

# Distraction osteogenesis in the treatment of temporomandibular joint ankylosis with mandibular micrognathia

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## ABSTRACT

**Aims:** The aims of the study were to evaluate the efficacy of simultaneous interpositional arthroplasty with distraction osteogenesis (DO) as a single procedure and to give the patient acceptable functional rehabilitation with correction of the gross facial asymmetry. **Materials and Methods:** Nine patients of temporomandibular joint (TMJ) ankylosis with micrognathia were treated with interpositional arthroplasty and simultaneous DO and followed for a period of minimum 3 years. Preoperative, immediate postoperative, at the end of distraction, at 6 months and 3 years postdistraction consolidation radiographs were taken along with the clinical examination for mouth opening, deviation, length of the mandible and ramus, midline shift, occlusal cant, and occlusion. **Results:** The results showed an increase in the mouth opening, length of the mandible and ramus height, correction of deviation, occlusion, and midline shift. Relapse was not seen in any case, rather one patient developed infection at the distractor site and two patients had fracture of the roots of the teeth at the osteotomy site. There was an overall improvement in the facial asymmetry. **Conclusion:** Simultaneous interpositional arthroplasty with DO should be used to correct TMJ ankylosis associated with facial asymmetry/micrognathia, as it reduces the need for second surgery, thereby saving the trauma of a second surgery and difficulty in intubation, increases the length of the mandible, corrects the deformity, thereby resulting in an acceptable facial esthetics and function.

**Keywords:** Distraction osteogenesis, mandibular micrognathia, temporomandibular joint ankylosis

## INTRODUCTION

Temporomandibular joint (TMJ) ankylosis is the fusion of the condyle to glenoid fossa resulting in limited movement of the mandible leading to severe debilitation. If it occurs at a young age, it can affect the growth of the mandible, leading to micrognathia, retruded chin, reduced airway, compromised function, and esthetics. Diagnosis and treatment, if done at an early age, would save the patient from psychological trauma and help in the overall growth. Treatment of TMJ ankylosis with mandibular micrognathia restores the form, function, and facial esthetics. The treatment varies from center to center, which includes resection of the ankylotic mass with physiotherapy,

reconstruction with costochondral graft, and orthognathic surgery to reconstruction with prosthesis recently to the distraction. The

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**Figure 1:** Preoperative frontal view



**Figure 2:** Preoperative mouth opening



**Figure 3:** During distraction



**Figure 4:** Postdistraction note the improved symmetry and chin projection



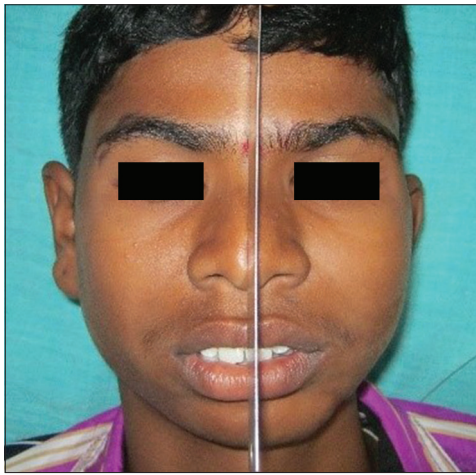
**Figure 5:** Postoperative mouth opening



**Figure 6:** Postdistraction dental midline

distraction osteogenesis (DO) offered the option of lengthening the mandible, providing space for correction of crowding and eruption of hitherto unerupted teeth, correction of occlusal cant, midline shift, and gross asymmetry. The main bone of

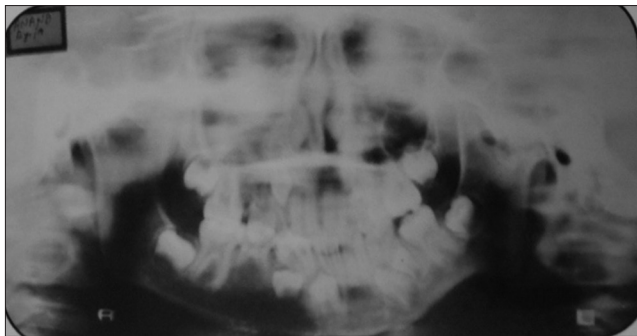
contention was whether to perform the surgery as a single stage procedure or as a two-staged procedure. In this study, we decided to do interpositional arthroplasty and osteotomy for DO simultaneously.



**Figure 7:** Postdistraction facial midline



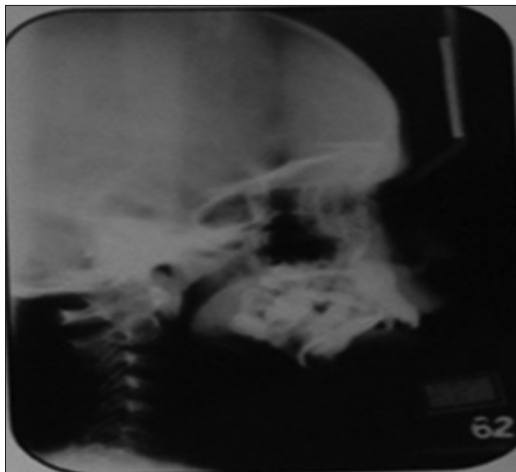
**Figure 8:** Distractors



**Figure 9:** Preoperative orthopantomogram



**Figure 10:** Postdistraction orthopantomogram



**Figure 11:** Preoperative cephalogram



**Figure 12:** Postoperative cephalogram

## MATERIALS AND METHODS

This clinical study was conducted in the Department of Oral and Maxillofacial Surgery, Government Dental College and Research Institute, Bangalore, from 2008 to 2012, on patients with TMJ ankylosis treated by interpositional arthroplasty and simultaneous DO. The patients were evaluated with regard to maximum pre- and post-operative mouth opening, midline shift, and cephalometric analysis (which includes length of condyloid to

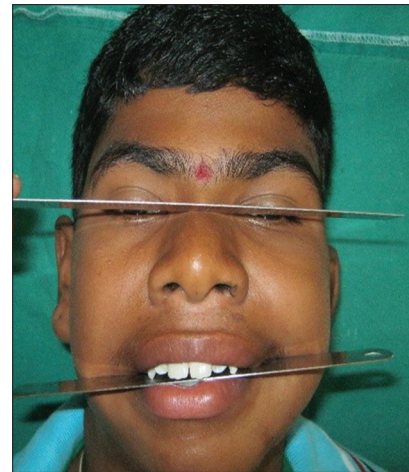
gonion for ramus height and gonion to gnathion for body length) including complications and recurrence of ankylosis, if any. The final results, after compilation, were assessed using SPSS version 18 (IBM Corporation, SPSS Inc., Chicago, IL, USA).

### Surgical technique

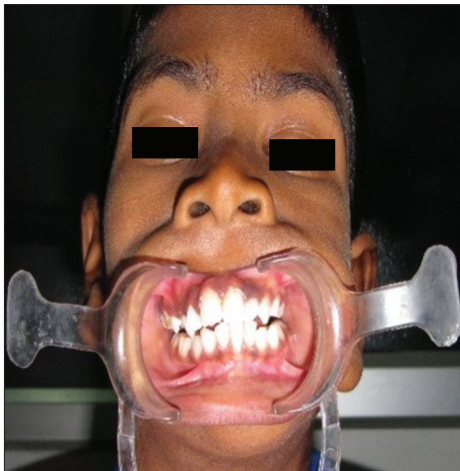
As with all our major surgeries, a strict premedication protocol was followed to relieve the anxiety and apprehension of the patient before the surgery and facilitate smooth induction which comprised anti-anxiety drugs, anticholinergics, anti-emetics, H<sub>2</sub> blockers, and prophylactic antibiotics. All patients were



**Figure 13:** Preoperative occlusal cant



**Figure 14:** Postdistraction occlusal cant



**Figure 15:** Preoperative occlusion



**Figure 16:** Postdistraction occlusion



**Figure 17:** Case 2 preoperative orthopantomogram



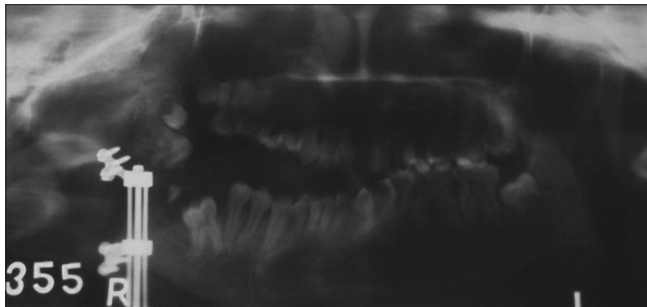
**Figure 18:** Case 2 - 3 years postoperative

advised not to take any food for 10 h prior to surgery. Following the standard norms of painting and draping, all the patients were operated under general anesthesia using fiberoptic naso-endotracheal intubation. Tracheostomy was usually avoided, except in few cases where fiberoptic intubation was unsuccessful. To approach the TMJ area, standard Al-Kayat and Bramley incision was used as it gives direct access to the ankylotic mass. The periosteum over the zygomatic arch and the ramus were incised and elevated to expose the ankylotic bony mass. A condylar retractor was placed to protect the tissues medial

to the condyle. Bone was removed by making a cut below the identifiable zygomatic arch and another cut about 1.5 cm below this using a straight fissure bur from posterior border to sigmoid notch or anterior border of the coronoid process further, using a chisel the block of bony mass was removed. The irregular edges were smoothed by large round bur. A temporalis myofascial flap was raised and interpositioned between the zygomatic arch and the mandible due to its proximity and ease of use, stability, owing to its connection at the base, its availability at the same surgical site, and its lack of cosmetic, and functional morbidity;<sup>[1]</sup>



**Figure 19:** Case 3 - preoperative



**Figure 20:** Case 3 - during distraction



**Figure 21:** Case 3 - 3 years postdistraction

apart from this, in our opinion, it provides the bulk and may offer resistance to re-ankylosis, especially in DO. All the cases underwent osteotomy for DO in the same procedure. This was achieved by making an osteotomy in the region of angle and placing a bone-borne unidirectional distractor after exposing via a submandibular incision. An oblique vector, resulting in both vertical and horizontal elongation of the mandible, will result when the osteotomy is performed at an angle between  $0^\circ$  (the vertical vector) and  $90^\circ$  (the horizontal vector) to the occlusal plane, generally in the angle region of the mandible.<sup>[1]</sup> Whenever possible, physiotherapy was initiated for most cases on day 3 or latest by 5<sup>th</sup> day postoperatively and continued over a period of 3 months. Distraction was initiated on 5<sup>th</sup> day postoperatively and continued till midline shift was corrected in case of unilateral ankylosis and in case of bilateral ankylosis distraction was carried out till the chin was brought forward to correct the deformity. Slight overcorrection of about 2 mm was made to compensate for the relapse. Distractor was left in place for 12 weeks for consolidation, and then removed under general

**Table 1: Etiology of temporomandibular joint ankylosis**

	<i>n</i> (%)
Birth trauma	1 (11.11)
Trauma due to fall	2 (22.22)
Infection	4 (44.44)
Unknown	2 (22.22)
Total	9 (100)

anesthesia. Based on the surgeon's preference, the period of time for bony consolidation varies.<sup>[1]</sup> We used a consolidation period of 12 weeks (3 months) based on the radiographic findings which showed a bony cortex by that time, in our opinion, mature bone might reduce relapse.

## RESULTS

The mean age of patients was 14.88 years with four males and five females. Of this, 4 (44.44%) were left and 4 were right and one (11.11%) was bilateral ankylosis. Infection was the major cause of ankylosis in our institution comprising 44.4%, followed by trauma, one case was due to birth trauma (11.11%) and two cases due to fall (22.22%). However, in two cases (22.22%), the etiology was unknown [Table 1].

The mean preoperative mouth opening was  $4.89 \pm 1.81$  mm; the mean postoperative mouth opening was  $34.89 \pm 1.98$  mm, which was statistically significant ( $P < 0.001$ ) [Table 2].

The correction of asymmetry was measured by lateral cephalometric analysis, in which, the changes in the pre- and post-operative condylion to gonion and the gonion to gnathion length were compared [Table 2].

The mean preoperative condylion to gonion length was  $49.78 \pm 2.36$  mm, and mean postoperative length was  $57.22 \pm 2.33$  mm, showing a statistically significant difference ( $P < 0.001$ ) [Table 2].

The mean preoperative gonion to gnathion length was  $55.78 \pm 1.72$  mm, and mean postoperative length was  $63.44 \pm 1.64$  mm, showing a statistically significant difference ( $P < 0.001$ ) [Table 2].

The mean preoperative midline shift was  $7.89 \pm 1.37$ ; postoperative mean was  $2.78 \pm 0.54$ , implying a correction of midline shift of  $5.11 \pm 0.83$  mm [Table 2].

The chin deviation was also corrected to acceptable limits. We noted that even though the midline discrepancy was corrected to a great extent, still there was, on an average, a midline shift of 2.8 mm still remaining to be corrected. The gross occlusal discrepancy was corrected in most of our cases, together with correction of the occlusal cant and lengthening of the mandibular ramus height and body length, which resulted in the eruption of the teeth, finer occlusal corrections were made with orthodontic treatment.

We had noted a few complications too. In two of the cases (22.22%), while giving an osteotomy cut, the tooth was split. In another case,

**Table 2: Results**

Patient	Age/sex	Diagnosis	Treatment done	Mouth opening (mm)		Chin midline discrepancy		Length (mm) of mandibular body (GO-GN)		Length (mm) of ramus height (CO-GO)	
				Preoperative	Postoperative	Preoperative	Postoperative	Before	After	Before	After
1	17/female	B/L TMJ ankylosis with facial asymmetry	B/L interpositional arthroplasty with DO on left body and ramus	1	34	5	Postoperative midline shift of 3 mm still noted	52	61	50	63
2	13/female	Right TMJ ankylosis	Simultaneous interpositional arthroplasty with DO	5	35	3	Postoperative midline shift of 2 mm still noted	52	59	39	46
3	23/male	Left TMJ ankylosis	Simultaneous interpositional arthroplasty with DO	17	39	9	Postoperative midline shift of 5 mm still noted	64	70	42	48
4	14/female	Left TMJ ankylosis	Simultaneous interpositional arthroplasty with DO	0	25	9	Postoperative midline shift of 2 mm still noted	52	58	48	56
5	7/male	Right TMJ ankylosis	Simultaneous interpositional arthroplasty with DO	4	25	7	Postoperative midline shift of 2 mm still noted	54	62	64	68
6	11/female	Right TMJ ankylosis with facial asymmetry	Simultaneous interpositional arthroplasty with DO	1	38	3	No discrepancy present	52	58	49	59
7	14/male	Right TMJ ankylosis with facial asymmetry	Simultaneous interpositional arthroplasty with DO	3	40	15	Postoperative midline shift of 5 mm still noted	53	69	51	62
8	21/female	Left TMJ ankylosis	Simultaneous interpositional arthroplasty with DO	10	38	7	Postoperative midline shift of 2 mm still noted	59	65	54	55
9	11/male	Left TMJ ankylosis with facial asymmetry	Simultaneous interpositional arthroplasty with DO	3	40	13	Postoperative midline shift of 4 mm still noted	64	69	51	58

TMJ=Temporomandibular joint; DO=Distraction osteogenesis; B/L=Bilateral

the patient developed infection (11.11%) which was taken care of; as compared to a study done by Verlinden *et al.*,<sup>[2]</sup> where they reported 21% of infection in a systematic review complications of DO in acquired deformities and an overall complication of 44%. However, we had an overall complication rate of 33.33%.

## DISCUSSION

TMJ ankylosis is a condition when there is a fusion of the mandibular condyle to the glenoid fossa of the temporal bone. When it occurs at a young age, it affects the growth of the facial skeleton resulting in retrognathic mandible, facial asymmetry, deviated chin, midline shift, occlusal cant, crowding of the teeth, and unerupted teeth. Decreased mouth opening also leads to poor oral hygiene, dental caries, and periodontal disease. Retrognathic chin and jaw also leads to reduced dimensions of the airway and some of these patients may have sleep apnea.

We had a total of nine patients, treated with simultaneous interpositional arthroplasty with DO. The DO in our cases helped lengthening the mandible, correct crowding, provide space for unerupted teeth, and improved airway [Figures 1-21].

Although several options are available to treat TMJ ankylosis with micrognathia such as orthognathic surgery and costochondral grafts, advantages of DO outweigh these procedures. DO lengthen bones to a greater degree compared to orthognathic surgery. The soft tissues are stretched slowly with DO so that they may

gradually adapt to the bony movements and result in potentially less relapse than that achieved with conventional orthognathic surgery. With DO, there is no potential donor site morbidity from graft harvesting, which may be necessary, as with costochondral grafts. Costochondral grafts are also associated with unpredictable growth.<sup>[3]</sup>

Papageorge and Apostolidis reported a case in which DO was used for lengthening of the mandible, in conjunction with a condylectomy and arthroplasty in a young patient with severe bony TMJ ankylosis. Fifteen months postoperatively, the patient had 35 mm mouth opening with no evidence of ankylosis. They also reported satisfactory correction of facial asymmetry.<sup>[4]</sup> Rao *et al.* achieved satisfactory mouth opening and cosmetic results after correction of mandibular deformities in six young patients with ankylosis of the TMJ and mandibular deformity by simultaneous gap arthroplasty and DO.<sup>[5]</sup> Yu *et al.* achieved satisfactory mouth opening and also increased mandibular body length apart from the correction of facial asymmetry in 11 patients using simultaneous gap arthroplasty and DO.<sup>[6]</sup>

Elsewhere, Zhu *et al.* too have addressed the problem of ankylosis with micrognathia in adults and suggested that DO is a better option to correct these deformities even though inverted "L" osteotomy with bone graft and SSRO options are available.<sup>[7]</sup> However, Fieldhouse, was able to correct the deformity (bilateral), using a genioplasty procedure (with bone

grafting), but the patient had to undergo a second surgery to improve chin prominence.<sup>[6]</sup> Su-Gwan have treated TMJ ankylosis with temporalis muscle and fascia flap in 7 cases, but have not addressed the problem of micrognathia or its associated complications.<sup>[9]</sup>

Orthognathic surgery can increase the length in the body of the mandible with bilateral sagittal split osteotomy and inverted "L" osteotomy, on the other hand, DO increases both ramus height and length of the body of the mandible. Moreover, since the process of DO is slow, over a period, tissues around the mandible adapt and improve the asymmetry.

## CONCLUSION

Simultaneous interpositional arthroplasty with DO for TMJ ankylosis, apart from increasing the length of the mandible, leads to the correction of gross facial asymmetry, occlusal cant, midline shift, and provides space for eruption of hitherto unerupted teeth. In our opinion, this procedure for TMJ ankylosis helps reduce treatment time, need for an additional surgery (if they were to be done as a two stage procedure) and also alleviates the need for second tracheostomy; if the fiberoptic intubation was not possible. It brings down the number of surgeries and so the cost. The advantage of single stage simultaneous interpositional arthroplasty with DO are multitude and its ability to correct micrognathia associated with TMJ ankylosis cannot be challenged or met by orthognathic surgeries or costochondral graft.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts

will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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