The contribution to success of various methods of treatment of temporomandibular joint ankylosis (a statistical study containing 24 cases)

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Temporomandibular joint (TMJ) ankylosis is an important joint disorder which, in addition to emerging through trauma, can also arise as a result of local and systemic infections. TMJ ankylosis which develops in childhood in particular has its own characteristics.

Despite the existence of different views on the treatment of TMJ ankylosis, various techniques have been defined, and three basic techniques are currently employed: gap arthroplasty, interpositional arthroplasty and joint reconstruction.

Our study is intended as a statistical inquiry into the contribution to the operation success of the three different methods of treatment. Moreover, the effect on treatment outcome of unilateral or bilateral ankylosis is also statistically evaluated.

In our study, eight cases were treated with gap arthroplasty, nine with interpositional arthroplasty and seven with joint reconstruction performed by costochondral graft. As a result of our statistical evaluation, it was determined that the effect of interpositional arthroplasty on post-operative maximal interincisal mouth opening was greater than that observed with the other methods.

Key words: temporomandibular joint, ankylosis, children.

Temporomandibular joint (TMJ) ankylosis is a pathological condition creating serious problems with regard to an individual's appearance and oral hygiene and functions[1]. The speech, swallowing and chewing functions of such patients are affected to a major extent. Patient nutrition is affected by the inability to open the mouth, and there is a question of retardation in development[1]. TMJ ankylosis which develops in childhood in particular has its own characteristics. In ankylosis which develops in childhood, since the growth and development of the mandible are affected, a bird-face appearance forms in bilateral cases and deviations towards the affected side appear in unilateral cases[2]. This emerges as a serious aesthetic problem[2]. As a result of insufficient patient nutrition, the child's physical development remains behind that of his/her contemporaries.

Temporomandibular joint ankylosis essentially emerges as the result of inappropriately treated joint fractures[3]. In such cases, fibrosis and calcification form in the wake of intra-articular hematoma[4]. Laskin[5] has reported that post-traumatic ankylosis is more frequently seen in children. In addition, local infections such as otitis media and mastoiditis, as well as systemic infections such as tuberculosis, scarlet fever and gonorrhea, can also give rise to ankylosis by the hematogenous route[6].

Despite the existence of different views on the treatment of TMJ ankylosis, various techniques have been defined, and three basic techniques are currently employed[7-9]:

1. Gap arthroplasty: the resectioning of the osseous mass between the articular cavity and the mandibular ramus; this resection field is left empty.

2. Interpositional arthroplasty: following resectioning of the osseous mass, the interpositional placement of biological (temporal muscle, skin or auricular cartilage, etc.) or non-biological (acrylic and silastic) materials in the operation space[2,10,11].

3. Joint reconstruction: reconstruction by autogenic costochondral graft or total joint prosthesis following resectioning of the osseous mass[12].

A number of studies regarding these methods of treatment appear in the literature[1-3,13,14]. In our examination of the literature, however, we encountered no study in which the levels of effectiveness of these methods were compared statistically. Our study was therefore intended as a statistical inquiry into the contribution to the operation success of the three different methods of treatment (gap arthroplasty, interpositional arthroplasty and joint reconstruction). Moreover, the effect on treatment outcome of whether ankylosis is unilateral or bilateral was also statistically evaluated.

Material and Methods

The study was performed in the light of data obtained from the hospital files of 24 children aged 15 or younger presenting at our clinic with mouth-opening and facial symmetry complaints, diagnosed with TMJ ankylosis as a result of clinical and radiological examination, and operated on at our clinic between 1985 and 2003.

The patients in the study were evaluated with regard to gender; trauma age; ankylosis etiology, localization and type; operation age; treatment methods employed; pre- and post-operative mouth opening; complications; post-operative follow-up periods; and recurrence. The absence of indications of recurrence in the post-operative period and post-operative mouth opening of at least 25 mm were adopted as the criteria for the operation to be regarded as successful. In the light of the data obtained from the hospital files, the contributions of the different methods of treatment to the success of the operation were analyzed statistically. For that purpose, the multiple comparisons test was employed to determine whether or not there was a statistical difference among the methods with regard to mouth opening. In addition, the effects of bilateral or unilateral ankylosis on treatment outcomes were also evaluated statistically. In order to evaluate whether or not recurrence was linked to bilateral or unilateral ankylosis, the chi-square test was employed. The independent samples t-test was used to determine the effect of bilateral or unilateral ankylosis on post-operative mouth opening.

Results

Of our cases, 56.5% were girls and 43.5% boys. The etiological factor in 23 of the 24 cases was joint fractures resulting from falls (Table I).

Table I. Characteristics and Outcomes of the Patients

P no.	Sex	Trauma Age	Etiol	U/B	Loc	OA	Tre	PreO MO	PostO MO	Com	F-U	Rec
1	M	4	Fa	U	L	14	G	6	38	N	180	N
2	F	9	Fa	U	R	13	I	12	42	N	24	N
3	F	5	Fa	U	R	13	G	0	29	N	12	N
4	F	5	Fa	U	R	7	G	0	30	N	12	N
5	F	4	Fa	B	LR	13	I	0	30	N	12	N
6	M	5	Fa	U	L	11	I	0	28	Y	14	N
7	F	7	Fa	U	L	12	I	0	30	N	16	N
8	F	5	Fa	U	L	11	G	0	28	N	18	N
9	F	8	Fa	U	L	15	I	15	35	N	12	N
10	M	8	Fa	B	RL	13	G	0	29	N	12	N
11	M	6	Fa	B	RL	12	I	0	30	Y	28	Y
12	M	6	Fa	B	RL	14	G	5	30	Y	24	N
13	F	6	Fa	U	L	11	R	0	30	N	28	N
14	F	5	Fa	U	L	13	R	0	20	N	12	N
15	M	7	Fa	U	R	12	R	10	25	N	12	N
16	F	4	Fa	U	R	11	R	5	25	N	15	N
17	F	1	OM	U	L	7	R	0	20	N	12	N
18	M	13	Fa	B	RL	14	I	0	30	N	12	N
19	M	6	Fa	B	RL	10	R	0	35	N	14	N
20	M	4	Fa	B	RL	12	G	9	29	N	26	N
21	F	6	Fa	B	RL	12	I	0	27	N	36	N
22	F	9	Fa	B	RL	12	R	0	30	N	48	N
23	M	6	Fa	U	R	12	I	0	37	N	16	N
24	M	4	Fa	U	L	14	G	0	35	N	14	N

Etiol: etiology, Fa: falls, OM: otitis media, U: unilateral, B: bilateral, Loc: location, L: left, R: right, OA: operation age, Tre: treatment, G: gap arthroplasty, I: interpositional arthroplasty, R: reconstruction, PreOMO: preoperative mouth opening, PostOMO: postoperative mouth opening, Com: complication, F-U: follow-up, Rec: recurrence.

Eight of our cases had been treated with gap arthroplasty, nine with soft tissue interpositional arthroplasty and seven with joint reconstruction performed by costochondral graft (Table I) (Figs. 1-3). The preferred surgical approach in all cases was the preauricular approach. Follow-up periods lasted at least one year. All patients received post-operative physiotherapy.

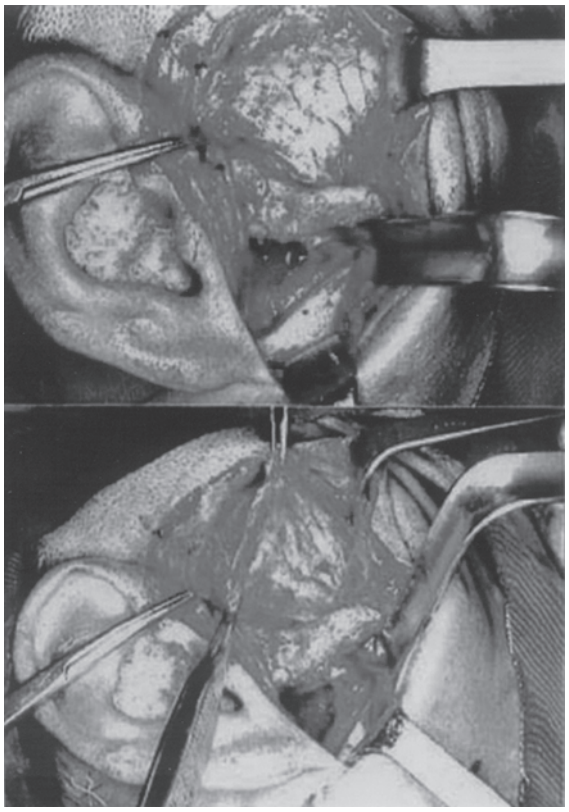

Fig. 1. Intra-operative view of the patient treated with interpositional soft tissue (temporal muscle) flap.

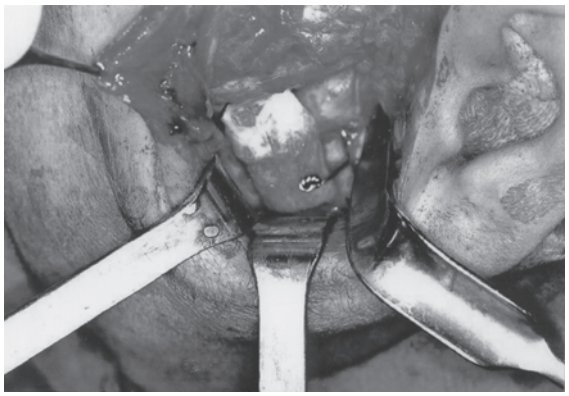

Fig. 2. Intra-operative view of the patient treated via costochondral graft.

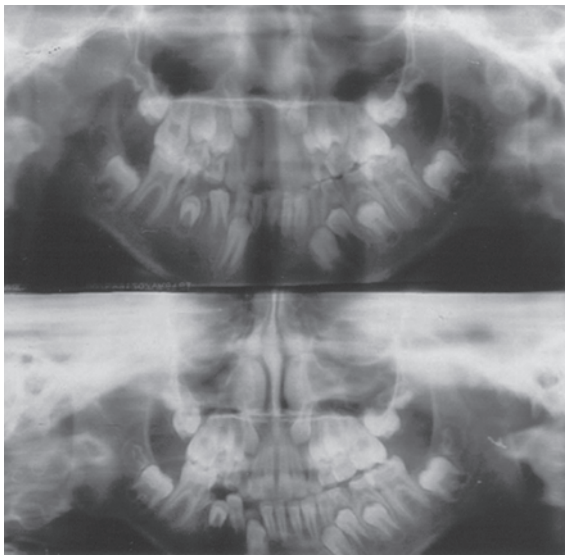

Fig. 3. Preoperative and postoperative panoramic appearance of the patient treated with gap arthroplasty.

Cases with postoperative mouth opening of 25 mm and more and with no recurrence were regarded as successful (Fig. 4). According to this evaluation, a total of three cases (12.5%), two

Fig. 4. Pre- and postoperative mouth opening view.

with postoperative mouth opening of 20 mm each and one in whom recurrence was observed, were determined as being unsuccessful, and the remaining 21 cases (87.5%) were determined as being successful (Table I). The case in whom recurrence was observed had bilateral joint ankylosis and was treated with interpositional soft tissue arthroplasty.

Of the cases, 14 were unilateral and nine bilateral. An independent samples t-test was performed to determine the effect of bilateral or unilateral ankylosis on the post-operative mouth opening achieved. As a result of that test, it was determined that the effect of unilateral or bilateral ankylosis on post-operative mouth opening was unimportant ($p > 0.05$).

The chi-square test was employed to determine whether or not there was a relationship between bilateral and unilateral ankylosis and the development of recurrence. As a result of that test, it was concluded that unilateral or bilateral ankylosis had no effect on the development of recurrence ($p > 0.05$).

In addition, multiple comparison analysis was performed to test whether post-operative mouth opening varied according to surgical technique. As a result of that test, it was determined that the levels of postoperative mouth opening in cases in which soft tissue interpositional arthroplasty had been performed were higher than that observed in the other methods ($p > 0.05$).

Discussion

Articular trauma is the basic cause of TMJ ankylosis. Local and systemic infections are etiological factors observed after trauma[3]. Laskin[5] has stated that the incidence of post-traumatic ankylosis is higher in children. Roychoudhury et al.[1] have stated that in their series consisting of 50 cases of TMJ ankylosis, trauma was the etiological factor in 86% of cases. In almost all the cases in the present study (95.8%), the etiological factor was joint trauma resulting from falls.

The treatment of TMJ ankylosis continues to be a topic of current interest because of both the difficulties encountered in surgical techniques and the high incidence of recurrence. The fundamental aim in the treatment of TMJ ankylosis is the successful surgical resectioning of ankylotic bone, the prevention of recurrence and aesthetic improvement by ensuring functional occlusion[13]. The techniques employed to that end are joint reconstructions performed with costochondral grafts or alloplastic joint prostheses, gap arthroplasty and interpositional arthroplasty.

Gap arthroplasty is based upon leaving this region empty by resectioning the ankylotic bone. Roychoudhury et al.[1] reported that they obtained rather good results in their series of 50 cases of joint ankylosis treated by gap arthroplasty. In their study, which evaluated two groups of patients, aged from 0-12 and 13-30, they reported the average post-operative mouth opening in groups I and II as 30.62 mm and 30.14 mm, respectively. Recurrence levels were reported as 2%. The same researchers suggest that the fundamental objective in the treatment of TMJ ankylosis was the restoration of functions to patients and that facial remodelling would follow. They stated their belief that facial aesthetics can be provided by surgical intervention if a satisfactory aesthetic structure is not formed after the completion of growth development[1].

In our series of 24 patients, eight were treated by gap arthroplasty. No recurrence was encountered in any case. Post-operative mouth opening varied between 28 and 38 mm, and functions were to a large extent restored. The follow-up period in our cases was generally one to three years. Apart from one patient whom we were able to monitor for as long as 15 years, we were unable to monitor our patients for very long. As maintained in the literature, it will only be possible to determine the extent to which the restoration of facial form has been achieved as a result of gap arthroplasty once our patients have completed their growth and development periods.

Despite its effectiveness in preventing recurrence, some of the disadvantages of interpositional arthroplasty performed with the application of autogenous or alloplastic materials to the ostectomy region, as stressed in the literature, are the possible occurrence of donor site morbidity and resorptions, and alloplastic materials possibly giving rise to foreign body reactions[3]. Various biological or non-biological materials are used for interpositional arthroplasty[1]. Chossegros et al.[15] reported their good results with full-thickness skin and temporal muscle flaps, but they failed to achieve successful results with the use of

homologous cartilage. In one study on a small number of patients, it was reported that resected bone tissue could be used for that purpose[16].

Reconstruction with alloplastic materials or autogenic bone grafts such as clavicle, metatarsal, fibula, iliac crest and costochondral grafts is another method employed in the treatment of TMJ ankylosis. Reconstruction by costochondral graft is a method which has gained in popularity over the last two decades. This has various advantages, such as biological and anatomical similarity to the mandibular condyle, ease of acquisition and of application to the region, and a large regeneration and growth capacity[2]. It is stated in the literature that quite positive results have been achieved with this method[6,17]. Costochondral graft also contributes to ensuring mandibular growth in children. It has been reported in the literature that problems such as excessive growth in the graft or necrosis and resorption may be encountered following costochondral graft[13]. Another disadvantage with regard to costochondral graft is donor site morbidity[1].

In our study, eight cases were treated with gap arthroplasty, nine with interpositional arthroplasty and seven with joint reconstruction performed by costochondral graft. As a result of our statistical evaluation, it was determined that the effect of interpositional arthroplasty on post-operative maximal interincisal mouth opening was greater than that achieved using the other methods.

The influence of bilateral or unilateral ankylosis on recurrence was also researched statistically in our study, and no statistical difference between the groups was found. However, our clinical experience and the surgical treatment applied to our adult patients lead us to think that bilateral ankylosis is an important factor in recurrence.

We also think that success of the physiotherapy applied to all treatment groups in the post-operative period is rather important from the point of view of the success of the treatment and the prevention of recurrence.

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