



Surgical treatment of temporomandibular joint ankylosis: Skims experience of 105 cases

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ABSTRACT

Ankylosis is a very common condition developed mainly after damage to mandibular condyles or temporomandibular joint (TMJ) at a growing age. Treatment of temporomandibular joint ankylosis is a challenge and suffers from a high incidence of recurrence. Although treatment of ankylosis has been tried as early as nearly 200 years ago, no single technique produced satisfactory results. To report our experience of 105 TMJ ankylosis cases managed with different surgical modalities from 1999 to 2014 in our institute. The sample consists of all the patients who have been operated in our deptt. for TMJ ankylosis using different surgical treatments from 1999 to 2014. Pre- and postoperative assessment included a thorough history and physical examination to determine the cause of ankylosis, the maximal incisal opening, type of the ankylosis and recurrence rate. The mean age was 15.4, 12.4, 13.6 and 14.3 years for gap arthroplasty, interpositional arthroplasty with CCG, Interpositional arthroplasty with acrylic spacer and Interpositional arthroplasty with temporalis myofacial flap respectively. Trauma was the only etiological factor in all the cases of the present study. Preoperative CT scans revealed various types of ankylosis, according to Sawhney's classification (9), type I (n=21), type II (n=40), type III (n=49) and type IV (n=8). The mean maximal incisal opening (MIO) in the pre and post operative period was 10.2 and 38.3 in gap arthroplasty group, 10.5 and 34.3 in interpositional arthroplasty with CCG group, 15.3 and 28.7 in interpositional arthroplasty with acrylic spacer group and 7.1 and 38.4 in interpositional arthroplasty with temporalis myofacial flap group. The recurrence rate was 10% (n=3) in gap arthroplasty, 2.63% in interpositional arthroplasty with CCG group, 8.33% in interpositional arthroplasty with acrylic spacer group and no recurrence was observed in interpositional arthroplasty with temporalis myofacial flap group. The recurrence always occurred in ankylosis type IV in all groups.

INTRODUCTION

Ankylosis of the temporomandibular joint (TMJ) is an intracapsular union of the disc-condyle complex to the temporal articular surface that restricts mandibular movements, including the fibrous adhesions or bony fusion between condyle, disc, glenoid fossa, and eminence (1). It is a serious and disabling condition that may cause problems in mastication, digestion, speech, appearance, and hygiene. It can also cause disturbances of facial and mandibular growth, and acute compromise of the airway invariably resulting in physical and psychological disability (2-5). TMJ ankylosis is most commonly associated with trauma (13-100%), local or systemic infection (10-49%), or systemic disease (10%), such as ankylosing spondylitis, rheumatoid arthritis, and psoriasis. Ankylosis can also occur as a result of TMJ surgery (6). The treatment of TMJ ankylosis poses a significant challenge because of technical difficulties and a high incidence of recurrence. A variety of techniques for its treatment have been described in the literature. However, no single method has produced uniformly successful results (3,6,7).

MATERIALS AND METHODS

A sample of 105 patients with unilateral and bilateral tmjankyloses who have been operated over a period of 15 years was taken. Patients were treated by gap arthroplasty, sialisticspacer, temporalis facia or muscle, total joint reconstruction with costochondral graft. Preoperative assessment included a thorough history and physical examination to determine the cause of ankylosis, age at presentation, sex, ankylosistype, treatment, recurrence rate, pre and post operative maximalincisal opening. The photographs were also taken preoperatively, intra-operatively and postoperatively. The ankylosis was classified according to Sawhney's classification(9) into four different types: type I when there was minimal bony fusion, but extensive fibrous adhesions around the joint; type II, when there was more bony fusion, especially at the outer edge of the joint surface, but no fusion within the more medial area of the joint; type III, when there was a bridge of bone between the mandible and the temporal bone; and type IV, when the joint was replaced by a mass of bone. Radiographic examination included panoramic radiographs and computed axial and coronal tomography (CT) to determine the extent of the ankylosis and to rule out any othercause of limited mouth opening.

Surgical Procedures: Exposure of the TMJ was done by the preauricular approach described by Ellis and Zide (10) under general anesthesia. After exposure and identification of the site of the ankylosis, aggressive excision of the fibrous and/or bony mass was carried out with round burs and chisels until the mandibular movements were achieved. Next the glenoid fossa was recontoured as necessary. For all surgical procedures bilateral coronoidectomy was performed irrespective of mouth opening achieved after ipsilateral coronoidectomy.

For the gap arthroplasty, in addition to this procedure, a gap of at least 15 mm was created between the glenoid fossa and the mandible. Fig.1

For total TMJ reconstruction, after resection, a costochondral graft was put in place in order to reconstruct the TMJ fig.2. The graft was inserted through a submandibular incision and fixed using two 1.5mmx6mm titanium screws. All the grafts have been taken from 6th rib on right side and contoured to the shape of condylar head before insertion. All patients were put on IMF for 10 days to allow graft stabilization.

In case of interpositional arthroplasty with acrylic spacer, the gap created was filled with medical grade acrylic after contouring it to the proper shape using acrylic trimmer burs.

The temporalis myofacial flap was raised and passed under the zygomatic arch and was sutured with the medial tissues fig.3

The post-operative jaw opening and closing exercises were started at 3rd post operative day using wooden ice cream sticks for initial six months except in patients with costochondral grafts where an initial period of 10 days IMF was placed. All patients were followed-up for one year and maximum incisal opening recorded at one ,three, six and twelve month intervals.

TABLE 1. Depicting the different surgical treatment modalities and the parameters used in the study

TYPE OF PROCEDURE	NO. OF PATIENTS	MEAN AGE (years)	MEAN PRE OP INCISAL OPENING (mm)	ANKYLOSIS TYPE I,II,III,IV	ETIOLOGY	MEAN POST OP INCISAL OPENING (mm)	RECURRENT RATE	MEAN ONE YEAR F/U M.O. (mm)
GAP ARTHROPLASTY	30	15.4	10.2	I=5 II=10 III=12 IV=3	Trauma=28 Infection=2	38.3	I=0 II=0 III=1 IV=3	30.5
INTERPOSITIONAL ARTHROPLASTY WITH CCG	38	12.4	10.5	I=7 II=13 III=16 IV=2	Trauma =37 Infection=1	36.4	I=0 II=0 III=0 IV=1	34.3
INTERPOSITIONAL ARTHROPLASTY WITH ACRYLIC SPACER	12	13.6	15.3	I=2 II=4 III=5 IV=1	Trauma =12	33.1	I=0 II=0 III=0 IV=1	28.7
INTERPOSITIONAL ARTHROPLASTY WITH TEMPORALIS MYOFACIAL FLAP	25	14.3	7.1	I=7 II=13 III=16 IV=2	Trauma =24 Infection=1	39.8	I=0 II=0 III=0 IV=0	38.4

RESULTS

105 patients (60 females and 40 males) were submitted to TMJ ankylosis surgery (Table 1).

The mean age was 15.4, 12.4, 13.6 and 14.3 years for gap arthroplasty, interpositional arthroplasty with CCG, Interpositional arthroplasty with acrylic spacer and Interpositional arthroplasty with temporalis myofacial flap respectively (table 1). Trauma was the main etiologic factor (96%) whereas history of infection was present in few patients (3.8%) (table 1).

Preoperative CT scans revealed various types of ankylosis, according to Sawhney's classification (9), type I (n=21), type II (n=40), type III (n=49) and type IV (n=8) (table 1). The mean maximal incisal opening (MIO) in the pre and post operative period was 10.2 and 38.3 in gap arthroplasty group, 10.5 and 34.3 in interpositional arthroplasty with CCG group, 15.3 and 28.7 in interpositional arthroplasty with acrylic spacer group and 7.1 and 38.4 in interpositional arthroplasty with temporalis myofacial flap group. The recurrence rate was 10% (n=3) in gap arthroplasty, 2.63% in interpositional arthroplasty with CCG group, 8.33% in interpositional arthroplasty with acrylic spacer group and no recurrence was observed in interpositional arthroplasty with temporalis myofacial flap group (Table 1). The recurrence always occurred in ankylosis type IV in all groups (Table 1).

DISCUSSION

The main causes of TMJ ankylosis are trauma and infection (2,6). Estimates of a traumatic origin range from 26% to 75% and of infection² from 44% to 68%. Roychoudhury *et al.* (3) retrospectively studied 50 cases of TMJ ankylosis and showed that trauma was documented as a major etiologic factor in 86% of all cases. In the present study also, trauma was the main etiologic factor. This may be because most of our patients were from a population where maxillofacial surgery is still in infancy and most of the patients with jaw fractures either remain undiagnosed or are mismanaged. TMJ ankylosis is a common condition, and its management is difficult (7). There is no agreed treatment, and results have been variable and often less than satisfactory (2,3,6,7). The most frequently reported operations include gap arthroplasty, interpositional arthroplasty and joint reconstruction with autogenous or alloplastic materials (2,3,6,11,12). Gap arthroplasty alone gives rise to a gap between the articular cavity and the mandibular ramus and has the advantage of simplicity and short operating time (6). On the other hand it has the disadvantage of generating a pseudo-articulation, with shortening of the mandibular ramus and, in addition, it seems to increase the risk of recurrence (3,6). Matsuura *et al.* (13) studied the functional and anatomic changes after gap arthroplasty by using animal models and showed that this procedure for TMJ ankylosis did not restore TMJ functionally and histologically to its preexisting state. On the other hand, Vasconcelos *et al.* (14) reported 8 cases of ankylosis (type I to IV) treated by gap arthroplasty and found no recurrence in their series with a follow up of at least 24 months. Complications such as the development of an open-bite in bilateral cases, premature occlusion on the affected side with contralateral open bite in unilateral cases, and limited mouth opening post-operatively are possible (6,13). In the present study, out of a total of 30 patients operated with this technique, there were three recurrences, probably related to the type of ankylosis in question (type IV). The mean MIO increased from 10.2 mm preoperatively to 30.5 mm in the post-operative period, which may suggest that this technique was generally successful in the treatment of ankylosis.

Interpositional arthroplasty with autogenous or alloplastic material at the osteotomy site is a mechanism for preventing recurrence (7,6,13). Various materials have been used such as skin (3), dermis (15), flaps of the temporal muscle/fascia (2), silicone (7,13) and cartilage (11). However, there are possible disadvantages, such as morbidity at the donor site and unpredictable resorption when autogenous material is used, and a risk of foreign body reaction when alloplastic material is used (13,16). Thus, at present, there is no ideal interpositional graft. The following problems are encountered with present grafts: muscle shrinkage and fibrosis, fascia lacking bulk, cartilage tending to fibrose and calcify, and alloplastic implants under functional loads disintegrating and causing foreign body giant cell reactions (4). In this study, four types of interpositional materials have been used with varying results with best results obtained from interpositional arthroplasty with temporalis myofacial flap.



Fig.1.Depicting gap arthroplasty



Fig. 2 Fig.2.Costochondral graft being exposed for TMJ reconstruction in a patient with TMJ ankyloses.



Fig.3.Interpositional arthroplasty using temporomyofacial flap

TMJ reconstruction may be necessary for patients with extensive osteotomy and consequently insufficient ramus height, and can be performed with costochondral grafts, claviculorosteochondral grafts, iliac crest grafts, coronoid process grafts and alloplastic condylar implants (7,6). The most widely accepted autogenous technique is a costochondral graft. According to MacIntosh (17), the advantages of this graft are its biological compatibility, workability and functional adaptability. The growth potential of the costochondral graft makes it the ideal choice in children (6,18). Potential problems include fracture, further ankylosis, donor site morbidity and the variable growth behaviour of the graft (19). This problem could be solved using the coronoid process, which in patients with long-standing TMJ ankylosis is longer and thicker, so it could be used to take the place of the condyle and lengthen the mandibular ramus, thus avoiding a second surgical site and no increase in donor site morbidity (20). This graft has also the advantage of a predictable behavior (6).

In all patients in this study the ipsilateral coronoidectomy was performed as the coronoid process tends to grow in along-standing ankylosis causing inadequate intraoperative interincisal opening (6). One patient using costochondral graft recurred, maybe because this patient had an ankylosis type IV associated with micrognathia, which was not treated at the same operation time.

To avoid these problems a number of alloplastic materials (acrylic, synthetic fibres, titanium total joint systems) and systems have been developed for use in the reconstruction of the TMJ (21). 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, reduction in operation time and a lower risk of recurrent ankylosis (19). The main problems associated with these materials relate to wear at the joint surfaces, foreign body reaction, mobility of the implant with displacement, and implant fracture, caused, most of the time, by the use of inappropriate alloplastic materials (17,22). Borçbakan (23) was the first to use an acrylic condyle in the surgical treatment of TMJ ankylosis. Acrylic is a simple, inexpensive material that can be produced locally and does

not require an additional surgical site. In this study, the results with acrylic spacer were not satisfactory. Out of 12 patients, 3 had extrusion of the acrylic spacer within a month's time, 2 had recurrence within three months and 4 patients were complaining of difficulty chewing the food.

Irrespective of the technique chosen by the surgeon, aggressive resection of the bony or fibrous ankylosed segment is crucial to avoid recurrence. In addition, a dissection of the muscles of the mandibular ramus and ipsilateral coronoidectomy must be carried out to prevent inadequate intraoperative interincisal opening, because the coronoid process may be elongated in long-standing cases (8). A reconstruction of the TMJ is ideal. After that, aggressive physiotherapy should be recommended in order to disrupt and prevent adhesions, prevent soft-tissue contractions and redevelop normal muscle function (8,24). Some authors prefer to wait for a period of 5 to 7 days for pain and swelling to subside before commencing mobilization of the mandible.

This delay allows early phase healing of the surrounding tissues. The potential problem with early mobilization is that it may provoke bleeding and create a large hematoma with delayed healing and an increased likelihood of wound breakdown, disorganization and ossification (4).

Regardless of the surgical approach used to gain access to the TMJ, the final dissection places the facial nerve at risk for damage (9,25). A loss of function of the frontalis and orbicularis oculi muscles is always a possibility (9). The incidence of complications such as permanent injury of the facial nerve is very low (5,26), with rate varying from 9 to 18% (27) and 1.5 to 32% (25), usually disappearing within 6 months. The right choice of technique for making the approach to the TMJ, such as the preauricular approach modified by Alkayat and Bramley (28) and the preauricular approach described by Ellis & Zide (10), when properly performed, may decrease the risk of damaging this nerve (4). All nerve damage in this study occurred in ankylosis type IV treated by gap arthroplasty with an incidence of 21.42%; two of these patients recovered within 4 months and the other within 6 months. It is possible that the difficulty of the surgical procedure in relation to the type of ankylosis may increase the risks of damage to the facial nerve, especially because the longer the duration of surgery, the longer tissues are separated, thereby increasing the risk of such damage.

The articular reconstruction with alloplastic or autogenous grafts, or gap arthroplasty for the treatment of ankylosis is shown to be efficient in relation to the post-operative maximal incisal opening, recurrence and articular function. Since the majority of the published studies on humans are case series, it is necessary to conduct studies with the same type of ankylosis and operative technique containing a larger sample in order to permit comparisons of the various forms of treatment.

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