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Original Article

Pre-arthroplastic and simultaneous mandibular distraction for correction of facial deformity in temporomandibular joint ankylosis

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ABSTRACT

Introduction: In cases of temporomandibular joint (TMJ) ankylosis, interposition arthroplasty allows return of functional jaw movements. In order to improve the facial appearance, distraction osteogenesis is the treatment of choice, and may be timed either as a pre-arthroplastic, simultaneous or post-arthroplastic procedure. This study was planned to compare the treatment outcomes of pre-arthroplastic distraction (PAD) and simultaneous arthroplastic distraction (SAD) to establish the better treatment modality in terms of improvement in function and aesthetics.

Materials and methods: This prospective randomized experimental study included 20 children and adolescents suffering from facial deformity due to long standing unilateral TMJ ankylosis. They were randomly allocated to the two surgical groups with ten in each group.

Result: Both groups resulted in good facial symmetry and aesthetics. Initially, during the distraction period, mouth opening of SAD group scored less than that of PAD group but became comparable in 30 days. More pain at the distraction site and over the normal TMJ was observed in PAD group. The excursive movements were almost comparable in both the groups.

Conclusion: We conclude that both procedures are effective in correcting the post-ankylosis deformity and improving function. Although PAD has better control over movement of the distracting segment, the contralateral TMJ may experience pain. SAD requires a shorter management period but is associated with a temporary decrease in function. Also, control of distraction may be difficult and chances of reankylosis are always there.

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1. Introduction

Temporomandibular joint (TMJ) ankylosis is one of the most debilitating joint disorder adversely effecting the quality of life. It hampers both facial aesthetics and functional movements of jaws.¹ Treatment of TMJ ankylosis is challenging, but rewarding and various protocols have been established.^{2,3}

Distraction osteogenesis is a form of in vivo tissue engineering whereby viable bone is regenerated as a result of gradually separating the two osteotomized bone edges.⁴ It has the added benefit of distraction histogenesis, or soft tissue augmentation, and has been effectively used for the reconstruction of congenital and acquired deformities of the mandible. Ilizarov,^{5,6} a Russian physician, developed this technique in Kurgan in West Siberia, when treating veterans of the World War II, and has gained popularity even in maxillofacial region.⁷

Distraction osteogenesis has recently become the mainstay of treatment for correction of facial deformity in TMJ ankylosis. While interposition arthroplasty may be performed to correct the functional movements, distraction may be timed either before (pre-arthroplasty),⁸⁻¹⁰ during (simultaneous arthroplasty)¹¹⁻¹⁶ or after (post-arthroplasty).¹⁷

This study was conducted with an aim to compare the treatment outcomes of pre-arthroplastic distraction (PAD) and simultaneous arthroplastic distraction (SAD) to establish the better treatment modality.

2. Materials and methods

The present study was carried out in the Department of Oral and Maxillofacial Surgery, King George's Medical University,

Lucknow from 2011 to 2012, with the aim to compare the treatment outcomes of PAD osteogenesis (Group I: PAD) and simultaneous distraction osteogenesis with interposition arthroplasty (Group II: SAD) in unilateral TMJ ankylosis cases presenting with facial deformity.

A total of 20 cases who agreed to participate in the study were included after obtaining their informed consent or their parents', if minor. The study was duly approved by the Institutional Research Board. Pre- and post-operative evaluations were done on the basis of clinical and cephalometric analysis. Pre-operative assessment included a thorough history, clinical examination and radiological evaluation on cephalogram (antero-posterior and lateral), orthopantomogram and computerized tomographic scans.

Patients were randomly allocated to the two experimental groups, with ten in each. In Group I, a two-stage protocol was followed. Initially in the first stage surgery, the distractor was placed via submandibular approach. The second stage surgery was performed after a consolidation period of 4-6 weeks, wherein temporalis fascia interpositional arthroplasty was performed via Al-Kayat Bramley approach and the distractor was removed. In Group II, temporalis fascia interpositional arthroplasty and distractor placement was done in a single stage. Mouth opening exercises were started on the first post-operative day and distractor activation on the fifth post-operative day.

The parameters for assessment of function were maximal inter-incisal mouth opening, excursive movements (protrusion, lateral excursion), pain over the distraction site and the contralateral non-ankylosed TMJ, the time required to achieve the desired mouth opening of approx. 35 mm post-operatively with improvement in aesthetics and any complications. Both the groups were prospectively followed for at least 6 months post-operatively, with a mean of 1.7 years.

Fig. 1 – Aetiology (%).

Table 1 – Age and sex distribution.

	Group I (PAD)	n (%)	Group II (SAD)	n (%)
Age				
5–15	3	30%	1	10%
16–25	7	70%	8	80%
>25	0	0%	1	10%
Sex				
Male	4	40%	4	40%
Female	6	60%	6	60%

3. Results

The preoperative mouth opening in these patients ranged from 0 to 18 mm, with a mean of 5 mm. There was a history of fall from height in 65%, ear infection (15%) and unknown in 20% of the patients (Fig. 1). Most of the patients were females (60%) and belonged to the age group of 5–30 years. Males in both groups represented 40%. Only one patient was above 25 years of age (Table 1).

Intra-operative mean maximal mouth opening of Group I: PAD was 38.5 mm. In this group, there was gradual increase in mouth opening from the 3rd day (mean = 22.3 mm) to 30th (mean = 35.4 mm), which was maintained till 180 days (mean = 34.3 mm). In Group II: SAD, intra-operative mouth opening was 38.9 mm, 3rd day (mean = 15.3 mm), 30th (mean = 34.5 mm) and 180 days (mean = 35.9 mm). The mouth opening achieved at 45 days was less in SAD patients than PAD but gradually increased later to become comparable (Fig. 2).

There was no significant difference in mouth opening among the groups post-operatively. The values obtained for lateral excursions towards the ankylosed and normal side were almost comparable in both the groups at different time intervals as were the scores for protrusion.

Assessment of pain on the distraction site was performed with the help of Visual Analogue scale. PAD group experienced more pain during the course of the distraction (Fig. 3). When pain on the contralateral non-ankylosed TMJ was assessed, PAD patients experienced mild pain till 12th day and moderate till the end of distraction. In contrast, the pain was always mild in SAD group (Fig. 4), but with no significant difference between the groups.

An active functional mouth opening of approx. 35 mm was achieved in SAD patients in around 15.6 days, and in PAD patients, it took around 84.4 days (Fig. 5). Both groups resulted in good facial symmetry and aesthetics (Figs. 6 and 7). Later at 15 months follow-up, there was recurrence of ankylosis in a patient in SAD group (Fig. 8).

4. Discussion

Kaban in the new protocol included distraction osteogenesis to reconstruct the ramal condyle unit. Others have reported correction of post-ankylosed facial deformity using distraction osteogenesis. Rao et al.¹⁸ performed SAD in 6 patients, aged 8.5 years (range 7–10 years), with a pre-operative average mouth opening of 1.6 mm (range 0–6 mm), and an average mouth opening achieved after surgery was 28 mm

Group 1: PAD, Group II: SAD

Fig. 2 – Comparison of mouth opening.

Fig. 3 – Comparison of pain over distraction site.

(range 24–36) at 3 months. Although 2 patients in their series developed 3–5 mm anterior open bite, the sensory supply to the chin was preserved in all. Some degree of scarring at the pin site occurred in all of them. These results were

comparable with our study, with a mean post-operative mouth opening of 31.8 mm in PAD and 32.4 mm in SAD at 3 months post-operative follow-up. No patient in our series developed permanent sensory alteration. Minimal scarring

Fig. 4 – Comparison of pain over non-ankylosed (contralateral) TMJ.

Group 1: PAD, Group II: SAD

Fig. 5 – Total time to achieve sufficient mouth opening.

occurred at the area where the distractor was exposed for activation.

In our study, the average mouth opening at 6 months was 34.3 ± 0.44 mm in PAD group and 35.9 ± 0.83 mm in SAD group. Yu¹⁹ favoured simultaneous distraction osteogenesis

with gap arthroplasty and presented a similar mouth opening of 32.4 (28–37) mm in 13–58 months of follow-up period.

In our study, no patient reported with relapse in the PAD group, similar to the study of Sadakah et al.⁸ who evaluated transoral bimaxillary distraction osteogenesis before releasing

Group 1: PAD

Fig. 6 – Improvement in aesthetics and function in Group I: PAD.

Group II: SAD

Fig. 7 – Improvement in aesthetics and function in Group II: SAD.

TMJ ankylosis using intraoral mandibular distractors in nine patients with a age range 4–35 (mean 19). After a mean follow-up period of 17 months, a mean post-operative mouth opening of 34.7 mm was achieved (0.6 mm preoperatively) and no re-ankylosis was detected. Yoon performed intraoral mandibular distraction osteogenesis in facial asymmetry patients with unilateral TMJ bony ankylosis with successful results.²⁰ However, one of our patient who underwent simultaneous distraction and interposition arthroplasty presented with reankylosis after 15 months.

Interestingly, we observed that the contralateral normal TMJ experienced more pain in the PAD group of patients. Such a finding has not been reported till now. However, when the pain over distraction site was assessed, the scores were similar for both the groups. Yang²¹ recently investigated bony changes in the mandibular condyle when it was subjected to functional loading using a unilateral surgical experiment in rabbits. Osseous changes of condyles were analyzed using micro-computed tomography and histological evaluation at four weeks post-operatively. They observed that a counterclockwise rotation of the proximal segment led to significant osteoporotic changes of the condyle like reduced bone volume and bone mineral density, thin and small number of trabeculae, thinning of condylar cartilage and reduced density of cartilaginous cells. A study on rat TMJs aimed to define the

effects of asymmetric force and analyzed the histological and osteogenic changes, and expression of types I, II and III collagens. They concluded that the heavier the applied force, more were the changes on the cartilage, subchondral bone and collagens of TMJ.²² Hence, it is suggested that studies should be planned to evaluate contralateral condylar changes after distraction.

While a sufficient active functional mouth opening was achieved in SAD patients in around 15.6 days, in PAD patients it took around 84.4 days. It can be, hence, suggested that PAD should only be attempted in patients who have good compliance for treatment, as it requires a longer management period. Also, it becomes important to consider the fact that in PAD group of patients, mouth opening is not achieved until the second surgery is done, while in SAD group, the patients get to open their mouth just after the first surgery, which is many a times the only complaint of the patient in developing countries like India.

Although PAD provides a better control of the distracting segment, it bears a disadvantage that the final mandibular position cannot be predicted. One of the PAD group patient developed inadvertent reverse over jet, after interposition arthroplasty. This may be attributed to the fact that the final mandibular position tends to change due to muscle pull after the release of ankylosis. Since in simultaneous

Fig. 8 – Reankylosis in one patient in SAD group at 15 months post-operative.

distraction, the distraction is performed on an already released ankylosis, the final mandibular position achieved is same as predicted.

Complications after mandibular distraction in congenital and developmental deformities have been extensively reviewed.^{23–25} Other complications observed in both groups of our study included transient facial nerve palsy and inferior alveolar nerve neurosensory disturbances, which eventually corrected in the post-operative phase, and local infection was managed by proper wound care. It can be concluded that none of the procedures is ideal, and the choice should depend on the need, patient co-operation and surgeons' opinion considering the merits and demerits of both PAD and SAD.

5. Conclusion

We conclude that both groups were effective in correcting the aesthetics and function. Although PAD has better control on distraction, contralateral non-ankylosed joint may experience pain. With SAD, the advantage is that it requires a shorter period of management time, but a temporary decrease in function may be initially seen, with difficulty in controlling the distracting segment and chances of reankylosis.

Conflicts of interest

The authors have none to declare.

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