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Approaches Towards Treating Temporomandibular Joint Ankylosis: Experience With 27 Cases

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ABSTRACT

Objective: To analyze various modalities used in the surgical treatment of temporomandibular joint ankyloses at a tertiary care teaching hospital in Pakistan. **Study design:** Case series (retrospective). **Settings:** Oral and Maxillofacial Surgery department, Dental section, Faisalabad Medical University, Faisalabad-Pakistan. **Duration:** January 2012 to December 2016. **Materials and methods:** Twenty-seven patients who presented with TMJ ankylosis were operated in these five years. The ankyloses were classified using the Sawheney's classification of TMJ ankylosis. Joints were exposed using Bramley Al Khayat and modified Blair incision in fresh cases while existing laceration was used in recurrent cases. Arthroplasty was carried out to restore mouth opening. The interpositioning was done using articular disc, temporalis muscle/fascia or silastic. The mouth opening exercises were initiated on the third post op day and the patients were followed regularly after the surgery. **Results:** Out of these 27 cases, 13 were male and 14 female (M:F 1:1.1). The age ranged from 02 years to 26 years with a mean age of 13.26±5.4 years. The average time for which the mouth opening remained restricted ranged from 01 year to 12 years with a mean of 5.96±2.8 years. Right side was affected in 11 cases and left side was involved in 9 cases while 07 were bilateral. 04 patients were classified as type I (14.8%), 10 type II (37%), 09 type III (33.3%) and 04 type IV (14.8%).Pre-operative mouth opening ranged from 02mm to 15mm with a mean opening of 5.85±3.5 mm. Post-operative mouth opening ranged from 20mm to 40mm with a mean opening of 31±4.2 mm. T-test was used to compare pre-operative mouth opening with post-operative mouth opening and the results were found to be statistically significant (P-value > 0.05). **Conclusion:** Treating TMJ ankylosis is a challenging task and there are various inherent difficulties in the procedure but with careful planning and meticulous surgical technique satisfactory results can be achieved which can improve the patient's quality of life quite significantly.

Keywords: TMJ ankylosis, Interpositional arthroplasty, Articular disc.

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INTRODUCTION

Temporomandibular joint (TMJ) ankylosis is a devastating condition which not only has marked influence on the functioning of the stomato-gnathic system of affected individual but also has profound psychosocial sequalae as well.[1,2] The condition refers to fusion of mandibular condyle with the skull base leading to restriction in mouth opening and causing retardation in mandibular growth, ultimately causing gross facial deformity.[2-4] The union can be bony, fibrous or a mixture of both and can affect one joint (unilateral) or both joints (bilateral).[5] Early childhood trauma leading to condylar fractures, chronic middle ear infections, birth trauma due to forceps delivery, autoimmune disease like rheumatoid arthritis or ankylosing spondylitis have been recognized as some of the leading causes of TMJ ankylosis.[6,7]

Clinically patient presents with restricted mouth opening, deviation of chin to the affected side in unilateral cases and receding chin (andy gump like deformity) in bilateral cases along with breathing difficulties, gross dental malocclusions, constricted maxilla etc.[8,9]

Interpositional arthroplasty has been the recommended modality of treatment where the bony or fibrous block is resected and the joint surfaces are lined by an interpositioning material followed by aggressive physiotherapy in the post-operative period. The interpositioning material commonly used are articulating disc, temporalis fascia, temporalis muscle, auricular cartilage, sling of fascia lata and Teflon, acrylic or silastic sheets, all having their own merits and demerits.[1,3,10,11]

The rationale of the current study is to analyze different modalities used for treating ankylosis patients and to evaluate results of different interpositioning materials used in our cases.

METHODOLOGY

Study Design: Case series (retrospective).

Settings: Department of Oral and Maxillofacial Surgery of Faisalabad Medical University, Faisalabad

Duration: January 2012 to December 2016

Methods: All the patients who presented with the complaint of restricted mouth opening due to TMJ ankylosis were included in the study. A thorough history was obtained from the

patients/attendants regarding duration for which restriction has been present, any past history of fall or trauma to lower jaw, any previous surgeries or birth trauma that could have resulted in development of ankylosis. They were also asked about any related breathing difficulties. The patients were initially diagnosed on the basis of clinical findings viz restricted mouth opening, absence of condylar movement on the affected side, gross facial asymmetry or micro-gnathia, presence of any scar mark on chin or scar due to previous surgery, constricted or canted maxilla and presence of dental malocclusions. Once the preliminary diagnosis was achieved, then the patients were advised baseline blood investigations, digital orthopantomograms (OPG) and computed tomograms from vertex of skull to base of mandible (axial, coronal and 3-D reformatted images) and they were prepared for surgery. Pre-anesthesia consultations and informed consents were obtained for all cases. CT scans were evaluated for degree and extent of fusion and classified according to Sawhney classification. Type 1 being fibrous union, type 2 bony fusion limited to lateral aspect of the joint, type 3 when the articular head was displaced medially and a bony bridge existed between the ramus and the zygomatic arch and finally type 4 when there was present a large bony block which replaced the joint architecture completely. This classification could not accurately be applied to the recurrent cases as the joint morphology was altered by their previous surgery.

Per-operatively, after provision of general anesthesia, the joints were exposed using Bramley AlKhayat incision or modified Blair incision in new cases while existing scar was employed for recurrent cases. In case of type 1 and type 2 ankylosis, the aim was to remove the obstruction, smoothening of the condylar heads and to maintain as much of the condylar stump and ramal height as technically possible. In type 3 cases after removing of the bony blob, the remaining condylar stump was assessed clinically. If it was found to be able to bear the masticatory loads, it was left intact otherwise it was surgically removed. In type 4 cases the bony fusion was broken, the ramal stump was trimmed in order to give it the shape of a pseudo condyle (Condyloplasty). This helped in maintaining the ramal height and prevented the development of post-operative open bite.

Regarding inter-positioning, we used four different techniques or materials. Our first preference in every case was to locate the articular disc and to reposition it in the gap. If it was unavailable or unusable due to perforation then we used the conventional temporalis muscle/fascia flap which was elevated and interposed in the created gap. The third method that we employed was a modified temporalis muscle flap which was based inferiorly and was elevated at the time of primary incision. The choice between modified flap and conventional flap was based on surgeon's preference. The last option was silastic and it was used only for recurrent cases in which disc, muscle and fascia could not be utilized per operatively.

After creation of gap and inter-positioning of material mouth opening was measured using a scale. It was considered adequate if it was between 25 to 30mm for patients under 10 years of age and 35mm and beyond for adolescents or adults. Hemostasis was achieved, drains were inserted and incisions were closed in layers and mastoid dressings were applied for 24 hours. Intactness of facial nerve was assessed in the immediate post-operative period. Drains were removed if the drainage was less than 20mm in 24 hours. Stitches were removed on the 7th post op day. Post-operative physiotherapy exercises were initiated on the third day after surgery and patients were advised to continue them for at least 2 years. Wooden spatulas (Wooden tongue depressors) and mouth gags were used for mouth opening exercises. Regular post op follow-up visits were arranged and the healing and mouth opening was assessed on every visit.

Data Analysis: All the acquired data was gathered on specially designed forms and was analyzed using SPSS (version 20). Frequency and percentages were presented in the form of charts. Student t-test was used to compare preoperative and post-operative mouth opening (P value< 0.05 was taken as significant).

RESULTS

Total twenty-seven (27) patients with TMJ ankylosis were operated in the last five-year period. Out of these 13 were male and 14 female with an overall male to female ratio of M:F 1:1.1. The age ranged from 02 years to 26 years with a mean age of 13.26±5.4 years. The average time for which the mouth opening remained restricted ranged from 01 year to 12 years with a mean of 5.96±2.8 years. Out of these 27 patients 11 affected right side, 9 involved left side (total 20 unilateral) while 07 were bilateral (Table 1).

Table 1: Showing relative frequencies and percentages of site of involvement

Site	Frequency	Percentage (%)
Right	11	40.7
Left	09	33.3
Bilateral	07	25.9
Total	27	100.0

Similarly, out of these 27 cases, 06 patients were operated before at some other center and were re-operated because of recurrence of ankyloses while the rest of the 21 were being operated for the first time. Regarding classification of ankylosis, 04 patients were of type I (14.8%), 10 type II (37%), 09 type III (33.3%) and 04 were classified as type IV (14.8%) (Table 2).

Table 2: Showing frequency and percentages of classification of TMJ ankyloses

Classification	Frequency	Percentage (%)
Type I	04	14.8
Type II	10	37.0
Type III	09	33.3
Type IV	04	14.8

Pre-operative mouth opening ranged from 02mm to 15mm with a mean opening of 5.85±3.5 mm. Post-operative mouth opening

ranged from 20mm to 40mm with a mean opening of 31±4.2 mm. T-test was used to compare pre-operative mouth opening with post-operative mouth opening and the results were found to be statistically significant (P-value > 0.05). The results are shown in Table 3.

Table 3: Showing comparison of Pre-op vs Post-op mouth opening (p value < 0.05 with a confidence interval of 95%)

Mouth opening	Mean (mm)	Std Deviation	Std Error Mean	Significance (Two tailed)
Pre-op	5.85	3.46	0.67	.000
Post-op	31.0	4.28	0.82	.000

Bramley Al-Khayat incision was used in 12 cases (44.4%), modified blair was employed in 9 cases (33.3%) while in all the 06 recurrent cases the existing scar was used to gain access to the joint (22.2%). (Table 4)

Table 4: Showing relative frequencies and percentages of various incisions used for joint exposure

Incision	Frequency	Percentage
Bramley Al-Khayat	12	44.4
Modified Blair	09	33.3
Existing Scar	06	22.2
Total	27	100.0

Regarding the inter-positioning material, articular disc was used in 11 cases (40.7%). In 07 cases, conventional temporalis fascia/muscle flap was used (25.9%). A modified temporalis flap approach was utilized in 07 cases (25.9%) while in 02 of the recurrent cases, silastic (7.4%) was used as temporalis muscle/fascia was not viable anymore (Table 5).

Table 5: Showing frequency and percentages of various inter-positional materials used for arthroplasty

Inter-positioning Material Used	Frequency	Percentage
Articular disc	11	40.7%
Modified Temporalis Fascial Flap	07	25.9%
Temporalis Muscle	06	22.2%
Temporalis Fascial Flap without muscle	01	3.7%
Silastic	02	7.4%
Total	27	100.0%

Figure 1: Conventional Bramley-Al Khyat Incision

Figure 2: Elevation of temporalis myofascial flap

Figure 3: In setting of temporalis flap

Figure 4: Modified blair like incision for arthroplasty

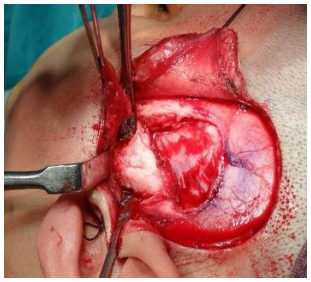

Figure 5: Elevation of inferiorly based modified temporalis flap before the exposure of the ankylotic mass

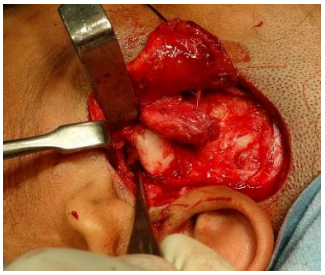

Figure 6: Modified temporalis flap reflected anteriorly while releasing ankylosis

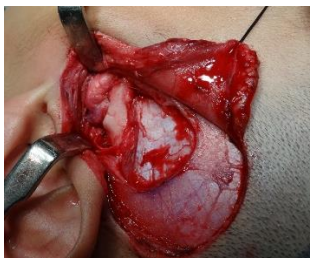

Figure 7: In setting of inferiorly based flap after the release of ankylosis

Figure 8: Articular disc in place after release of ankylosis

Figure 9: showing existing scar being used for exposure in a recurrent case

The follow up time period ranged from 04 months to more than 30 months with a mean follow up period of 16.44±7.2 months. Different intubation techniques were used in these cases. Fiberoptic intubation was employed in 06 (22.2%) cases, blind awake was used in 10 (37%), 06 (22.2%) were intubated with

retrograde intubation while in 05 cases (18.5%) tracheostomy has to be employed (Table 6).

Table 6: Showing frequency and percentages of different intubation techniques used for surgery

Intubation Technique Used	Frequency	Percentage (%)
Fibreoptic	06	22.2%
Blind Awake	10	37.0%
Retrograde	05	18.5%
Tracheostomy	06	22.2%
Total	27	100.0%

Three patients out of 27 (11.1%) required ipsilateral coronoidectomy while 02 other cases required (7.4%) bilateral coronoidectomy in order to achieve satisfactory mouth opening. In order to correct facial deformity 05 (18.5%) patients later on underwent distraction osteogenesis (Table 7).

Table 7: Showing frequency and percentages of various additional surgical procedures performed for ankyloses patients

Additional Surgical Procedures Performed	Frequency	Percentage (%)
None	17	63.0
Ipsilateral coronoidectomy	03	11.1
Bilateral coronoidectomy	02	7.4
Distraction Osteogenesis	05	18.5
Total	27	100.0

DISCUSSION

TMJ ankylosis is a devastating disease which is much more prevalent in the developing countries like Pakistan, India and other south Asian countries as compared to the developed countries mainly due to ignorance of the masses and the lack of awareness of the doctors, limited expertise and resources to diagnose and treat it correctly and at the right time.

We treated 27 patients of TMJ ankyloses in the last five years. Out of these 13 were males and 14 females with an overall male to female ratio of (M:F 1:1.1). The age of the patient ranged from 02 years to 26 years with a mean age of 13.26±5.4 years. An almost similar male to female ratio and age of presentation has been depicted by Kumar et al[3] and Maqsood et al[12] in their papers. Out of these 27 cases, 20 cases (74.1%) presented with unilateral ankylosis while 07 (25.9%) had bilateral ankylosis. Vasconcelos et al[13] in his series has depicted similar percentages (63% unilateral and 37% bilateral). Six (06) case out of these 27 cases were being operated for recurrence of their ankylosis. In our series of 27 cases, 04 patients were classified (according to Sawhney's classification) as type I (14.8%), 10 type II (37%), 09 type III (33.3%) and 04 type IV (14.8%) showing that Type II and III were the most common types while in his series Vasconcelos has shown that Type III and IV were the most prevalent[14,15].

Regarding mouth opening, in our series pre-operative mean incisal opening (MIO) ranged from 02mm to 15mm with a mean opening of 5.85±3.5 mm and post-operative mouth opening ranged from 20mm to 40mm with a mean opening of 31±4.2 mm. An almost similar result has been reported by other authors like Liu[1], Maqsood[12] and Vascancelos[13,14] as well with a marked improvement in MIO with the surgical intervention.

Bramley Al-Khayat incision was the most commonly used incision in our series and was employed in 12 cases (44.4%) while modified blair was used in 9 cases (33.3%). In all the 06 recurrent cases the existing scar was used to gain access to the joint (22.2%). The smaller modified blair like incision saved some of the operating time and was able to give adequate access to the ankylosed joint. Rowe's, Thoma or preauricular incision described by Ellis and Zide were not employed in any of our cases as it is difficult to perform temporalis muscle/fascia inter-positioning through these incisions[16,17].

Regarding the arthroplasty, in type 1, 2 and 3 our strategy was to preserve the ramal height rather than going for aggressive resection as advocated by Kaban[16,18]. In type 1, we removed the fibrous ankylosis and trimmed the sharp ridges. In type 2, we removed the lateral block and maintained the condylar head as such. In type 3 and 4, after releasing the ankylosis we tried to preserve whatever portion of the ramus that can be preserved. This technique helped not only in maintaining the ramal height but also obliterated the need for costo-chondral grafting. None of our patient presented with post-operative open bite because of this technique. Although we did not follow Kaban's protocol[16,18] very religiously in our cases, but we still had to do coronoidectomies in three of our recurrent cases as the mouth opening after release of ankylosis was less than 30 mm per-operatively.

Talking of the inter-positioning material, articular disc was used in 11 cases (40.7%). In 07 cases, conventional temporalis fascia/muscle flap was used (25.9%). A modified temporalis flap approach was utilized in 07 cases (25.9%) while in 02 of the recurrent cases, silastic (7.4%) was used as temporalis muscle/fascia was not viable anymore. As inter-positional material our first choice was always the articulating disc. Every attempt was made to locate the disc which we were able to utilize in 11 cases. In all these cases, the disc was found to be displaced antero-medially. Its fibrous adhesions with the glenoid fossa were released and it was retracted postero-laterally so that it should cover the surgically created articulating surface of the joint. It was stitched with the zygomatic arch or the fibers of the temporalis muscle in order to keep it anchored over the articulating surface. Use of articular disc has also been proposed by De Oliveira et al[19]. The benefits of using the articular disc are that it reduces surgical time, does not produce temporal hollowing which is associated with temporalis flap and last but not the least, it is the most natural barrier that can be interposed between the articulating surfaces. The second material that we used was temporalis fascia/muscle flap which was used in 14 (50%) of our cases. Use of temporalis fascia or muscle has been widely reported by various authors in the literature.[12,17,18,20,21] Two different approaches were used in this regard. One was the conventional approach where the flap was

elevated above the zygomatic arch and rotated over it to be secured with the remnants of disc/lateral pterygoid muscle in the glenoid fossa. This approach was used in 07 cases. Out of these seven cases, four were recurrent cases and in only three cases we used the technique in a fresh case. In the modified approach, which was also used in 07 cases, we raised the flap during the initial incision and was based on temporo-parietal fascia. The benefit was that it could be raised from a very small incision and did not result in bulge over the zygomatic arch. The limitation of the technique was that one had to retract it all the time so that it did not hinder the rest of the arthroplasty. In two of our recurrent cases, we used silastic as temporalis muscle/fascia was already utilized during their previous surgery. Although silastic prevented the recurrence, both of those patients still maintaining opening of 35mm or more even after two and a half years of follow up, silastic had to be removed in both the cases because of recurrent infection. Use of silastic/silicone based material has been reported by Gupta et al[4] and Vasconcelos et al[15] but they also report that infection and unpredictable results are known complications. We did not use costochondral graft in any of our patients because of increased morbidity and unpredictable growth of the CCG.[22] Instead, we tried to preserve as much of the ramus as possible by doing condyloplasty which precluded the development of post-operative anterior open bite due to ramal shortening.

Management of airway is always a daunting task in these cases owing to the limited mouth opening and distorted facial anatomy.[23] Coming towards management of airway in our cases, we employed different intubation techniques. As mentioned above fiberoptic intubation was employed in 06 (22.2%) cases, blind awake was used in 10 (37%), 06 (22.2%) were intubated with retrograde intubation while in 05 cases (18.5%) tracheostomy has to be employed which was carried out under local anesthesia prior to surgery. Once the airway was secured by these techniques, the rest of the surgery was carried out using isoflurane and atracurium. The extubation was done once the patient was fully awake and was able to follow commands. All these techniques have been mentioned in literature with varying success and complication rates.[23-25]

Regarding per-operative and post-operative complications, one patient presented with temporary weakness of the facial nerve which resolved in a months' time by the use of steroids and physiotherapy. Two patients presented with troublesome bleeding during the operation which was from the branches of maxillary artery and vein. We were able to manage it by ligating the bleeder, packing the surgical site with oxidized regenerated cellulose and judicial use of electro cautery. Another problem that we faced in two of our very young patients was carrying out of physiotherapy exercises. They were unable to cooperate for the mouth opening exercises. They were asked to use chewing gum for as much time of the day as possible and once every week the exercises were carried out under sedation using mouth gags. Although none of our patients has presented with complete recurrence of ankylosis but in three cases the mouth opening was less than 30 mm and one patient shows ipsilateral deviation of jaw on opening. Distraction osteogenesis followed by orthodontic management was done in five of our cases in order to correct facial deformities and malocclusions. We performed DO once at least one year had passed after successful arthroplasty and the patient has shown compliance in following post-operative mouth opening exercises.

CONCLUSION

Treating TMJ ankylosis is a challenging task and there are various inherent difficulties in the procedure but with careful planning and meticulous surgical technique satisfactory results can be achieved which can improve the patient's quality of life quite significantly. More emphasis should be placed on preventing the development of TMJ ankylosis rather than treating it as prevention is always better than cure.

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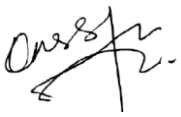
Dr. Omer Sefvan Janjua Associate Professor, Oral & Maxillofacial Surgery Dental Section Faisalabad Medical University, Faisalabad	Conception of Idea, Data Collection, Manuscript Writing	
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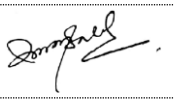
Dr. Muhammad Imran Saleh Assistant Professor, Oral & Maxillofacial Surgery De'montmorency College of Dentistry, Lahore	Manuscript Completion, Proof Reading	
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