious point of these flaps in TMJ reconstruction.

\textbf{DISCUSSION}

\textbf{Etiopathogenesis And Clinical Features}

Common aetiologies include prolonged maxillary-mandibular fixation, infection, trauma, forceps delivery, degenerative joint disease and prior gap arthroplasty. Thus, in a majority of cases TMJ ankylosis may be post-traumatic or post-surgery for TMJ disease. Rheumatoid Arthritis, Sickle Cell Anaemia and Fibrodysplasia Ossificans Progressiva are more unusual etiological factors.\textsuperscript{[4]} Factors like trauma, neoplasms, systemic and local infections in the area are the prime etiologic factors of TMJ ankylosis. Laskin reported a high incidence of post-traumatic ankylosis in children.\textsuperscript{[5]}

Ankylosis is defined as loss of joint movement resulting from fusion of bones within the joint or calcification of the ligaments around it. Generally calcification of the ligaments around the joint is non painful, with reduced mouth opening of about \( \leq 1 \) inch only. Bony fusion within the joint is the reason for pain and restricted jaw movement. Stretching exercises often aids people with calcification, but surgery is mandatory in people with calcification and bony fusion to restore the jaw movement.

According to Graziani, patients with a TMJ ankylosis have limited mouth opening of about 1-2 mm. Meanwhile, Zarb \textit{et al.} in patients with TMJ ankylosis recorded an interincisal opening of about 5-7 mm with restricted protrusion or lateral mandibular movement.\textsuperscript{[2,6]}

In unilateral cases, patients can have a lateral movement of 3-4 mm towards the affected side. Once the movements of the TMJ are restricted, pain is asymptomatic in ankylosis. The characteristic sign is the limited mouth opening movement. In general, patients related a history of progressive restriction of opening movement up to an unacceptable level of limitation. In some cases, the patient is hampered by a complete lack of mandibular movement.

Early ankylosis of the TMJ in children can deteriorate normal mandibular growth resulting in a mandibular hypoplasia, especially in bilateral cases.\textsuperscript{[7]} Due to the delayed growth and development of the affected areas, the effects of the ankylosis will be more evident as the child grows. The limited jaw development results in breathing problems, dental malocclusion and psychological problems.

\textbf{DIAGNOSIS}

Osseous ankylosis presents characteristic radiographic features, which facilitate the diagnosis. In general, it is observed that the condyle is bridged with a temporal bone. These present patients presented these radiographic features. It could be a small piece of bone or even a huge bone mass that could involve the condyle of the mandible, temporal bone and zygomatic process.\textsuperscript{[9,8]} In some cases, it is possible to note a radiolucent area inside the lesion, which represents a remanescant interarticular disc.

Diagnosis of a fibrous ankylosis is more difficult; since the soft tissue fibrosis is not visible by a conventional radiographic examination. Osseous components of the TMJ in fibrous ankylosis present a normal image, or small areas of erosion, but the joint space is reduced in association with a limited mandibular opening movement. TMJ osseous components may remodel as an attempt to adapt to the new situation.\textsuperscript{[9]} In this type of ankylosis, magnetic resonance image (MRI) provides better diagnostic information, once the alterations in the soft tissues are located.

Osseous alterations can be observed in conventional radiographic images, such as panoramic radiography, lateral mandibular projection, posteroanterior (PA) projection, lateral skull projection, submentovertex projection and transcranial projection. Since 1930, radiographic images have been used as an important diagnostic tool in TMJ diseases. A lot of new techniques and devices have been created in order to provide a better image. The major problems are the overlapping of structures and image distortion.\textsuperscript{[11]}

Conventional film-based tomography is designed to represent more clearly objects lying within a plane of interest. This is accomplished by blurring the images of superficial- and deep-lying structures adjacent to the plane of interest, resulting in no overlapping and better
diagnostic information. It is clearly possible to note the lesion edge and extension.

Since the introduction of computed tomography (CT), which has superior low-contrast resolution, film-based tomography has been used less frequently. CT provides more information about condyle, mandibular fossa, articular eminence and surrounding tissues. CT was the primary choice for examination in both cases presented in this paper. Switching the image slices, it is possible to evaluate the condyle medial pole and lateral pole as well as the central region.[10]

Data from sagittal and coronal slices are the most useful for studying TMJ ankylosis. Three-dimensional reformatted images have also been considered for determining the soft tissues and osseous component images. Currently, 3-dimensional computed reconstruction allows elaboration of realistic and spatially accurate images for diagnosis and surgical planning.

It is important to stress that no case of ankylosis should be treated without a previous radiographic diagnosis. This must include the projection, which provides all-important information about the lesion required to formulate an adequate treatment plan.

SURGICAL MANAGEMENT

To approach the TMJ area, a preauricular incision (hockey stick) with a temporal extension was planned. The incision line was then mapped out with marking ink. It was started just within the hairline, about one pinna's length above the ear, and curved anteriorly and inferiorly well behind the main branches of the temporal vessels to the uppermost skin attachment of the pinnea, following this anteriorly to the tragus and then moving endaurally and finally out again to the skin crease in front of the lobe of the ear and no further. Local anaesthetic containing a vasoconstrictor was injected beneath the line of incision not only to reduce bleeding, but also to define tissue plane. The incision was started at the temporal end and taken down to temporals fascia. In developing the flap from above, temporalis fascia was properly identified and the superficial fascia and preauricular fascia were lifted as part of the skin flap. Once in the right plane, the flap was quickly reflected using the back of the point of the scalpel blade. At about 2 cm above the malar arch, the flap development was stopped. At this stage, the skin was dissected off the cartilage of the tragus and its continuation as the cartilage of the external auditory canal using a no. 15 scalpel or blunt scissor blades and skin hooks. This dissection lead directly to the postglenoid tubercle and was at the same depth as the temporals fascia in the upper part of the flap development. The pocket between the lateral and medial layers of the temporals fascia was identified. Starting at the root of the malar arch, an incision running at 45 degrees upward and forward was made through the superficial layer of temporals fascia.

Once inside, this pocket of periosteum of the malar arch on its deeper surface was safely incised and raised as one flap with the outer layer of temporal fascia and superficial fascia containing the nerves. The frontal branch of the facial nerve lies in the superficial layer of the deep cervical fascia. The zygomatic branch of the superficial temporal artery was noted in the fat and was ligated. The pocket was extended to the posterior border of the frontal process of the malar bone. Posteriorly, the incision of the peristium was extended to the postglenoid tubercle. At this point, it joins the dissection close to the external cartilaginous canal, and further blunt dissection proceeded deep to the parotid gland and the superficial temporal vessels. When the full extent of peristeal incision had been completed, the tissues lateral to the joint capsule and condylar neck were reflected safely. The ankylosed TMJ was palpable and an incision was made directly onto the bone, exposing the ankylosed TMJ. Excision of the fibrous tissue and ankyloytic bony mass was carried out using a round burr until a thin cortical bone was left in the depth. To not injure the internal maxillary artery or pterygoid plexus of veins, two segments were gently split and fractured using a chisel. The irregular edges of the segments were shaved by burr and disconnected completely the ramus from the upper bony block. The TMJ was lined with a superficial layer of the temporals fascia flap rotated over the arch into the joint. The flap was sutured medially, anteriorly, and posteriorly with 4-0 absorbable (Polyglactin 910, Ethicon; Johnson & Johnson) suture material. Arch bars were placed following the lining of the joint. Repair was made from the inside through the outside. A modified mastoid pressure pad and bandage were used for the first 24 hours. Maxillomandibular fixation was maintained for 7 days. A nonsteroidal anti-inflammatory drug was used for 4 weeks after the operation. The patients were started on a soft diet and jaw-opening exercises using an interinsical metal gag with jack screw after the release of maxillomandibular fixation. Physiotherapy was started once a day for the first 2 weeks and once every 2 days for the next 2 weeks.[11]

Management of TMJ ankylosis requires a combination of surgery and early physiotherapy to restore mandibular function and to prevent recurrence. Two crucial issues in ensuring successful results are the extent of bone resection and the choice of material if interposition is performed.[12] The need to use an interpositional material to prevent TMJ re-ankylosis after arthroplasty in treatment of TMJ ankylosis has been widely discussed. Various interposition materials have been used, including autogenous materials (temporalis muscle and fascia, dermis, auricular cartilage, fascia lata, fat, and lydura) and alloplastic materials (silastic, silicone, and various metals).

Valentini et al.[9] evaluated the use of silastic as an interpositional material and reported that the relapse was favored by silastic inducement of foreign body granuloma. This material, first used in arthroplasty by
Clauser et al carried out reconstruction with the temporalis myofascial flap in 182 cases specifically for reconstructive craniomaxillofacial surgery; trauma, deformities, tumours, TMJ ankylosis, and facial paralysis. No major complications were observed. The use of this flap constitutes a quick, reproducible method of reconstruction associated with minimal morbidity.\textsuperscript{[16]}

Recurrence is a major problem that occurs after the release of TMJ ankylosis. Raveh et al proposed that the radical removal of the TMJ bone is essential to avoid recurrence. Chossegros et al on the other hand, reported that early physiotherapy and the choice of interpositional material are important in preventing recurrence.\textsuperscript{[13]}

Many variations of the temporalis myofascial flap used in TMJ reconstruction have been documented. Feinberg and Larsen in 1989, described a full-thickness pedicled temporalis musclepericranial flap that included the periotome as well as the muscle. This flap was rotated in an anterior direction to the articular eminence and was then posteriorly rotated into the TMJ where it was sutured to the retrodiscal tissue. This procedure allows maintenance of tissue viability and functional movement of the flap during mandibular excursions.\textsuperscript{[17]} Pogrel and Kaban described a flap that may include fascia only or fascia and muscle, and is rotated inferiorly over the zygomatic arch and into the joint space.\textsuperscript{[15]} They suggested reducing the thickness of the zygomatic arch, if necessary, to avoid bulkiness. Alternatively, the zygomatic arch may be osteotomized in two sites and a segment of the arch may be removed. The flap then may be rotated through the space created by the osteotomy into the joint, and the segment of the arch may be replaced and secured with rigid fixation, as described by Bergey and Braun in 1994.\textsuperscript{[18]} In light of the related literature, case reports in the study support the use of a superficial layer of the temporalis fascia because of its aesthetic advantages during its rotation over the zygomatic arch and into the joint space. The other reason for choosing this thin flap is to provide physiologic function and movement of the articular disc.


\textit{Hansen and Deshazo}, witnessed a widespread diffusion because of its large availability, ease of handling, and low cost. Although complications from the use of silastic are infrequently reported, it has been ascertained that in some patients, such an alloplastic material can induce foreign body reactions.

In 1995, Kearns et al. suggested a protocol for the management of failed alloplastic TMJ implants. Failure of the implant was defined by clinical evidence of pain, changes in occlusion, decreased movement, or radiographic demonstration of joint disease. The reported cases that were treated by superficial temporalis fascia flap in this article showed that this technique has these advantages such as ease of handling, low risk of infection, and there is no cost.\textsuperscript{[13,14]}

The versatility of the temporalis muscle and/or fascia flap in maxillofacial surgery are well recognized. It has been used to support and replace orbital contents and to reconstruct the oral cavity and maxillofacial region after ablative surgery. Several advantages are associated with the choice of the temporalis muscle and fascia flap, as follows.\textsuperscript{[13,16]}

1. The flap can be harvested through the same incision used for the TMJ procedure.
2. The flap is well vascularized and evidence suggests that the viability is maintained
3. The plane of dissection is on the deep temporal fascia and this protects the facial nerve from injury.
4. Morbidity at the donor site is minimal.
5. The flap can consist of fascia only or muscle and fascia to provide greater bulk if necessary.
6. The presence of vascularized muscle in an area of chronic inflammation has been shown to promote wound healing in other sites, and it has been postulated that the temporalis muscle and fascia flap, because of their vascularity, may be responsible for healing in the multiply operated TMJ, particularly those associated with foreign body reactions.

Smith et al presented in their article, the earliest description of the role of temporalis muscle and/ or fascia flap in TMJ surgery for the management of ankylosis. The first available report reveals Verneuil in 1872, as the one to use the temporalis muscle and fascia flap as an interpositional material after ankylosis release.\textsuperscript{[9]}

Umeda et al used temporalis muscle and fascia axial flaps on 81 patients (115 TMJs) to correct ankylosis, traumatic defects, congenital anomalies, and defects resulting from tumour resection, degenerative joint disease, autoimmune arthritides, and lateral capsule flaccidity. Results of this study indicate that the temporalis muscle and fascia axial flap survive when they are carefully dissected and inferiorly based to preserve blood supply.\textsuperscript{[12]}
IMAGES

Fig-1: Unilateral Tmj Ankylosis With Deviation of Mandible Towards Affected Side

Fig-2: Multiple 3d Volumetric Reconstruction Showing Unilateral Ankylosis On The Right Side

Fig-3: Preauricular Hockey Stick Incision Approach For Surgical Management Of Tmj Ankylosis
CONCLUSION

Early ankylosis of TMJ in children deteriorates normal mandibular growth. Thus, early diagnosis along with immediate surgical intervention and management of TMJ ankylosis should be of prime concern. Radiographic diagnosis, Proper projection and all important condition of TMJ ankylosis is always essential before finalizing the necessary treatment plan. Currently, 3-dimensional computed reconstruction allows elaboration of realistic and spatially accurate images for diagnosis and surgical planning.

Management of TMJ ankylosis requires an amalgamation of surgery and early physiotherapy to restore mandibular function and to prevent recurrence. Two critical issues ensuring successful results are the extent of bone resection and the choice of material if interposition is performed.

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