



## BILATERAL TEMPOROMANDIBULAR JOINT ANKYLOSIS- A CASE REPORT AND REVIEW OF VARIOUS TREATMENT MODALITIES

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Article Received on 07/09/2020

Article Revised on 28/09/2020

Article Accepted on 18/10/2020

### ABSTRACT

Temporomandibular joint ankylosis is defined as the bony or fibrous adhesion of the anatomic joint components accompanied by limitation in opening the mouth, causing difficulties with mastication, speaking and oral hygiene as well as adversely influencing mandibular growth. Surgical treatment procedures include arthroplasty of the joint cavity with or without reconstruction and coronoidectomy, an autogenous costochondral rib graft, distraction osteogenesis and intensive mouth-opening exercise, corrective orthognathic surgery or alloplastic joint prostheses. In the current article we have discussed a case report of bilateral TMJ ankylosis in a young girl and its successful management. We have also discussed other modalities of treatment briefly.

### INTRODUCTION

Temporomandibular joint (TMJ) ankylosis is a bony or fibrous adhesion of the anatomical joint components by an ankylotic mass. The inability to move the mandible has significant functional and esthetic ramifications, such as the inability to eat and asymmetry of the face. It is primarily caused by trauma, infection, or failed surgery. The treatment of TMJ ankylosis is surgical, either gap arthroplasty, interpositional arthroplasty, and/or joint reconstruction using autogenous grafts or alloplastic material. A successfully reconstructed TMJ should reproduce normal joint structure, provide functional articulation, and permit adaptive growth or remodeling.

True temporomandibular joint ankylosis affects the joint, whereas false TMJ ankylosis is an extra-articular type.<sup>[1]</sup> According to the type of tissue growing in the intracapsular structures of the joint, ankylosis is classified as fibrous, bony or mixed.<sup>[2,3]</sup>

Taking into account the degree of TMJ mobility limitation, Sawhney,<sup>[4]</sup> divided TMJ ankylosis into 4 types:

- Type I: The head of the condylar process is visible but significantly deformed, with the fibro adhesions making TMJ movement impossible;
- Type II: Consolidation of the deformed head of the condylar process and articular surface occurs mostly at the edges and in the anterior and posterior parts of the structures, and the medial part of the surface of the condylar head remain undamaged;

- Type III: The ankylotic mass involves the mandibular ramus and zygomatic arch; an atrophic and displaced fragment of the anterior part of the condylar head is in a medial location;
- Type IV: TMJ is completely obliterated by bony ankylotic mass growing between the mandibular ramus and cranial base.

Taking into account heterotopic bone formation within the ankylotic mass, temporomandibular ankylosis was classified by Turlington and Durr,<sup>[5]</sup> into 4 grades:

- Grade 0: No bone islands visible;
- Grade 1: Islands of bone visible within the soft tissue around the joint;
- Grade 2: Periarticular bone formation;
- Grade 3: Apparent bony ankylosis.

Grades 1, 2 and 3 are further classified as symptomatic (S) and asymptomatic (A). The symptomatic ossification includes: severe pain, decreased interincisal opening (15 mm or less), closed locking of the jaw, or decreased lateral or protrusive movement.

### CASE REPORT

A 16-year-old female patient was referred to the department of dental surgery in Santom Hospital, Delhi. The patient had a history of trauma 3 years back after which she developed reduced mouth opening that finally resulted in a completely closed mouth and inability to eat. On clinical examination, mouth opening was nil and

no condylar movements were palpable. Patient presented with micrognathia and crowding of teeth. Cervico-mental angle was also reduced. There was no relevant medical history. Orthopantomogram revealed deep antegonial notch and fusion of condylar segment with glenoid segment. On 3D CT scan, complete bony fusion of the joint was seen.

Treatment plan was made

Incision and exposure

Gap arthroplasty at least 1-1.5 cm to prevent re-ankylosis

Ipsilateral coronoidectomy and temporalis myotomy

Contralateral coronoidectomy and temporalis myotomy

Bilateral Lining of temporalis myofascial flap

Suturing in layers

### Early and aggressive physiotherapy

The procedure was accomplished under general anesthesia with nasal intubation. Alkayat Bramley

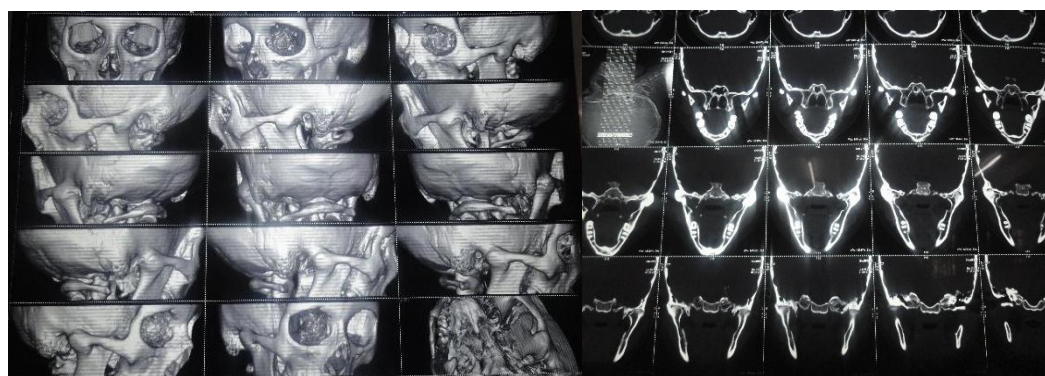
question mark incision was made on the right side first. Skin incision begins antero-superiorly within the hairline & curves backwards and downwards well posterior until it meets upper ear attachment. Incision then follows ear attachment endaurally. It has following advantages- less bleeding, fascial planes can be easily identified, excellent visibility and good cosmetic result. After bilateral resection of ankylotic mass and coronoidectomy, intraoperative mouth opening of 37 mm was achieved. The joint was lined with temporomyo-fascial flap and the wound was closed in layers. Aggressive physiotherapy was done and patient was encouraged for regular follow ups.



**Fig. 1: Patient's profile picture and intra oral picture.**



**Fig. 2: Orthopantomogram showing deep antegonial notch and Bilateral TMJ ankylosis.**



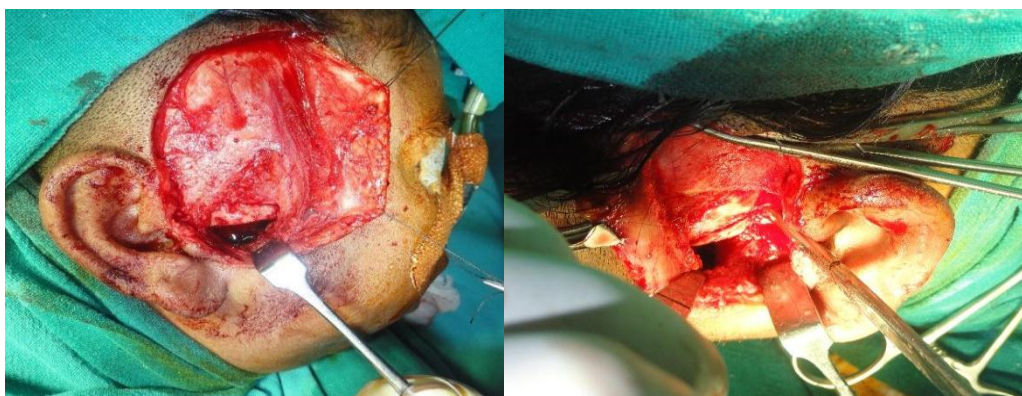
**Fig. 3: CT scan revealed completely fused condyle with glenoid fossa bilaterally.**



**Fig. 4:** Alkayat and Bramley skin incision for right side and left side.



**Fig. 5:** Ankylotic mass exposed.



**Fig. 6:** Gap arthroplasty done.



**Fig. 7:** Intra operative mouth opening achieved 37 mm and wound closed in layers.

### Various other treatment modalities of TMJ ankylosis

The first step in developing methods of surgical treatment of TMJ affected by ankylosis was taken in 1851. From 1850 to 1860, condylectomy and arthroplasty of the newly-created joint cavity were performed using a myofascial flap,<sup>[6]</sup> To the present day, all modalities of this surgical procedure have been applied.

The surgical treatment procedures include:

1. Arthroplasty of the joint cavity;
2. Arthroplasty and a free costochondral graft,<sup>[7]</sup>
3. Arthroplasty with temporalis myofascial flap insertion in the newly created joint cavity accompanied by a simultaneous unilateral coronoidectomy on the affected side or a bilateral coronoidectomy;
4. Distraction of the ramus and body of the mandible on the affected side;
5. Reconstruction of the joint using an alloplastic prosthesis,<sup>[8,9]</sup>
6. Arthroscopic laser-assisted preparation of the articular surfaces,<sup>[10]</sup>
7. Postoperative radiotherapy,<sup>[11]</sup>

8. Bilateral arthrotomy.

A necessary complement of the surgical treatment is physiotherapy (intensive mouth-opening exercise).

According to current knowledge, surgical treatment should not be postponed. Based on the Moss functional matrix theory, the surgery and function restoration of both the bones and neighbouring soft tissues release the growth potential of the mandible and prevent further development of the deformity.<sup>[12,13]</sup>

### Autogenous bone grafts

In many medical centres, various non-vascularised free autogenous bone grafts from the tibial or clavicular bone, sternoclavicular joint, iliac crest, metatarsal bone or metatarsophalangeal articulation are used,<sup>[14]</sup> In some centres, TMJ reconstruction is also performed using autogenous vascular grafts harvested from rib, iliac crest or tibial bones.<sup>[15]</sup> Another solution is to postpone surgery until growth completion. Further steps include joint reconstruction with another autogenous graft, and orthognathic surgery improving the facial appearance and occlusion.

| Graft derived from the distant site | Advantages                                                                                                                                                                                                                            | Disadvantages                                                                                                                                                                                                                 |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Costochondral                       | Most widely used, Has a cartilage cap, mimicking both the bone and cartilaginous components, Has intrinsic growth potential. <sup>[12]</sup> Easy accessibility and adaptation, Gross anatomical similarity to the mandibular condyle | Unpredictable growth, Poor bone quality<br>Possible separation of cartilage from bone<br>Possible donor-site complications: pleural tear, pneumothorax, pleural effusion, atelectasis, empyema                                |
| Sternoclavicular                    | Similar anatomical and physiological characteristics, Consists of a cartilaginous cap, Option for a whole joint graft, Has the potential for growth, Probability of regeneration at donor site                                        | Unacceptable location of surgical scar, Donor site complications: damage to the great vessels, instability of the clavicle under stress with resulting shoulder instability, Clavicle fracture                                |
| Fibular                             | Tubular in shape and densely cortical<br>Vascularized graft has better survival rate<br>More suitable for large mandibular defects                                                                                                    | Lacks articular cartilage, Donor-site complications: great toe flexion contractures and valgus deformity, ankle stiffness, instability and weakness; numbness of the lateral side of the leg; pedal ischaemia and foot oedema |
| Iliac crest                         | Has a cartilage cap, mimicking both the bone and cartilaginous components Has potential for growth More suitable for large mandibular defects                                                                                         | Donor-site complications: altered gait, poor scar/bone contour, herniation of abdominal contents, ilium fracture, peritonitis, and retroperitoneal haematoma                                                                  |
| Coronoid                            | Avoidance of a secondary surgical site and associated donor complications, Longstanding cases usually have elongated and                                                                                                              | Ankylosed segment also involves the coronoid process, then not possible to use, Relatively pointed architecture, No long-term                                                                                                 |

|                           | sturdy coronoid                                                                                                 | studies                                                                                                                                                                            |
|---------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Posterior border of ramus | Bone of a size and shape adequate for new condyle with similar histological characteristics, Is a pedicle graft | Damage to the contour of the mandibular angle, Lack of growth, Two extra-oral incisions which might be unappealing for aesthetically concerned patients, Lack of long-term studies |
| Ankylotic mass            | Dense bone with a smooth cortical surface<br>Recycling of bony ankylotic mass                                   | Bulk resection is a must, Possibility of risking the nearby structures especially the internal maxillary artery and facial nerve. Lack of literature regarding long-term efficacy  |
| Tissue engineering        | Avoidance of morbidity associated with second surgical site                                                     | Regeneration of a single tissue, but involves two integrated tissues, Still in infancy                                                                                             |

### Distraction osteogenesis

Distraction osteogenesis constitutes another reconstruction method applied to the TMJ structures damaged by ankylosis. A reverse L-osteotomy is made, creating a transport segment, which is advanced through the defect. New bone is created in the distraction gap and the leading edge of the transported bone fragment becomes enveloped by a fibrocartilaginous cap, thus reconstructing a neo-condyle and a pseudo-disc. The transport segment is advanced superiorly 0.5 mm twice a day until contact with the glenoid fossa is achieved. Further advancement provides a correction of the vertical deficiency of the mandibular ramus.<sup>[13]</sup> The long-term results are good provided intensive postoperative physiotherapy is carried out. A negative aspect of the distraction osteogenesis is the amount of bone left after the removal of affected tissues, limiting the possibility of creating a segment for the transporting distraction osteogenesis.<sup>[14,15]</sup>

### Alloplastic replacement of the temporomandibular joint

Another solution applied in order to reconstruct the TMJ is the use of alloplastic joint replacement, which thus far has been applied primarily in adult patients. Owing to the fact that the prosthesis is a mechanical device and not biological, it improves the quality of life, but its durability is unknown. Moreover, it has not been considered an attractive treatment method for growing patients until now. While performing the implantation of a TMJ replacement, it has to be noted that it requires alloplasty of all articular structures (both the mandibular condyle and the glenoid fossa). Based on clinical experience, priority is given to total joint replacement with a prosthesis protecting the glenoid fossa against damage resulting from the excessive impact of the "condyle" of the prosthesis.<sup>[16-19]</sup>

### Alloplastic Devices For Tmj Reconstruction

#### Kent-Vitek Total Prosthesis

In the early 1970s Kent and colleagues developed a glenoid fossa implant (VK-1) that originally consisted of a bilaminar fossa with a polyaramid fabric reinforced

ultra-high-molecular-weight, polyethylene articular surface. The inner layer of the prosthesis was composed of Proplast-hydroxyapatite, which could be contoured to fit against the base of the skull. This Proplast layer originally came in thicknesses of 2.5 and 4.5 mm. The flange of the prosthesis was secured to the zygomatic arch with screws. The condylar prosthesis was constructed of chromium-cobalt with a layer of Proplast on the inner surface of the ramal flange to encourage rapid ingrowth of both hard and soft tissues. Also, an L-shaped flange was incorporated into the posterior and inferior edge of the ramal surface as an anti-rotational groove. The original VK-1 fossa had an articulating surface composed of poly tetrafluoroethylene (PTFE). The fossa was revised and called the VK-2 fossa, and its articulating surface was composed of ultra-high-molecular-weight polyethylene (UHM-WPE). Complications included glenoid fossa resorption, especially in patients who had undergone ramal lengthening.

#### Christensen Prosthesis

The Christensen TMJ fossa eminence prosthesis (FEP) is designed to be used alone as a partial joint for treatment of severe internal derangement, adhesions, disc perforation and ankylosis. The condylar prosthesis is always used in conjunction with a FEP and constitutes a total joint replacement (TJR) (Figure 8). Christensen was the first person to attempt to cover the fossa eminence with an anatomically correct device to treat ankylosis. Christensen reported on total joint replacement with the fossa eminence devices in conjunction with cobalt-chrome (Co-Cr) alloy condylar prosthesis, which had a molded polymethylmethacrylate (PMMA) head.



**Fig. 8: Patient-Specific all metal TJR mounted on a stereolithography model of the patient for which the prosthesis was fabricated.**

### Lorenz Prosthesis

The basic goal for the Lorenz total joint prosthesis was to maximize the mating of articular surfaces, which was accomplished with a spherical condylar head. This design feature allows positional freedom of the mandibular component, following fixation of the fossa component, in all planes without sacrificing the desired articulation.<sup>[20]</sup> The mandibular component is manufactured from cobalt-chrome (Co-Cr) alloy with a roughened titanium plasma coating on the host bone side of the ramal plate. The condylar component is secured to the ramus with self-retaining, cross drive 2.7-mm self-tapping bone screws made of titanium alloy (TI-6AL-4V). The ramus of the mandibular component is currently manufactured in lengths of 45 mm, 50 mm, and 55 mm. The fossa component is manufactured from a specific grade of ultra-high molecular weight polyethylene (UHMWPE) called Ar-Com manufactured by Biomet (Warsaw, IN) specifically for use in articulating orthopedic joint designs (Figure 3). The fossa is fixed to the zygomatic arch with self-retaining, self-tapping 2-mm cross drive screws. These screws are also manufactured from TI-6AL-4V titanium alloy.

### TMJ Concepts/ Techmedica Custom Made Total Joint Prosthesis

Total alloplastic joint reconstruction is a biomechanical rather than a biologic solution for the treatment of severe joint disease. It provides an efficient and effective means of dealing with distorted articular anatomy, while avoiding the issue of the vascularity of the periarticular tissues so essential in autogenous reconstruction, and it eliminates the need for a second surgical site with all the morbidity involved. However, there is a need for a custom total alloplastic temporomandibular joint (TMJ) reconstruction prosthesis because of the increasing number of functionless, multiply operated TMJs in which a stock prosthesis is unable to correct the mutilated or variable anatomy. These prostheses are CAD/CAM devices (computer assisted design/computer assisted manufacture), designed to fit the specific anatomical requirements for each patient.

### CONCLUSION

TMJ ankylosis has been one of the greatest challenges to surgeons over decades, the reason being that TMJ is a complex anatomic structure. With improved knowledge on distraction osteogenesis and new avenues of tissue engineering the day is not too far when the surgeon will be able to provide a better quality of life with optimum function and esthetics to a patient operated for TMJ ankylosis.

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