

Interposition Gap Arthroplasty of Ankylosed TMJ: A Case Report and Review of the Literature

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Abstract: The temporomandibular joint (TMJ) is the most active, functioning joint of the body. Limitations of the mouth opening and deformity of the lower jaw can be caused by bony or fibrous ankylosis of the TMJ due to various reasons and mostly is due to fusion of the condyle to the base of the skull. Trauma to the TMJ is the most common etiology of ankylosis of TMJ. Clinical examination, radiographic evaluation including Computed Tomography (CT), is essential to confirm the diagnosis. Management of the TMJ ankylosis is mainly by surgical intervention but still composes a considerable challenge because of the high recurrence rate. Interposition arthroplasty in accordance with Kaban protocol was found to be the most successful treatment modality over other techniques due to lesser chance of recurrence while maintaining the ramal height. Though many types of autogenous grafts and alloplastic materials are available for the interposition arthroplasty, the temporalis myofascial flap offers significant advantages like ease of harvesting, minimal donor site morbidity and effective coverage of the arthroplasty site. The present case describes a surgical management of unilateral bony ankylosis of TMJ due to trauma which has been fused with glenoid fossa and root of the zygoma by interposition gap arthroplasty and distraction osteogenesis.

Keywords: Temporomandibular joint, bony or fibrous ankylosis, ankylosis, gap arthroplasty, interposition arthroplasty, distraction osteogenesis.

INTRODUCTION

Ankylosis of the TMJ is a condition where the movement of condyle is limited and that leads to complete or partial inability to open the mouth. In most of the cases it is due to fusion of the condyle of the mandible to the base of the skull. Although there are many causes which give rise to ankylosis of TMJ, trauma and infection are the leading causes among them [1]. Most unilateral cases are caused by mandibular trauma or infection while rheumatoid arthritis in bilateral causes [2]. If it occurs in a child, it affects the future growth of the mandible and causes a grossly deformed lower jaw apart from the limited mouth opening.

Various classifications have been proposed for the ankylosis of the TMJ, based on location, type of tissue involved, and extent of fusion. Ankylosis may be intra articular vs extra articular, bony, fibrous & mixed, complete vs incomplete, unilateral vs bilateral, true vs false accordingly. True ankylosis is occurred by fibrous or bony fusion of the structures within the joint, and bony fusion of the condyle to base of the skull reflects the most severe form. True ankylosis has been further classified into subtypes according to the anatomic location of the condyle and the extent of bridging bone

[3]. Topazian has proposed a three stage classification in order to grade complete ankylosis [4].

According to literature, trauma is the most common cause of bony and fibrous ankylosis [5, 6]. In some cases, there can be history of traumatic forceps delivery that give rise to TMJ ankylosis and factors that affect TMJ during intrauterine period can lead to congenital ankylosis [7]. Scarring and osseous replacement following formation of intra articular hematoma is believed as the process of ankylosis following injury to the joint. That leads to narrowing of TMJ space. Sometimes extension of fusion to the cranial base, sigmoid notch, zygomatic arch, coronoid process can be seen in advanced cases. Involvement of lateral pterygoid plates and even sphenoid bone can be taken place in most severest cases [7].

Patients with true ankylosis usually present with restricted mouth opening and variable deformity in mandibular size and shape. Unilateral ankylosis in children may result in significant lower facial asymmetry, most probably due to shortened ramus. Development of anterior open bite with malocclusion may also note due to the reduced ramal height [3].

Usually history and physical examination of a particular patient with ankylosis of TMJ give an idea about whether it is unilateral or bilateral process. In addition to the clinical examination, radiographic evaluation is important in arriving at a final diagnosis, severity, involvement of adjacent structures and ultimately to plan the treatment. Although plain radiographs are helpful up to some extent in evaluating TMJ ankylosis, Computed Tomography (CT) has become the top imaging modality. When considering the plain radiographic imaging, pathology of the affected joint can be compared with the normal joint in unilateral cases using orthopantomograph, because both the joints can be seen. Elongation of the coronoid process can be seen in lateral oblique view since anteroposterior dimension of the condylar mass can be seen. Posteroanterior view shows medial-lateral extension of the bony mass and also clearly demarcates the asymmetry in unilateral cases [7].

But Plain radiographs have limited value in assessing the ankylosed TMJ [3]. CT has become the gold standard radiological investigation in managing patients with ankylosed TMJ. Relationship of the ankylotic mass to the middle cranial fossa, anteroposterior and mediolateral dimensions, glenoid fossa can be reliably and clearly assessed in a series of very thin sections. Therefore it gives a very accurate and descriptive explanation in all three planes. Magnetic Resonance Imaging (MRI) also poses great impact in evaluating TMJ. But CT imaging is superior in diagnosing bony ankylosis [8].

Management of the TMJ ankylosis is mainly performed by surgical intervention. Although different techniques have been described for the management of ankylosis, no single option has shown entirely successful. Various surgical treatment options for this condition have been described in the literature including condylectomy [7], simple arthroplasty [9], interposition arthroplasty [10] using temporal muscle, deep temporal fascia, fascia lata, ear cartilage or alloplastic material and reconstruction of the joint using costochondral graft (CCG), fibula, iliac, clavicle crest, metatarsal head or alloplastic material like acrylic or titanium prosthesis [11]. Although satisfactory results can be achieved following modern surgical treatment modalities, some complications can be arise following the surgical procedures. Those complications can be occurred during anesthesia, during surgery and postoperatively.

During anesthesia intubation related difficulties can give rise to various complications because intubation has to be done blindly, throat packing cannot be done and risk of airway obstruction can be taken place after extubation. During surgical procedure, excessive haemorrhage can be occurred following damage to the internal maxillary vessels, transverse facial artery, inferior alveolar vessels, pterygoid plexus of veins, superficial temporal vessels.

Accidental nerve damage related to the zygomatic and temporal branch of the facial nerve and auriculotemporal nerve can be happened. Additionally iatrogenic damage to the external auditory meatus, middle cranial fossa, parotid gland and damage to the teeth while attempting to open the mouth forcefully can also be happened. Post-operative infection is a common complication. Development of malocclusions and recurrences are the most possible post-operative complications that are associated with surgical management.

CASE REPORT

A 32 years old otherwise healthy male was presented with persisting severe reduction in mouth opening with gross asymmetry of the face for 16 years. The patient has faced with a road traffic accident when he was 8 years old and no symptoms were noticed until 14 years of age. At the age of 14, gradual reduction in mouth opening with gross facial asymmetry was noticed and a surgery has been done, but no improvement was gained in mouth opening following the surgery. After 16 years, patient was presented to the Dental Hospital, Peradeniya with severe reduction in mouth opening and gross facial asymmetry.

On examination, 3mm of maximum mouth opening with painful right side TMJ was noticed. Gross asymmetry of the face due to shortness of the right side of face was clearly noticed (Figure 1). Both side pre auricular and TMJ areas were not tender on palpation, but right TMJ area was painful while opening the mouth. Radiological investigations were done to identify the involvement of adjacent structures (Fig 2). According to the CT scan, obliteration of the right TMJ space and bony fusion of condyle to glenoid fossa of right side was clearly observed as a radio dense mass. Surgery was planned to release ankylosed TMJ by interpositional gap arthroplasty using deep temporal fascia.

A written informed consent was taken for the procedure. General anesthesia was induced following fiber optic guided nasotracheal intubation since inter incisal opening of the patient was only 3mm. Standard preparation was done. Alkayat Bramley incision was made in order to achieve a greater access and prevent damage to the zygomatic and temporal branches of facial nerve and auriculotemporal nerve (figure 3). Further, incision was not extended below the level of tragus in order to prevent damage to facial nerve. Incision was deepened up to deep temporal fascia. Downward dissection was continued along the fascial plane up to the root of the zygoma. At the same time adequate length of deep temporal fascia was designed as an interpositional graft.

Excision of ankylotic mass was performed using surgical bur and chisel. Lateral aspect of the bony mass was removed using surgical bur. Medial aspect of

the ankylotic mass was removed using hand chisel and mallet. Care was taken to protect maxillary artery. After the excision of ankylotic mass, approximately 1.5 cm gap was achieved. Ipsilateral coronoidectomy was performed through intra oral approach, and the result was 10 mm of inter incisal opening. Contralateral coronoidectomy was performed according to Kaban's protocol and finally 35 mm of inter incisal opening was attained.

Post-operative mouth opening exercises were carried out and four stages of subsequent forceful mouth opening under general anesthesia were performed for better results. Long term prognosis is yet to be established since patient is on regular follow up without complications. Expected follow up period will be one year. Once the mouth opening becomes constant after one year, distraction osteogenesis was planned to correct anteroposterior defect of the mandibular body.



Fig-1: Preoperative View



Fig-2: CT Showing the TMJ region



Fig-3: Designed deep temporal fascia flap was rotated and positioned into the site of arthroplasty without undue tension. Layered wise suturing was done and surgical drain was placed.

DISCUSSION

Trauma is the leading cause of TMJ ankylosis while infections take the position after the trauma [1]. One study done by Roychoudhury et al. using 50 cases of TMJ ankylosis, revealed that trauma was the etiological factor in 86% of cases [9]. According to the literature incidence of post traumatic ankylosis of TMJ is higher in children. The patient of our case also had faced with an accident in his childhood and trauma to the right side TMJ was has gone unnoticed until significant sign and symptoms started to develop after several years. The sequelae of unilateral ankylosis includes retarded facial growth and development, impairment of speech, nutrition, respiration, development of malocclusion, poor oral hygiene and multiple carious teeth [7].

Management of TMJ ankylosis is always surgical [7]. The main objective of early surgical intervention to correct TMJ ankylosis is to restore the function of the TMJ while preventing the future recurrence. The choice of treatment option depends on the age of onset, extent of ankylosis, unilateral or bilateral, associated facial deformity and experience and preference of the surgeon.

Condylectomy is done via a preauricular incision in cases of fibrous ankylosis of TMJ with minimum deformity of the condylar head. It is performed by horizontal osteotomy at the level of condylar neck using a surgical bur, after exposing the area via a preauricular incision. Care should be taken to protect vital structures which are located medially to the condylar neck. Condylar head is then detached from the superior attachments and remaining cut end is smoothed [7]. Special condylar retractors should be used in order to prevent damage to the vital structures

which are located in medial aspect of the condyle. But as shortcomings, deviation of the mandible to the same side following the unilateral condylectomy can be occurred following this procedure while anterior open bite will be caused following bilateral procedures.

The gap arthroplasty is the surgical procedure that creates a new area of articulation in cases where extensive bony ankylosis has taken place involving joint, sigmoid notch and coronoid process [12, 13]. Therefore identification of joint demarcation is difficult or impossible and level of the osteotomy is below the previous joint space. That is done by creation of a 1cm of minimum gap by two horizontal osteotomy cuts between glenoid fossa and ramus without interposing any substance [7]. Gap arthroplasty procedure takes relatively less time and avoid donor site surgery compared to interposition gap arthroplasty. The main disadvantage of gap arthroplasty is re-ankylosis because no substance is interposed in to the gap which is surgically created [7]. Other possible reason could be incomplete or inadequate osteotomy in the medial aspect. That is because although lateral bone can be removed using a large surgical bur, bony mass in the medial aspect is removed carefully using hand chisel or osteotome. Therefore inadequate osteotomy in medial aspect could be given rise to reankylosis. Development of postoperative malocclusion due to shortening of ramal height and limited range of movements are other most common problems associated with gap arthroplasty [14].

Since re-ankylosis was the most troublesome as well as most common complication following surgical intervention, it was the main barrier that lowered down the success rate of treatment. Several possible factors have been documented to give rise to reankylosis [7] including inadequately created gap, inadequate coverage of the glenoid fossa, higher osteogenic potential, inadequately removed medial condylar bone, fracture and loosening of the costochondral graft, inadequate post-operative physiotherapy.

Interposition arthroplasty in accordance with Kaban protocol was found to be the most successful treatment modality over gap arthroplasty due to lesser chance of recurrence while maintaining of ramal height.

Complete excision of the ankylotic mass with or without subsequent joint reconstruction has shown better results following the surgery. Better treatment protocol for the management of ankylosis of TMJ was documented by Kaban and colleagues, which is based on wide resection of the ankylotic mass [15]. Since prolong ankylosis commonly give rise to muscle fibrosis and coronoid hyperplasia, in addition wide resection of the ankylotic mass, dissection of the temporalis, masseter, and medial pterygoid muscles followed by ipsilateral coronoidectomy are performed

through the same incision. The aim is to achieve at least 35mm of maximum inter incisal opening following the procedure. If the maximum inter incisal opening is less than 35mm after above procedure, subsequent contralateral coronoidectomy with temporalis myotomy is performed through an intraoral approach to achieve the desired level of inter incisal opening.

Since complete resection of the ankylotic mass commonly associate with significant reduction in the ramus height, reconstruction of the joint should be considered. Commonly, temporalis fascia flap is used to fill the glenoid fossa while costochondral graft which is harvested through an inframammary incision, is used to restore ramus height [3]. Dependable blood supply, autogenous origin, proximity to the TMJ, less chance of failure and ability to alter the arc of rotation have made the temporalis myofascial flap ideal for filling the fossa. Costochondral graft poses biologic and anatomical similarities to the mandibular condyle. Complications at the donor site of costochondral graft are rare and re-generation of the ribs is generally completed within one year [16]. Although interposition arthroplasty procedure takes longer time to perform and it poses additional donor site surgery in some cases, this has shown better results following the surgery. Subsequent forceful mouth opening and adjunct physiotherapy can be performed following the surgery to attain excellent results. Patient is directed to a schedule of post-operative mouth opening exercise, until desired maximum inter incisal mouth opening is obtained.

Recently distraction osteogenesis instead of costochondral grafting came in to treatment plan for reconstruction of ramus height [17]. Distraction can be proceeding at 1mm/d until the desired length is achieved. This has avoided additional surgery at the donor site as well as allows immediate mobilization of the jaw.

When surgical intervention has to be performed in order to release ankylosed TMJ, surgical access to the condyle and TMJ is critical. Additional care should be taken to prevent damage to the adjacent vital structures, because condyle and TMJ have a close relationship with facial nerve, auriculotemporal nerve, and several dominant blood vessels. Clinically several commonly practicing approaches to the TMJ have been described [7]. Postauricular incision that is taken behind the external ear in the crease closer to the upper aspect of pinna and extending to the mastoid process is an incision which poses superior esthetic value. But access and visibility is less since it has little surgical exposure. Risk of infection and stenosis of the external auditory canal is another disadvantage. Sometimes temporary or permanent paraesthesia may be experienced by the patient. Deformed auricle also can be resulted following the postauricular approach. Therefore this approach poses more disadvantages over advantages. Although endaural approach is also cosmetically better, it has

become limited due to restricted access, risk of ear infection and meatal stenosis. Submandibular or risdon approach has limited access to the condylar head. Therefore this has limited value in surgical procedures related condylar head region. Postramal or hind approach is better in procedures involving ramus and condylar neck. It has the advantage of better accessibility with superior esthetic value. Care should be taken to avoid damage to the facial nerve and posterior facial vein. Approach to the TMJ via preauricular incision has become the most accepted standard technique. Although several modifications of this technique has popular due to superior advantages, those techniques introduced later was based on this standard technique. This approach poses the advantages of greater accessibility and less risk of damaging to the facial nerve and auriculotemporal nerve compared to previous techniques.

If the surgical procedure involves the zygomatic arch, blair and ivy incision is much beneficial. Thoma's angulated vertical incision has lesser risk of facial nerve damage. Al-kayat Bramley approach is the most superior incision that was described in 1979. Wide access to the TMJ, temporal region and zygomatic arch can be gained using this excellent approach while protecting branches of the facial nerve. Additional advantage of this technique is access to the temporal myofascial flap which is used in interposition gap arthroplasty can be gained by the same incision.

In the management of current case, Al-kayat Bramley approach was selected according to the treatment plan and because of its superior advantages. Case in which we have treated in accordance with kaban's protocol, finally 35 mm of post-surgical inter incisal opening was attained. Distraction osteogenesis will be done one year post surgically. Final outcome is yet to be observed since patient is currently on regular follow up for a period of 12 months following surgery.

Patients with possible trauma to TMJ should be carefully evaluated by the clinicians and need to make accurate and early diagnosis. Unnoticed trauma to the TMJ can cause potential complications related to the ankylosis even after several years later similar to the present case. Interposition gap arthroplasty with temporalis myofascial flap in accordance with kaban protocol was found to be the most successful treatment modality for treating ankylosis. A satisfactory surgical outcome was obtained in our patient with the above method.

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