

# Evaluation of Alloplastic Reconstruction of Temporomandibular Joint Using Artificial Condyles

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## ABSTRACT

*Background:* Restoration of normal function of temporomandibular joint is very important and very challenging especially in cases when excision of one both condyles, with or without ramus resection, is mandatory.

*Purpose:* The objective of this article is to evaluate the effectiveness of artificial condyles as a solid and reliable method for temporomandibular reconstruction.

*Patients and Methods:* Eighteen patients were included in this study in the period from July 2009 to February 2018, all patients suffered from loss of TMJ function; eight cases due to tumors, six cases due to trauma, two cases due to iatrogenic causes, two cases due to recurrent TMJ ankylosis. Unilateral TMJ reconstruction with artificial condyle was done in fourteen cases and bilateral reconstruction was done in four cases. Follow-up period ranged from one year to eight years.

*Results:* All patients were evaluated as regards; functions and esthetics. Patients showed excellent improvement in occlusion, mouth opening, and regaining facial height. From the esthetic point of view, there was a little deviation of mouth in maximum opening to the affected side in unilateral cases. No recurrence of ankylosis was noted.

*Conclusion:* Temporomandibular joint reconstruction using alloplastic artificial condyle is an effective and reliable method of reconstruction.

**Key Words:** *Alloplastic reconstruction – Temporomandibular – Artificial condyles.*

## INTRODUCTION

Disturbances in temporomandibular joint functions either due to acute or chronic problems is a disabling condition that causes disturbances in mastication, digestion, speech, cosmetics, social communications and psychological stability [1].

It can also cause disturbance in craniofacial growth in young patients and acute compromise of airway due to shortening of posterior facial height followed by retrognathia which negatively reflected on the width of the airway [1-4].

The indications for reconstruction of the Temporomandibular Joint (TMJ) include ankylosis, severe osteoarthritis, rheumatoid arthropathy, neoplastic disease, posttraumatic dysfunction, and congenital disease [5].

The aims of reconstruction include the restoration of mandibular function and form, decreased patient disability and suffering, and the prevention of disease progression [6].

Various procedures for the treatment of temporomandibular joint functional disturbances have been described in the literature. These include gap arthroplasty, interpositional gap arthroplasty, with or without joint reconstruction using autogenous grafts or alloplastic materials [7].

Alloplastic prosthesis have been used in treatment of degenerative conditions and other functional problems of temporomandibular joint either due to, tumors, trauma, infections or iatrogenic [8].

A number of alloplastic materials and systems have been developed for use in reconstruction of the TMJ. Alloplastic joints are said to allow a closer reproduction of the normal anatomy of the joint (with restoration of vertical dimension), avoidance of donor site morbidity, and reduction in operation time and reduction in the chance of recurrent ankylosis. All these factors allow immediate physiotherapy and rehabilitation with consequent increased benefit to the patient [9].

## PATIENTS AND METHODS

Part of this study was one in Plastic Department, Faculty of Medicine, Menoufia University Hospital. It was done in the period from July 2009 to February 2018. All eighteen patients were treated surgically by replacing the lost or affected condyle or condyles either unilateral or bilateral using alloplastic artificial condyles with or without using reconstruction plate.

When mandibular body resection needed, autogenous bone graft was used to compensate for mandibular body resection in 2 patients.

All patients were subjected to history taking, clinical examination, and laboratory investigations and radiological in form panoramic X-ray cephalometric studies and three dimensional CT scan.

Eight patients suffered from mandibular tumors in form of ameloblastoma with wide destruction of mandible extending in two cases to mandibular body, in which we did mandibular body resection and reconstructed with split bundle rib graft in addition to alloplastic artificial condyle and reconstruction plate.

Six cases suffered from trauma due to road traffic accidents; two cases artificial condyles were initially fixed directly on the ramus to compensate for the fragmented destroyed condyle using mini escrows 9mm. In the remaining four cases surgery was done after long period from the time of trauma.

Two cases had iatrogenic temporomandibular dysfunction due to disc removal as a treatment of internal derangement, followed by limited mouth opening and chronic pain, ankylosis occurred, condylectomy done, reankylosis again, finally treated with alloplastic artificial condyles.

Two cases with well formed bony ankylosis with several operations as gap arthroplasty, interpositional gap arthroplasty and costochondral grafts with resorption reankylosis and finally treated with alloplastic artificial condyles also in these cases we need concomitant bimaxillary orthognathic surgery to correct accompanying skeletal problems due to longstanding ankylosis.

#### *Surgical technique:*

The operation was done under general anesthesia with nasotacheal intubation, armored tube was fixed using silk stich zero to the septum to avoid slippage during surgery and pre-operative antibiotics were given and continued for 10 days after surgery.

Periauricular incision is used in cases which needed condylar replacement only and submandibular incision is done in cases we need to reconstruct mandibular body in addition, in one case we used periauricular incision with retro mandibular incision in continuity. C-arm was used to predict the exact position of condyles in cases in which we used submandibular incision alone, the length of condyle needed was determined after adjustment of occlusion and securing the occlusion by IMF during

fixation of artificial condyles, in cases we need to put split bundle rib graft was fixed to reconstruction plate 2.7 or 2.3mm by screws, suction drain was inserted and removed after ten days, compression bandage was left for first 72 hours. Patients with longstanding ankylosis were subjected to program of physiotherapy in form of insertion of gradually increased tongue blades between anterior teeth for gradual slow muscle elongation to alleviate pain and to encourage normal mouth opening and painless mastication, all patients were followed-up for a period ranged from one to eight years.

## RESULTS

The study was carried out on eighteen patients; fourteen were females (77%), and four were males (23%), age of patients ranged from eighteen years to fifty two years with mean range (20.8). The etiology of the complaint was after tumor resection in 8 cases, post traumatic in 6 cases, iatrogenic in 2 cases and after ankylosis in 2 cases. Patient's data were shown in (Table 1).

Table (1): Patients' data.

Patient data	Characteristics (N=18)	
	No.	%
<i>Sex:</i>		
Male	4	23
Female	14	77
<i>Comorbidities:</i>		
Smoking	4	23
DM	2	11.5
<i>Age (y.):</i>		
Mean		20.8
Median		35
Range		18-52
<i>Etiology:</i>		
Post tumor excision	8	
Post traumatic	6	
Iatrogenic	2	
Post ankylosis	2	
<i>Site:</i>		
Unilateral	14	
Bilateral	4	

Fourteen cases (77%) had unilateral alloplastic condylar reconstruction and four cases (23%) had bilateral alloplastic condylar reconstruction.

Regarding to post-operative complication; two patients (11%) out of eighteen had limited infection due to infected hematoma treated with broad spectrum antibiotics and developed chronic sinus. One case (5.5%) only developed slippage of the alloplastic condyle. All patients had deviation to the artificial condyle side in unilateral cases on maximum mouth opening. Post-operative complication data were shown in (Table 2).

Table (2): Post-operative complications data.

Post-operative complications data N=18	Characteristics	
	No.	%
Hematoma	2	11
Wound infection	2	11
Chronic sinus	2	11
Slippage of the condyle	1	5.5
Wound dehiscence	0	0
Duration of hospital stay (in days)	3	

All patients were seen 72 hours after surgery, compression bandage is removed, wound is checked, patient is assured that all pre-operative complaints are gone and they suffered only from wound pain, panoramic X-ray was done also to check artificial condyles, also dental occlusion is checked for any aberration, and patients were checked every 4 weeks after that for the next six months. The post-operative results were evaluated as regards the subjective improvement of patients' complaints and integrity of reconstruction and condyle position in the glenoid fossa.

*Case demonstration:*

*Patient 1:* A 23 years female patient, committed suicide with multiple body bony fractures and comminuted fracture left condyle, artificial condyle was fixed to the remaining part of ramus after excision of comminuted condyle after adjustment of occlusion by IMF, Fig. (1).

*Patient 2:* A 50 years male patient with long-standing ameloblastoma extending from the right condyle to the ipsilateral first molar, resection was done to all affected bone through wide submandibular incision and reconstruction was done using artificial condyle with reconstruction plate and split bundle rib graft to replace the resected mandibular body, infection occurred in the tenth day due to presence of hematoma, Fig. (2).

*Patient 3:* A 30 years female patient was complaining of pain in TMJ due to chronic internal derangement was treated by bilateral discectomy followed by TMJ ankylosis, patient was also treated with gap arthroplasty, interpositional gap arthroplasty, and finally with bilateral alloplastic condylar reconstruction, Fig. (3).



Fig. (1A): Pre-operative 3D CT.



Fig. (1B): Pre-operative coronal CT cut.

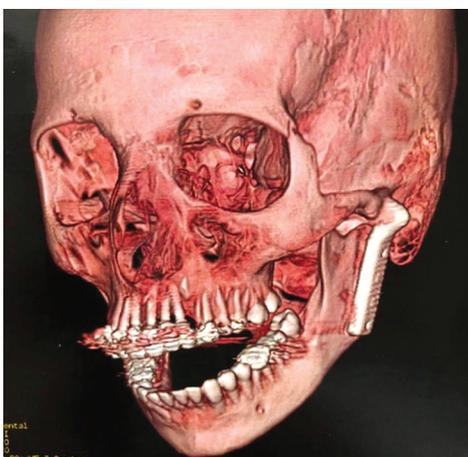


Fig. (1C): Post-operative 3D CT.



Fig. (1D): Late post-operative photo of the patient.



Fig. (2A): The artificial condyle used for the patient.



Fig. (2B): Autogenous bone graft was used to compensate for mandibular body resection.



Fig. (2C): Intraoperative photo showing the incision and reconstruction plate.



Fig. (2D): Intraoperative photo by C-arm.

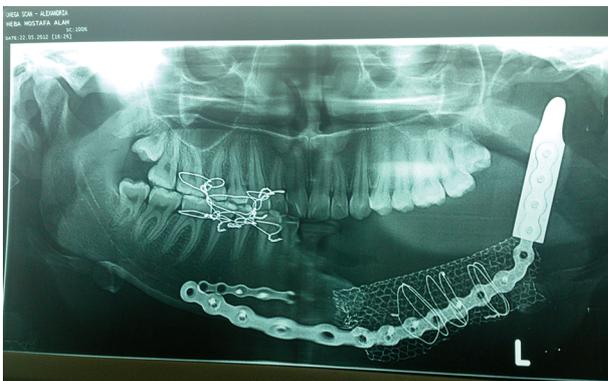


Fig. (2E): Post-operative panorama X-ray.

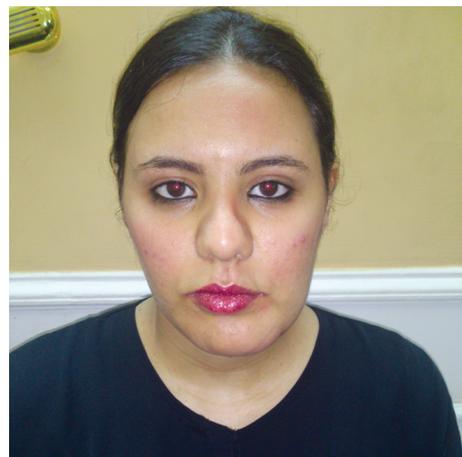


Fig. (2F): Late post-operative photo of the patient.

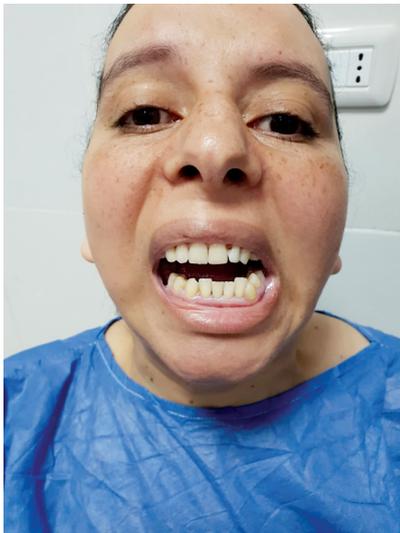


Fig. (3A): Pre-operative photo show limited mouth opening.

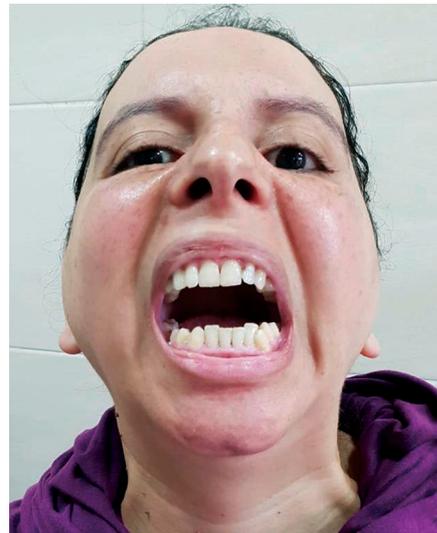


Fig. (3D): Post-operative photo showing the improvement of mouth opening.



Fig. (3B): Intraoperative photo showing artificial condyle in place.

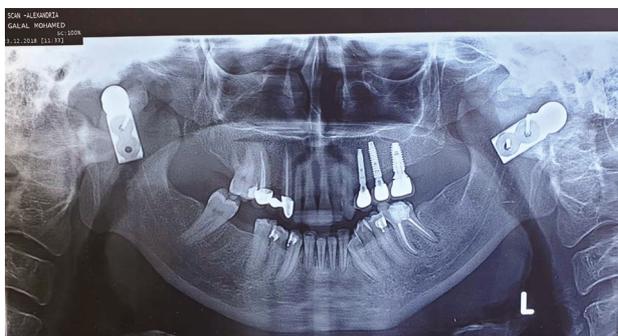


Fig. (3C): Post-operative panorama showing bilateral artificial condyle.

## DISCUSSION

Different types of operations for the management of TMJ ankylosis have been described in literature including; gap arthroplasty, interpositional gap arthroplasty and joint reconstruction [10].

There is no agreed treatment described, and results have often be variable and less than satisfactory, gap arthroplasty including condylectomy is a simple method with a short operating time, whoever, the disadvantages are many, including the creation of pseudo articulation, a short ramus, failure to remove all the bone pathology, increased risk of re ankylosis, and lack of functional restoration of the joint [10]. In addition, complications include the development of an open bite in bilateral cases, premature occlusion on the affected side, open bite on the contrary side in unilateral caser and suboptimal post-operative range of motion for these reasons, GA has largely been abandoned for the treatment of TMJ ankylosis [11].

The interpositional gap arthroplasty IPG, autogenous or alloplastic materiales are placed at the osteotomy site to prevent recurrent ankylosis, the various autogenous materiales that can be used as interpositional material include a TMF, fascia lata, auricular cartilage, dermis and full thickness flap. The temporalis muscle is the most widely used among the interpositional materiales due to dependable blood supply, proximity to the temporal joint, good functional results, minimum risk of facial paralysis, successful clinical results and minimal complications.

The various autogenous materiales that can be used for reconstruction of the joint are costochondral graft, rib graft, second and fourth metatarsal bones, sternoclavicular joint, ulnar head, clavicular bone, fibula and iliac bone. Advantages of costchondral rib grafts include biological compatibility, workability; the growth potential of CCG makes it the ideal choice in children, while its advantages

include; fracture, re ankylosis, increased operating time, additional donor site morbidity and potential overgrowth of the graft and suboptimal post-operative range of motion [9].

To avoid these problems, a number of alloplastic materials have been developed of TMJ reconstruction. Alloplastic joints or condyles allow restoration of posterior facial height, no additional site morbidity, short operative time and mostly no recurrence of ankylosis, however there are disadvantages of alloplastic condyles include increased risk of infection. Slippage wear or failure of material, high cost and no future growth so it is not suitable for growing children [12].

We have presented our experience of the use of single stage technique for the replacement of the damaged TMJ with alloplastic artificial condyle with or without reconstruction plate, there was a considerable follow-up time, despite the presence of infection in two cases we did not have any serious complications. Most of the patients tolerated the alloplastic condyle with minimal mouth deviation to the reconstructed side in unilateral cases, only we had one case that she developed slippage of prosthesis posteriorly in one side due to lack of patient compliance and also there was some dental ocular interference, treated with some teeth grinding physiotherapy, patient restored normal range of movement and pain disappeared in spite of persistent slippage of artificial condyle. A single stage procedure is beneficial to the patient and to the community as it is cost-effective alternative to two stages technique. Other single stage techniques that have been described require the use of expensive surgical navigation equipment's.

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