

Management of temporomandibular joint ankylosis with combination of gap arthroplasty surgery and physiotherapy

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ABSTRACT

Background. Temporomandibular joint (TMJ) ankylosis is a union of the articular surface of the temporal bone to the disc-condyle complex that restricts mandibular movements due to either a fibrous or bony union between the head of the condyle and the glenoid fossa. Common etiological factors are trauma, infection, and pathology in the joint or systemic diseases. The diagnosis of TMJ ankylosis is established through physical and clinical evaluation, and imaging examination. Currently, the surgical techniques used to treat TMJ ankylosis are gap arthroplasty, interpositional arthroplasty, joint reconstruction, and distraction osteogenesis. **Purpose.** To provide overview about management of temporomandibular joint ankylosis with gap arthroplasty combined with physiotherapy post surgery. **Case.** A 12-year-old female patient came to Department of Oral and Maxillofacial Surgery with complaint of opening mouth restriction, which occurred since one year prior to admission. After complete physical and radiographic examination, patient then was diagnosed with TMJ ankylosis due to neglected odontogenic infection. The treatment was performed with gap arthroplasty under general anesthesia. Patient then underwent physiotherapy after the surgery, including application of heat on the affected region and exercises to open and close mouth. **Discussion.** Ankylosis of TMJ is an uncommon case that results in chronic and severe limited mouth opening. The critical factor of successful treatment of TMJ ankylosis is early detection, correct surgery approach, implementation of an intensive physiotherapy program, and a good post-operative conduct. Therefore on this patient, gap arthroplasty was the chosen surgery approach followed by intensive physiotherapy. **Conclusion.** Management goal in TMJ ankylosis is to increase the patient's mandibular function, correct associated facial deformity, decrease pain, and prevent reankylosis. Careful surgical technique and subsequent attention to physiotherapy are both considered essential to achieve a satisfactory result.

Keywords: ankylosis, temporomandibular joint, gap arthroplasty, TMJ physiotherapy

ABSTRAK

Latar Belakang. Ankilosis sendi temporomandibular (TMJ) adalah persatuan permukaan artikular tulang temporal dengan kompleks diskus-kondilus yang membatasi mandibula karena perlekatan fibrous atau tulang antara kepala kondilus dan fossa glenoid. Faktor etiologi umum adalah trauma, infeksi, dan kelainan patologi sendi maupun sistemik. *Diagnosis ankilosis TMJ diperoleh melalui evaluasi fisik dan klinis, serta pemeriksaan radiologi. Saat ini, teknik bedah yang digunakan untuk ankilosis TMJ adalah gap arthroplasty, interpositional arthroplasty, rekonstruksi sendi, dan osteogenesis distraksi. Tujuan.* Untuk memberikan gambaran tentang pengelolaan ankilosis sendi temporomandibular dengan gap arthroplasty dikombinasikan dengan fisioterapi pasca bedah. *Kasus.* Seorang pasien wanita berusia 12 tahun datang ke Departemen Bedah Mulut dan Maksilofasial dengan keluhan pembukaan mulut terbatas sejak satu tahun yang lalu. Setelah pemeriksaan fisik dan radiografi, pasien didiagnosis dengan ankilosis TMJ yang disebabkan infeksi odontogenik yang tidak dilakukan pengobatan. Perawatan dilakukan dengan gap arthroplasty. Pasien kemudian menjalani fisioterapi pasca operasi, yaitu aplikasi panas pada daerah yang terkena serta latihan membuka dan menutup mulut. *Diskusi.* Ankilosis TMJ merupakan kasus yang jarang terjadi, yang menyebabkan terbatasnya pembukaan mulut. Faktor penting dalam keberhasilan pengelolaan ankilosis TMJ adalah deteksi dini, pendekatan bedah yang sesuai, pelaksanaan program fisioterapi intensif, dan evaluasi pasca operasi. Oleh karena itu pada pasien ini, gap arthroplasty adalah pendekatan bedah yang dipilih, diikuti dengan fisioterapi intensif. *Kesimpulan.* Pengelolaan ankilosis TMJ adalah untuk meningkatkan fungsi mandibula pasien, memperbaiki deformitas wajah, mengurangi nyeri, dan mencegah timbulnya ankilosis berulang. Penggunaan teknik bedah yang sesuai dan fisioterapi yang baik akan memberikan hasil yang memuaskan.

Kata Kunci: ankilosis, sendi temporomandibular, gap arthroplasty, fisioterapi TMJ

INTRODUCTION.

Temporomandibular joint (TMJ) ankylosis is a union of the articular surface of the temporal bone to the disc-condyle complex that restricts mandibular movements due to either a fibrous or bony union between the head of the condyle and the glenoid fossa.¹ The restriction of the jaw opening can be partial reduction to complete immobility of the jaw.²

Common etiological factors are trauma, infection, and pathology in the joint or systemic diseases.¹ The incidence of trauma as an etiological cause ranges from 26% to 75%, whereas infection ranges from 44% to 68%.^{3,4} In the pre-antibiotic era infection was the most common cause of ankylosis. Kaban et al maintain that infection is still the most common cause of ankylosis in the third world countries.⁵

The diagnosis of TMJ ankylosis established through physical examination and clinical evaluation, complemented by an imaging examination. The primary sign of this condition is the limitation of jaw opening, in view of the

character of asymptomatic disease. Imaging diagnosis is essential in differentiating and in evaluating of the degree of ankylosis. Currently, the computer tomography (CT) scan is the gold standard for assessment of TMJ hard tissue.⁶

The treatment of choice for ankylosis of the TMJ is always surgical. This treatment permits the removal of all rigid bone mass that involves the articulation, creating enough space to allow the interposition or even full reconstruction of TMJ with customized prostheses.⁴ Currently, the surgical techniques used to treat TMJ ankylosis are gap arthroplasty, interpositional arthroplasty, joint reconstruction, and distraction osteogenesis.³

The critical factor of successful treatment of TMJ ankylosis, at long term, is early detection, implementation of an intensive physiotherapy program, and a good post-operative conduct. Long period of physical therapy is essential for obtaining good results in treatment. The main objective of this treatment is to prevent bone neoformation in articulations, as well as to minimize fibrosis and to prevent scar retraction, trismus, atrophy, and muscle spasms.⁶

In this paper we present a case of TMJ ankylosis that was managed with gap arthroplasty combined with physiotherapy post surgery.

CASE REPORT

A 12-year-old female patient, admitted at the Department of Oral and Maxillofacial Surgery Hasan Sadikin Hospital, with chief complaint of inability to open jaw since one year before admission. Patient's history revealed that she had an episode of odontogenic infection on left lower molar that was not treated properly. She developed swelling on left submandible region, which resolved in due course of time. After resolution of swelling, her jaw opening reduced gradually.



Figure 1. Preoperative clinical picture; A Frontal side; B. Lateral (left) side.

On examination her facial was asymmetry with a slight mouth deviation to the right side.

There was no mouth opening on this patient. A panoramic radiography revealed the fusion of the left mandibular condyle to the base of the skull, which is represented by a radiopaque image and widening of the left head condyle, suggestive of TMJ ankylosis.



Figure 2. Panoramto radiograph shows radiopaque image and widening of left head condyle.

After cone beam computerized tomography (CBCT) analyses, on axial view of jaw opened left side, noticeable changes are seen in the shape of the head of the medial condyle, the condyle head exceeds the normal size, and there's still visible distance between the condyle and the glenoid fossa. Coronal and sagittal view of jaw opened and closed left side shows bone ankylosis on superior to anterior condyle head. An axial view of jaw closed left side shows visible changes in the shape of the head of the medial condyle, condyle head exceeds normal size, and there's no visible distance between the condyle and the glenoid fossa.

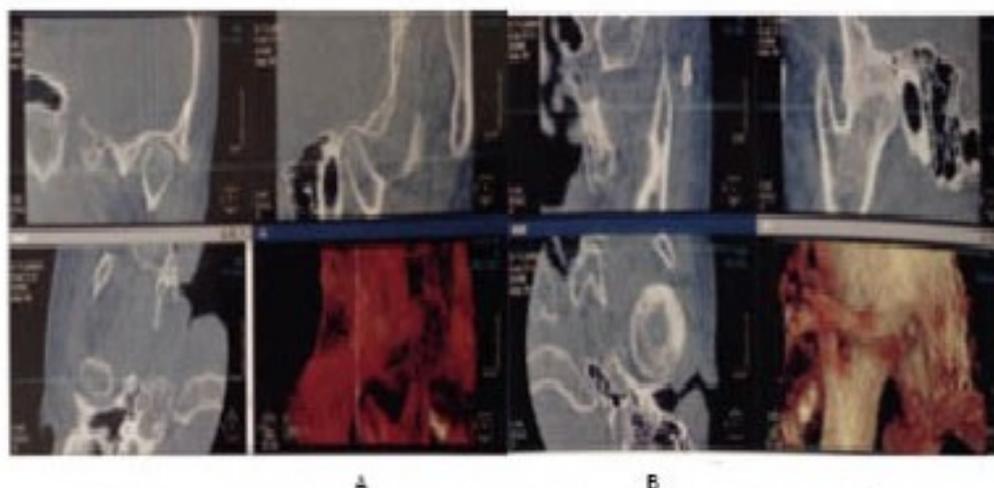


Figure 3. CBCT of TMJ anatomical position with (A) jaw opened right side; (B). jaw closed left side.

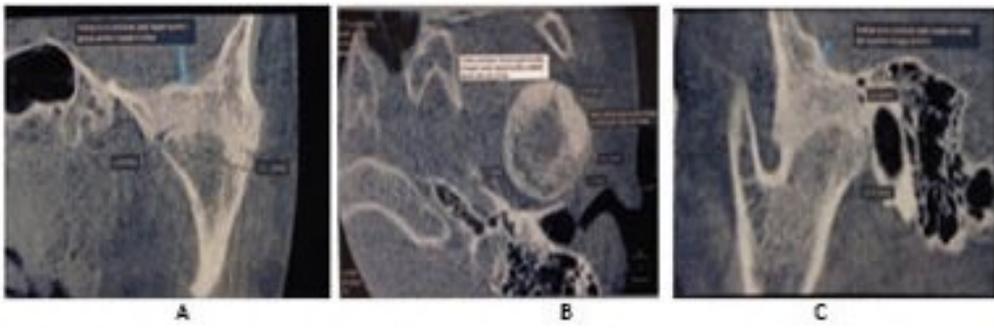


Figure 4. CBCT of TMJ (A) coronal, (B) axial, (C) sagittal view of jaw opened left side.

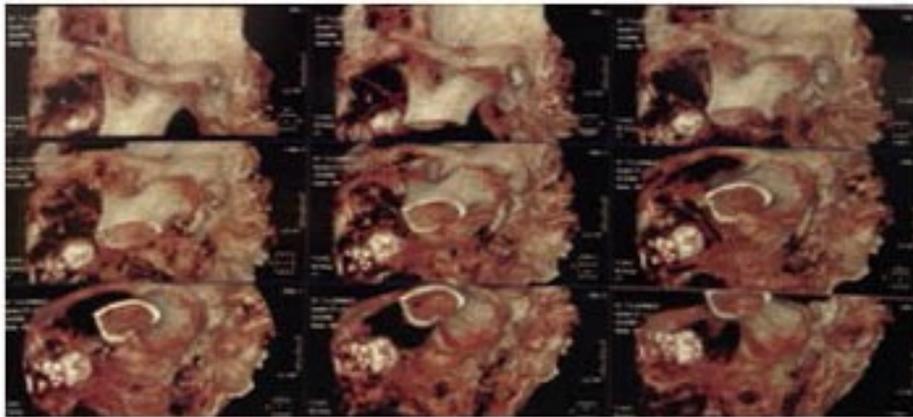


Figure 5. CT 3D of TMJ anatomical position with jaw closed left side.

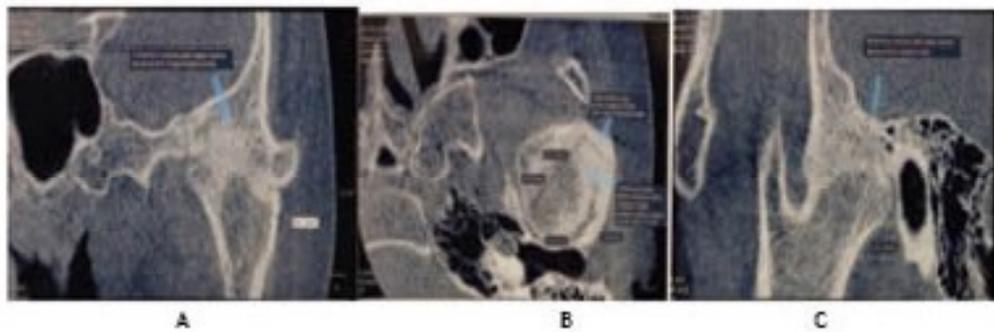


Figure 6. CBCT of TMJ (A) coronal, (B) axial, (C) sagittal view of jaw closed left side.

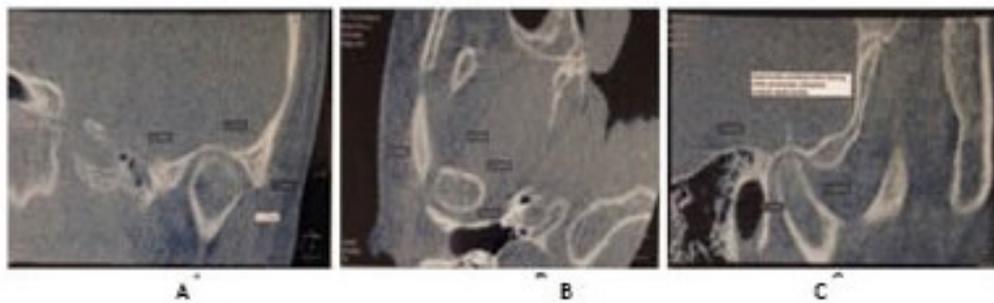


Figure 7. CBCT of TMJ (A) coronal, (B) axial, (C) sagittal view of jaw closed right side.

After complete evaluation, a gap arthroplasty, left side coronoidectomy and condylectomy were decided to be performed under general anesthesia. Prior to surgery, a tracheostomy was performed on the patient by ENT. A fibre - optic nasoendotracheal intubation was done.

Surgery was initiated by placing preauricular incision on the left side to expose the ankylotic mass. A condylectomy was performed. A question mark incision was employed to open the superficial temporal fascia, then incision at temporal region following the question mark incision was employed. Dissection was performed and the superficial temporal fascia was reflected to caudal and inserted into interdiscus space. The superficial temporal fascia then sutured to lateral pterygoid muscle. Suturing of temporal muscles was then performed.

A coronoidectomy was performed after giving an incision in the region of left lower third molar. Intraoral and extra oral closure were done. Immediate post-operative jaw opening was 15 mm.



Figure 8. Preauricular Incision marking.



Figure 9. Articular disk.



Figure 10. A question mark Incision marking.



Figure 11. (A) Dissection was done above the superficial temporal fascial plane and the superficial temporal fascia was reflected; (B) Closure of operative site with drain placement.

Maxillomandibular fixation was maintained for 1 week. Post-operative antibiotics and pain medication was prescribed. There was no motor deficit on either side of the face. Post-operative physiotherapy was performed to maintain the mobility and to prevent hypomobility secondary to fibrous adhesion, including heat therapy and exercise of jaw opening with wooden tongue blade in a graded manner.



Figure 12. Post operative day one showed a mouth opening of 15 mm (measured from incisal edge of upper and lower incisors)

The patient was followed at two weeks interval, with a maximum jaw opening of 25 mm. Jaw opening and facial expression were evaluated. The patient has attended the post-operative sessions showing good jaw opening and wound healing aspects, as well as healthy rehabilitation.

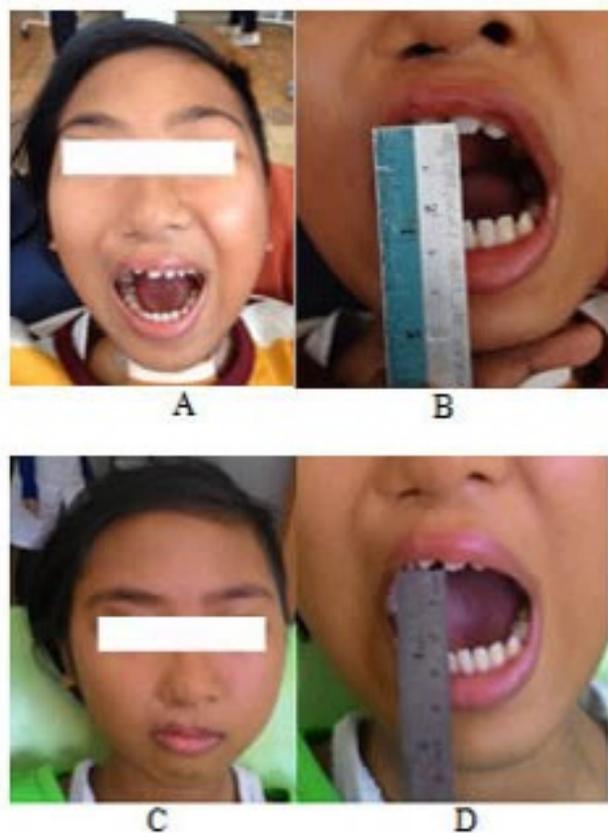


Figure 13. (A and B) Post-operative 2 weeks, showed adequate mouth opening (20 mm incisal edge distance) and rehabilitation; (C and D) After 1 month follow-up showed mouth opening of 25 mm was established.

Treatment and Discussion

Temporomandibular joint (TMJ) ankylosis is a union of the articular surface of the temporal bone to the disc-condyle complex that restricts mandibular movements due to either a fibrous or bony union between the head of the condyle and the glenoid fossa.¹ The restriction of the jaw opening can be partial reduction to complete immobility of the jaw.²

It is most commonly associated with trauma, local or systemic infection, tumors or systemic disease, such as ankylosing spondylitis, rheumatoid arthritis, or psoriasis.² The incidence of trauma as an etiological cause ranges from 26% to 75%, whereas infection ranges from 44% to 68%.^{3,4} In the pre-antibiotic era infection was the

most common cause of ankylosis. Kaban et al 2009 maintain that infection is still the most common cause of ankylosis in the third world countries.⁵

Infection of the TMJ most commonly occurs secondary to contiguous spread from otitis media or mastoiditis, but it may also result from hematogenous spread of infectious conditions such as tuberculosis, gonorrhea or scarlet fever. Systemic causes of TMJ ankylosis include ankylosing spondylitis, rheumatoid arthritis and psoriasis.⁷

Classic symptom of masticatory space infections is limitation of jaw opening. Infections causing limitation of jaw opening could be of odontogenic or non odontogenic in nature. In this case, it was suspected that the cause of the TMJ ankylosis on this patient was because of neglected odontogenic infection that was not properly treated. When the infection develops acutely, fibrinogen is accumulated within the joint and it results in difficulty of jaw movement.⁸

TMJ ankylosis may be classified by a combination of location (intra- or extra-articular), type of tissue involved (bony, fibrous, or fibro-osseous) and extent of fusion (complete, incomplete). Literature classifies ankylosis as true and false. Any condition that gives rise to osseous or fibrous adhesion between the surfaces of the TMJ is a true ankylosis. False ankylosis results from pathologic conditions not directly related to the joint.⁹

The impairments on orofacial function included limited chewing ability, alterations in speech, compromised oral hygiene and dental care, restricted airway, and decreased posterior dental eruption. The clinical features of unilateral TMJ ankylosis include facial asymmetry, chin deviation to the affected side, elongation and flatness on the nonaffected side with roundness or fullness on the affected side when observed from a frontal view. A bony thickening is often felt in the preauricular area of the affected TMJ. The lateral profile has a reduced mandibular projection with "bird face deformity" in the most severe cases.² Ankylosis of the TMJ can occur at any age; however, it has a higher incidence in younger patients. Moreover, the evolution of the pathological process is more severe in children because of the defective cartilage osteogenesis damaged by the ankylotic process and of the loss of muscle guidance over the mandibular growth process. In

adults, the changes of secondary maxillofacials alterations due to the ankylotic blockage are less complex and can be resolved after restoration of the joint function.⁴

The diagnosis of TMJ ankylosis established through physical examination and clinical evaluation, complemented by an imaging examination. The primary sign of this condition is the limitation of jaw opening, in view of the character of asymptomatic disease.⁴

Imaging diagnosis is essential in differentiating and in evaluating of the degree of ankylosis. Currently, the computer tomography (CT) scan is the gold standard for assessment of TMJ hard tissue. Coronal CT scans are helpful in elucidating the delayed state of the pathological hard tissue and can also change the plan of treatment in accordance with the imaging diagnosis.⁴

The goals for the release of TMJ ankylosis are to create a pseudoarthrosis that will improve function or movement of the mandible, prevent relapse, relieve airway obstruction if present, achieve normal growth and correction of deformity in children, restore appearance and occlusion in adults and facilitate maintenance of good oral hygiene.^{10,11}

The first goal in the management of TMJ ankylosis is the resection of the ankylosed segment and reestablishment of the mandibular movement.² A 7-step protocol has been developed for the treatment of TMJ ankylosis: 1) aggressive resection of the ankylotic segment, 2) ipsilateral coronoidectomy, 3) contralateral coronoidectomy when necessary, 4) lining of the joint with temporalis fascia or cartilage, 5) reconstruction of the ramus with a costochondral grafts 6) rigid fixation of the graft and 7) early mobilization and aggressive physiotherapy.¹²

Three basic techniques have been developed for the surgical correction of TMJ ankylosis:¹ 1. Gap arthroplasty: Resection of the osseous mass between the articular cavity and the mandibular ramus, without interpositional material; 2. Interpositional arthroplasty: Creation of gap by resecting the osseous mass followed by interposition of a biological (e.g. temporal muscle flap) or non-biological material (acrylic, silastic); 3. Joint reconstruction: Resection of the osseous mass and reconstruction by autogenous bone grafts

or by total joint prosthesis. In the gap arthroplasty, an approximately 1 cm gap is made between the two bony segments (ramus of mandible and base of skull), but nothing will be placed in this gap. In the second approach materials like vital graft (muscular fascia, skin, cartilage, etc) is placed in the gap.¹²

Roychoudhury et al recommended a gap of at least 15 mm between the recountoured glenoid fossa and the mandible and subjected this gap to extensive active jaw opening exercises to prevent re-ankylosis when using gap arthroplasty.¹³

According to Kaban et al, the advantages of gap arthroplasty are its simplicity and short operating time and the disadvantages include:⁹ 1. Creation of a pseudoarticulation and a short ramus; 2. Failure to remove all the bony pathology, and; 3. Increased risk of reankylosis. In our series, using this technique, we were able to reduce operating time, but patients with bilateral involvement showed more frequent anterior open bite.

This complication was treated with physiotherapy and the use of elastics.

The most commonly used incision in gap arthroplasty is the Al Kayat-Bramley incision. This incision has a temporal extension, which allows for elevation of a temporalis fascia flap for interpositioning. Other commonly used incision are preauricular and submandibular. On this case, we use the preauricular incision.¹²

The joint is approached through a preauricular incision extended into the temporal region for exposure of the temporalis fascia. The dissection is proceeded in this plane till the zygomatic arch is reached. The periosteum over the arch is incised and the joint entered through an incision over the lateral capsule.¹²

Once the site of ankylosis is exposed, aggressive resection of the ankylosis mass is done. The 1st bone cut is in line with the lower edge of zygomatic arch. The 2nd bone cut is 8 mm below and parallel to the 1st cut. A minimum gap of 1 cm should be created.¹² Although there is an agreement on the importance of aggressive physiotherapy after the release of TMJ ankylosis, but there is still controversy on when to start with the mobilisation of the jaws. Some authors believe in early mobilisation, while others immobilise the patient for a period of 1-10 days.³

Early aggressive postoperative physiotherapy has been recognized as an essential for the prevention or treatment of TMJ hypomobility or ankylosis. The biological and physiological basis for increasing the range of motion using dynamic exercise in restoring normal functions after surgery and prolonged immobilization has been well documented in trauma, orthopedic and physical therapy literature.⁴

Three facets of physiotherapy in the management of ankylosis include:¹⁴ 1. Heat - commonly used as adjunct therapy to stretching exercises involving the muscles of mastication. Heat has been known to increase the extensibility of collagen tissue, decreases joint stiffness, and relieves pain and muscle spasm. It is also known to increase blood flow which washes away inflammatory mediators and reduces oedema of the muscles of mastication; 2. Exercise - This therapy breaks the fibrosis involving muscles of mastication. The potential benefits of TMJ opening and closing exercises are improved muscle vascularity, increased muscle mass and protein metabolism, decreased muscle fatigue and increased strength, reversal of the atrophic and degenerative changes within the joints and restoration of the normal internal fibrous structure anatomy. Devices are available that keeps the jaw open in a graded manner. Wooden stick (tongue blade) can be used to gradually open the jaw; 3. Massage - This adjunct therapy increases blood flow and helps in relaxation of muscles of mastication. Objectives of physiotherapy are:¹⁴ 1. Reduction of oedema; 2. Soften and causing stretch of scar tissue; 3. Increasing the range of joint movement; 4. Increasing muscle strength of masticatory muscles.

Factors that have been postulated as cause of this high reankylosis rate can be classified into patient factors, surgical factors and postoperative factors. Patient factors are high osteogenic and periosteal reaction in children.³

Andrade et al noted that some patients develop respiratory distress during exercises which leads to non-compliance to exercises resulting in reankylosis. Surgical factors include failure to adequately remove medial extent of the ankylotic mass, failure to explore and remove the coronoid processes when indicated and failure to strip off contracted muscles of mastication that

pull the ramus towards the base of the skull. Post-operative causes would include lack of compliance to the exercises.¹⁵

CONCLUSION

TMJ ankylosis are relatively common in the third world countries. Management goal in TMJ ankylosis is to increase the patient's mandibular function, correct associated facial deformity, decrease pain, and prevent reankylosis. The current recommendation is to treat it as soon as possible. Regardless of the procedure performed, the literature unanimously found that anatomical restoration of the mandibular condyle associated with early mobilization with aggressive physical therapy is the best way to avoid a new temporomandibular ankylosis. A careful surgical technique, and subsequent meticulous attention to long-term physiotherapy are both considered essential to achieve a satisfactory result.

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