

# GAP ARTHROPLASTY VERSUS INTERPOSITIONAL ARTHROPLASTY IN THE MANAGEMENT OF TEMPOROMANDIBULAR JOINT ANKYLOSIS

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## ABSTRACT

**Objective:** The study was aimed to compare the results of gap arthroplasty and interpositional arthroplasty in the treatment of temporomandibular joint ankylosis surgery with particular reference to the recurrence of ankylosis.

**Material and Methods:** A total of 30 patients with temporomandibular joint ankylosis, 19 unilateral and 11 bilateral (41 joints) were operated and included both male and female, with age range from 3-40 years with at least 2-3 years of follow up.

**Results:** There were no cases of re ankylosis where interpositional arthroplasty was done regardless of the age and duration of ankylosis. Good results were achieved with interpositional arthroplasty with maximum mouth opening of 35mm (mean). In adult cases where interposition was done there was no re ankylosis and the mouth opening was 32.6mm (mean) at the end of follow up period. In growing children and adult cases where only gap arthroplasty was done there was recurrence of ankylosis and the maximum mouth opening achieved in adult patients at the end of follow up period was less than 30mm (mean).

**Conclusion:** The interpositional arthroplasty is the treatment of choice in any type or stage of ankylosis regardless of the age and duration.

**Key words:** Temporomandibular joint, Gap arthroplasty, Interpositional arthroplasty, Recurrent ankylosis.

## INTRODUCTION

Ankylosis of temporomandibular joint means stiff joint and it produces a disability consisting of permanent incapability of mouth opening and facial deformity. The true ankylosis is an intracapsular condition which occurs between the glenoid and condyle or fractured proximal portion of ramus.

It is thought to occur due to the organization of hematoma within the joint, with or without a related intra capsular fracture of the condyle<sup>1,2</sup>. This again can be incomplete (fibrous and fibro-osseous) or complete (bony)<sup>3</sup>.

The aetiology of true ankylosis is mainly trauma in childhood or growing age. Infection of middle ear in childhood may be a cause in developing countries. The neoplasia of the joint can also be a cause but very rare<sup>4</sup>.

In the long standing cases the facial asymmetry is similar to mild hemi facial microsomia in unilateral cases and retrognathia, micrognathia or microgenia in bilateral cases, presenting with a bird face like appearance.

The preoperative radiography is essential for successful surgery. The destructive and proliferative changes along with narrowing of the joint space are seen in a fibrous variety where as a full bony obliteration of the joint space with dense sclerotic bone is noticed in a bony or complete ankylosis. An OPG x-ray will reveal the anteroposterior dimension of ankylosing mass and the position of coronoid and acute antegonial notch on the affected side. The PA face radiograph will reveal the medio lateral extent of the bony mass. A tomogram of temporomandibular joint region gives the most valuable information that is the medial extension of the bony mass, which is quite helping in correcting the ankylosed joint<sup>5</sup>.

The preferred approach to the condylar region is, the preauricular or modified Al-kayat incision<sup>6</sup>, as it gives excellent exposure of condylar area and aesthetically acceptable scar while the postauricular and endaural incisions are discouraged because of their complications. The preauricular incision along with Risdon approach is beneficial for placing graft in the region<sup>2,9</sup>.

The technique to immobilize frozen joint depends upon the pathology present that is fibrous, fibro osseous or bony and is best assessed by Sawhney's<sup>10</sup> classification of the ankylosis in children as, 1) Type I or Fibrous. 2) Type II or Fibro osseous. 3) Type III or an external bridge of ankylosis over underlying somewhat normal functioning joint and 4) Type IV whole joint replaced by ankylosing bone and is mainly due to fracture dislocation of joint. In adults the Topazian's<sup>11</sup> three-stage classification of established ankylosis is useful, 1) Stage I ankylosis confined only to TMJ region. 2) Stage II ankylosis extending to sigmoid notch. 3) Stage III ankylosis extending to the coronoid process.

The main surgical procedures used now a days are, 1) Gap arthroplasty or a creation of gap through the ankylosis at the site of previous joint space and 2) Interpositional arthroplasty or a similar creation of gap and insertion of a barrier (autogenous or alloplastic) between the cut bony surfaces to minimize the risk of recurrence<sup>1</sup>.

Coronoidectomy is also performed where after creation of a sufficient gap, the mouth opening is not satisfactory due to short temporalis muscle particularly in long standing cases or where coronoid is fused with zygoma<sup>1,2</sup>.

The recurrence is less likely to occur where interpositional material is used between the cut bone ends. The autogenous tissues such as fascia lata, adipose tissue, muscle, full thickness skin and cartilage or the alloplastic materials like acrylic, vitallium,

tantalum, teflon and silastic or silicone rubber tubings have been used as an interpositional materials<sup>3,11,12,13,14</sup>.

## OBJECTIVES

The purpose of the study was to compare the success of temporomandibular joint ankylosis surgery after only the gap arthroplasty or the interpositional arthroplasty. The postoperative exercise was advised in all cases. Those patients who maintained or achieved the maximum mouth opening of 35mm at the end of follow up period were considered the most successful. The patients with reducing mouth opening during follow up were considered unsuccessful and were looked for re ankylosis or other factors like shortening of the ramus height, failure of exercise, or remains of ankylosis on the medial aspect.

## MATERIAL AND METHODS

This case study was carried out at Maxillo Facial Surgical Unit of Khyber College of Dentistry Peshawar. A total of 30 patients both male and female with age range from 2-40 years were selected who were diagnosed and admitted for surgical correction of temporomandibular joint ankylosis in this unit. There were 19 unilateral and 11 bilateral cases (or 41 joints). The patients were followed up to two to three years on quarterly basis.

All these patients reported in the out patient department of Maxillo Facial Surgical

Unit of Khyber College of Dentistry Peshawar. The main complaint was reducing or limited mouth opening. The diagnosis was comparatively easier with history and facial appearance. The OPG and PA face radiographs were used to assess the extent of ankylosis in horizontal and medio lateral dimensions. On radiological basis attempt was made classify the ankylosis into types I to IV in children (as by Sawhney<sup>10</sup>) and into stages I to III (as by Topazian<sup>4</sup>) in adults. Routine blood and urine investigations were done and any anomaly if present was corrected. The patients were admitted on settled appointment and operated next morning.

All were operated under general anesthesia with naso tracheal intubation, except in few patients with severe chin loss where preoperative tracheostomy was done to prevent respiratory complications during the postoperative period. It was because in such cases mandible tends to push back wards thereby carry the risk of pressing trachea and thus respiratory embarrassment. It is worth mentioning here that majority of our patients were anaesthetized with blind intubation successfully and in no case emergency tracheostomy was required.

All patients were pre shaved on temple region on the affected side. They were draped properly after being scrubbed. A piece of wet gauze placed in external auditory meatus to avoid any entry of blood during operation and was removed at the completion of operation. Local anesthesia with adrenaline was injected sub cutane-

GROUP I (TYPE I-III ANKYLOSIS) REVIEW UP TO 2-3 YEARS

|                              | Patients | Coronoidectomy | Disc | T-Flap | IID (Mean) | Re Ankylosis |
|------------------------------|----------|----------------|------|--------|------------|--------------|
| Gap Arthroplasty             | 8        |                |      |        | 32.4mm     | 3            |
| Interpositional Arthroplasty | 4        |                | 2    | 2      | 35mm       | 0            |

TABLE - 1

ously in the pre marked line of incision as a vaso constrictor. An inverted question mark incision started anterior to the helix just above the lobe of ear to avoid damage to the cervical branch of facial nerve, extended upwards and above the ear, curved broadly on the temple region anteriorly. Skin and sub cutaneous tissue incised till superficial fascia was reached; these layers were elevated by blunt dissection with blunt dissecting scissors and index finger till inferior border of zygomatic arch was reached. Then in front of tragus a T shaped incision was given on the capsular tissues with horizontal bar of T on the inferior border of zygomatic arch. Using a broad blade periosteum elevator the tissues were reflected and ankylosed condylar region exposed. The ankylosis was relieved using a round trimmer bur and where necessary coronoidectomy was performed. For the purpose of study the patients were divided into two main groups.

### GROUP I

This included Type I, II and III ankylosis. In Type I or fibrous ankylosis, when condylar area was exposed there were adhesions or fibrous tissues with little ossification, when these adhesions or fibrous tissues were removed, the jaw became mobile, the disc was normal and in position, condyle was little deformed. A little contouring of condyle or high condylar shave performed. In type II cases or fibro osseous ankylosis, little bone formation was seen. This was trimmed with a round trimmer bur, a minimum gap achieved, jaw mobilized and the disc found either in position or if

displaced brought to position. No contouring of glenoid was required but little shaving of remaining portion of condyle was done to smoothen sharp edges. The Type III was different, there was a bridge of ankylosis between external inferior border of zygomatic arch and the neck of condyle and on removing this bone, a somewhat normal working condyle but slightly bent on the medial aspect along with the disc was observed. The bent portion of the condyle was trimmed, disc brought to normal position and external inferior border of zygomatic arch contoured. At the end of operation the area was irrigated with saline, the disc was secured in position by suturing it to the capsular tissues. The capsular tissues and deeper layers were then closed with 2/0 vicryl and the skin approximated with 4/0 proline. The inter incisal distance (IID) was noted at the completion of operation, next morning and the day of discharge and quarterly follow up to 2-3 years.

### GROUP II

This group included the Type IV ankylosis in children and Stage I to III ankylosis in adults. In these cases after exposing the ankylosed region, the anterior and posterior borders of ankylosis identified, and using a round trimmer bur ankylosis removed. First a gutter made in ankylosis below the zygomatic arch antero posteriorly, it was then deepened and bone removal done very care fully on the medial aspect because of the danger of severing the internal maxillary artery that lie on the medial aspect. Here the bone was only thinned out

GROUP II (TYPE IV- STAGE III ANKYLOSIS) REVIEW UP TO 2-3 YEARS

|                              | Patients | Coronoidectomy | Disc | T.Flap | IID (Mean) | Re Ankylosis |
|------------------------------|----------|----------------|------|--------|------------|--------------|
| Gap Arthroplasty             | 13       | 8              |      |        | 30.7mm     | 5            |
| Interpositional Arthroplasty | 5        | 2              | 3    | 2      | 32.6mm     | 0            |

TABLE - 2

and then pressure applied with some strong instrument to break it, the part of ramus detached from glenoid. In cases where ankylosis was long standing and even after removal ankylosis mouth opening was not satisfactory, due to short temporalis muscle, the coronoid was cut and removed by dissecting the superficial fibres of temporalis attached to it. In few cases coronoid was found fused with zygoma and so removed. The glenoid was also contoured. Special attention given to the medial aspect as mostly hanging ankylosis lie there even after jaw is released. In most cases, dislocated fractured condyle along with ankylosing bone lied at  $45^{\circ}$  -  $90^{\circ}$  to the proximal ramus. In such cases a broad blunt instrument placed under it and the dislocated condyle was cut and removed. At the end the area was irrigated with saline, where the disc found was secured in position by suturing it to the capsular tissues. The pedicled temporalis muscle flap or musculo-aponeurotic flap if raised was passed beneath the under surface of zygomatic arch anteriorly and interposed between the cut bony surfaces and sutured to the capsular tissues using 2/0 vicryl. The capsular tissues and deeper layers closed with 2/0 vicryl and skin with 4/0 proline. The inter incisal distance (IID) was noted at the completion of operation, next morning and the day of discharge and on quarterly reviews up to 2-3 years.

## RESULTS

### *Group I (Table 1):*

There were 12 patients with Type I-II ankylosis, the age range was from 3-14 years and the duration of ankylosis was from 4 months to 5 years. It was further subdivided in to two subgroups.

1. Gap arthroplasty: In this sub group there were 8 patients. Mean mouth opening at the end of follow up period was 32.4mm. This sub group showed 3 cases of re ankylosis. These were

noticed during follow up period and operated again. The 5 successful cases had followed the instructions of exercise and follow up completely. One case of re ankylosis was too young to understand the exercise or cooperate with parents.

2. Interpositional arthroplasty: In this sub group there were 4 patients. The interposition was done with natural disc (2 cases) and with pedicled temporal muscle flap (2 cases), as disc was not found. In this sub group there was no case of re ankylosis. The results were excellent with maximum mouth opening of 35mm (mean) at the end of follow up period.

### *Group II (Table 2):*

In this group 18 patients were operated, ankylosis included type IV in children (below 15 years) and stage I-III in adults (age 15years or above). The age range was from 6-40 years and duration of ankylosis was 2-20 years. This group was again further subdivided in to two sub groups.

1. Gap arthroplasty: In this sub group there were 13 patients. In these 8 patients had coronoidectomy as well. The mean mouth opening at the end of third year was 30.7mm. Five patients of this sub group showed re ankylosis despite of proper exercise and follow up recalls.
2. Interpositional arthroplasty: In this sub group, there were 5 patients where interpositional arthroplasty was done, 3 with natural disc and 2 with anteriorly pedicled temporal muscle flap. This sub group showed no cases of re ankylosis. The mean mouth opening at the end of third year was 32.6mm.

## DISCUSSION

In our study where surgical technique of interpositional arthroplasty was used for



Fig. 1. Stage II ankylosis, coronoid also fused with zygoma. There is also acute ante gonial notch.



Fig. 2. Preauricular Alkayat Incision.



Fig. 3. Gap Arthrolasty



Fig. 4. Interposition with natural disc



Fig. 5. Interposition temporal muscle flap



Fig. 6. Interposition with temporal musculo aponeurotic flap

the correction of temporomandibular joint ankylosis had shown no cases of re ankylosis and this interprets that the interpositional arthroplasty may be done in every type of ankylosis despite of the age and duration and helps in preventing re ankylosis. The results are comparable with those reported by Topazian<sup>11</sup> and Chossegron<sup>12</sup>.

In types I and II ankylosis a gap of 3-5mm is sufficient. On removing of adhesions or a high condylar shave and whether natural disc found in position or if displaced brought to position. Mouth opening checked in all excursions of mandibular movements, is all that has to be done and patients perform well in later life. But if disc is not

found or is ruptured some type of interposition is required. In our study in types I and II ankylosis where natural disc was not found and only gap arthroplasty was done showed re ankylosis and this is ascribed to the failure to do postoperative exercise, as the patients were too young to understand its benefit or co-operate with parents. This factor makes a positive indication for interpositional arthroplasty even in types I and II ankylosis and in very young children. Here we consider temporal fascia or muscle flap as the best interpositional material. The type III ankylosis is different and is extra articular and underneath that a small and deformed but normally functioning condyle along with disc in position is present. There fore after removing extra articular ankylosis a satisfactory mouth opening is achieved and no further modification of any structure is required.

The real problem is with type IV cases where whole joint is replaced with ankylosing bone and normal joint is absent and after removal of this ankylosing mass the ramus length is definitely reduced. In such cases where a child has achieved much of its growth, and if the case is unilateral, the occlusion can be maintained with immobilization for a short duration but where much growth and development is expected the lost ramus length and joint must be replaced and this is total agreement with the results of Munroe<sup>17</sup>. Here again our study revealed that in type IV ankylosis where interposition was not provided showed re ankylosis and the cause is attributed to reduced ramus length and the action of elevator muscles, which pull the ramus to the bare glenoid causing fusion or re ankylosis. This emphasizes the necessity of interposition and correction of ramus length in type IV ankylosis cases in children.

The more challenging are the cases of established ankylosis in adults and gap arthroplasty is thought to be the treatment

of choice as growth is stopped. In these cases the removal of massive bony ankylosis is a difficult and risky job particularly in bilateral cases and ends in much larger gap and reduced ramus length and has to be corrected to avoid later complications like posterior gagging or anterior open bite. Here again where interposition was not provided re ankylosis or fusion of bare bony surfaces occurred emphasizing the need of interposition and correction of ramus length. This again proves that interposition should be provided cut bony ends in adult and long standing cases along with maintenance of the ramus length. This is also in agreement with the results of Kent<sup>15</sup> and Stern<sup>16</sup>. The disc is a natural remedy but where it is not found or disintegrated or ruptured, the temporalis muscle flap is an alternate effective remedy against re ankylosis. In our study we have used anterior pedunculated temporal muscle only or musculo-aponeurotic flap to create a "neo-disc" between the cut bony surfaces as by Chossegros<sup>3</sup>. The disc seems to be most natural interpositional material creating a false but new physiological and functional joint and only possible in short duration and early-diagnosed Type I-IV cases, where ramus height is sufficient.

## CONCLUSION

It is concluded that interpositional arthroplasty is the choice of treatment in any type or stage of ankylosis regardless of the age and duration. Different materials are available and can be used for interposition but the natural disc if found or other wise temporal muscle flap are the best locally available tissues for interposition. But only interposition may not be sufficient even in a growing child with Type IV ankylosis, as here production of gap may cause loss of ramus length and correction is required preferably with costochondral rib graft. In few adults cases even the temporalis muscle flap may not be sufficient to cover the entire

cut bony surfaces particularly the glenoid fossa and risk of fusion or re ankylosis exists. In such cases where only interposition is required a glenoid fossa implant with silastic interposition or where correction of ramus height is also required a costochondral rib graft or a total joint prosthesis with a large block of silastic with out disturbing occlusion should be tried. There fore a further comparative study is required in this regard.

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