

# Zurich pediatric distractor for ramal condylar unit distraction in temporomandibular joint ankylosis

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## ABSTRACT

Temporomandibular joint (TMJ) Ankylosis is an extremely disabling condition characterized by difficulty or inability to open the mouth resulting in facial asymmetry, malocclusion and dental problems. Surgical excision of the ankylosed mass is the only treatment option available to gain mouth opening. The loss in vertical height of ramus following release of ankylosis is difficult to manage in both unilateral and bilateral TMJ ankylosis. Out of all the methods to restore this height Distraction Osteogenesis (DO) is gaining popularity because of predictable gain in the length without any associated morbidity. Recurrent bilateral TMJ ankylosis in a 32 year old male was treated by osteoarthrectomy and temporal fascia interpositioning arthroplasty. Bilateral reconstruction of ramal condylar unit (RCU) was carried out by Zurich paediatric distractor (KLS Martin, Tuttlingen Germany). Following a latency period of 7 days distraction was carried out at a rate of 1mm/day for 8 days. Distractors were removed after 12 weeks of consolidation period. The case was followed up for 12 months during which the mouth opening was maintained at 38 mm and there was no anterior open bite.

**Keywords:** Condylar ramal unit reconstruction, distraction osteogenesis, temporomandibular joint ankylosis, Zurich pediatric distractor

## INTRODUCTION

Temporomandibular joint (TMJ) ankylosis is an extremely disabling condition characterized by difficulty or inability to open the mouth resulting in facial asymmetry, malocclusion, and dental problems. Various studies have reported the etiology of TMJ ankylosis to be most commonly associated<sup>[1-5]</sup> with trauma (13–100%), followed by local or systemic infection (0–53%), systemic diseases such as ankylosing spondylitis, rheumatoid arthritis and psoriasis (28%), and failure of previous TMJ surgery. According to a recent study by Kumar *et al.* muscular hypertrophy has been considered as a cofactor in the pathogenesis of TMJ ankylosis.<sup>[6,7]</sup> Surgical excision of the ankylosed mass is the only treatment option available to gain mouth opening. The loss in vertical height following the release of ankylosis is difficult to manage in both unilateral and bilateral TMJ ankylosis. The condition further deteriorates

in cases of reankylosis and subsequent surgeries. Anterior open bite is a common finding following release of bilateral ankylosis. Costochondral grafts (CCGs) have long been used as an effective method of treatment to reconstruct the ramal condylar unit (RCU). However, problems have been experienced with an unpredictable growth, donor site morbidity, and reankylosis.<sup>[4]</sup>

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Reconstruction with autogenous grafts or alloplastic materials in these patients has the disadvantage of difficult to shape the graft, late resorption, and tissue reactions.<sup>[5]</sup> Of all the methods distraction osteogenesis (DO) is gaining popularity because of predictable gain in the ramal height without any associated morbidity. We report an adult patient of bilateral TMJ ankylosis successfully managed by osteoarthrectomy, temporal fascia interpositioning arthroplasty, and reconstruction of RCU by DO using Zurich pediatric distractor.

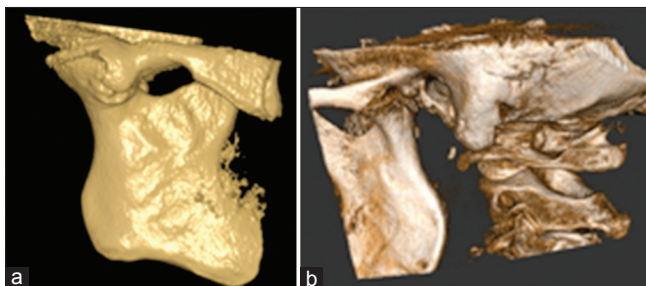
## CASE REPORT

A 32-year-old male reported to the Department of Oral and Maxillofacial surgery Armed Forces Medical College, Pune with the limitation of mouth opening since past 7 years [Figure 1]. He had problems with eating and difficulty in maintaining oral hygiene. The patient sustained a maxillofacial injury in an alleged road traffic accident. Suffered direct trauma to the chin and fractured both his mandibular condyles for which he was managed conservatively. Patient's mouth opening gradually reduced.

Clinical examination revealed a bilateral bony mass in the preauricular area. Minimal condylar movements were palpable. The maximum interincisal opening (MIO) was 4 mm. An orthopantomogram (OPG) [Figure 2] showed marked anatomical changes in both the joints and an elongated coronoid process. Cone-beam computed tomography (CBCT) showed right condylar head fused to glenoid fossa, fractured articular surface of left TMJ and narrowing of joint space and hypertrophied coronoid process [Figure 3]. He was diagnosed as a case of bilateral TMJ ankylosis.



**Figure 1:** Preoperative photograph showing limited mouth opening



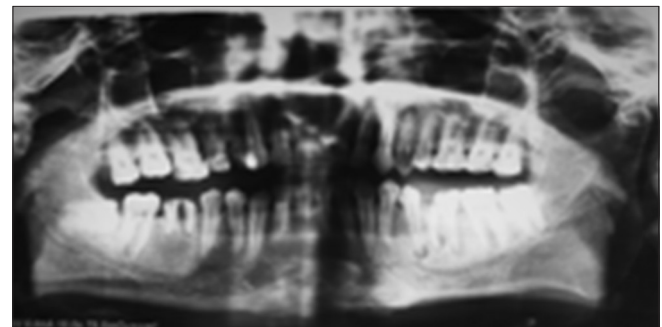
**Figure 3:** (a) Cone-beam computed tomography showing right condylar head fused to glenoid fossa, and hypertrophied coronoid process. (b) Left side showing fractured articular surface, narrowing of joint space and irregularity in the articular surface of the condyle

The treatment plan was to release the ankylosed mass and create a functional joint to improve patient's nutrition, oral hygiene and to carry out necessary dental treatment.

### Surgical technique

The right TMJ was exposed by modified Alkayat–Bramley approach. Osteoarthrectomy was carried out to create a gap of about 1 cm [Figure 4a] and the coronoid process was excised. Since there was no improvement of MIO, similar surgical procedure was carried out on the left side. The intraoperative MIO of 42 mm was achieved. Glenoid fossa was interpositioned with posteriorly pedicled temporalis myofascial flap [Figure 4b]. Reverse "L" osteotomy [Figure 4c] was marked bilaterally on the posterior border of the ramus and the position of Zurich Pediatric Ramus Distractor (KLS Martin, Tuttlingen, Germany) was predetermined. The osteotomy was completed, and the distractor device was returned to its predetermined position [Figure 5]. Hemostasis was achieved and wound sutured in layers.

On the 2<sup>nd</sup> postoperative day, active jaw exercises were started in the form of opening and closing using jaw musculature and were repeated several times a day. On the 5<sup>th</sup> postoperative day, passive jaw movements using wooden spatulas were started. Moreover, both active and passive jaw exercises were repeated five times a day. After latency period of 7 days, distraction was carried out at a rate of 1 mm/day (0.5 mm twice daily). Progress with distraction was monitored both radiographically and clinically. OPG was taken during the distraction period to observe the position of distraction vector. Radiographs were taken before starting distraction, 7 days after starting distraction and on completion of distraction and regular follow-ups at 1 month, 3 months. On completion of 8mm of distraction, OPG



**Figure 2:** Orthopantomogram showing marked changes in the temporomandibular joint anatomy and elongated coronoid process



**Figure 4:** (a) Osteoarthrectomy done. (b) Glenoid fossa interpositioned with temporalis fascia. (c) L-shaped osteotomy done

was taken [Figure 6]. Distractors were removed after 12 weeks of consolidation. The patient was followed up for 12 months and mouth opening of 38 mm was achieved without any anterior open bite [Figure 7].

## DISCUSSION

The TMJ is a multi-axial, ginglymoarthroidal synovial joint endowed with a capacity to perform a wide range of movements, primarily through its bicondylar mandible freely articulating with a stationary (fixed) fossa of the squamous temporal bone.<sup>[6]</sup> The challenge of TMJ ankylosis is an age-old problem, and despite advances in surgical treatment, the basic problems faced by the clinician remain the same, i.e., restoration of vertical height, mandibular function, and prevention of recurrent ankylosis.

The anterior open bite is a typical problem seen following the release of bilateral ankylosis. Due to the telescopic effect of residual ramus into glenoid fossae, there is a premature contact of posterior teeth leading to anterior open bite. The clockwise rotation of mandible converts it biomechanically from a Class 3 lever to Class 1 lever in which the points of premature molar contact act as fulcrum. Mandible has the fulcrum at the TMJ, muscles attached to the bone further toward the middle apply the effort and the load is applied through the teeth at the end. Hence, Class 3 lever [Figure 8a]. In cases where the ankylotic mass is released, there is a premature contact of posterior teeth,

and it acts as fulcrum. Thus, the conversion from Class 3 to Class 1 lever [Figure 8b].

In such cases, the amount of anterior open bite should be taken into consideration while calculating MIO. Therefore, reconstruction is required in bilateral ankylosis cases.

The options for restoring vertical height include CCG, prosthetic TMJ, and mandibular ramus DO. A CCG is biocompatible and has inherent growth potential. However, it requires a donor site remote from the area of surgery. Growth is also unpredictable and could occur at any time leading to the possibility of a return of the facial asymmetry.<sup>[4,6]</sup> Prosthetic TMJ is very expensive and can cause foreign body reaction. There is no long-term data available to support the use of the prosthetic device for reconstruction in ankylosis cases. DO is a relatively newer technique for correction of deficiency of maxillofacial skeleton. There is no need to harvest tissue from a donor site, and the regenerated bone does not represent a foreign body, as is the case with TMJ prosthesis. There is no resorption as compared to free grafts.

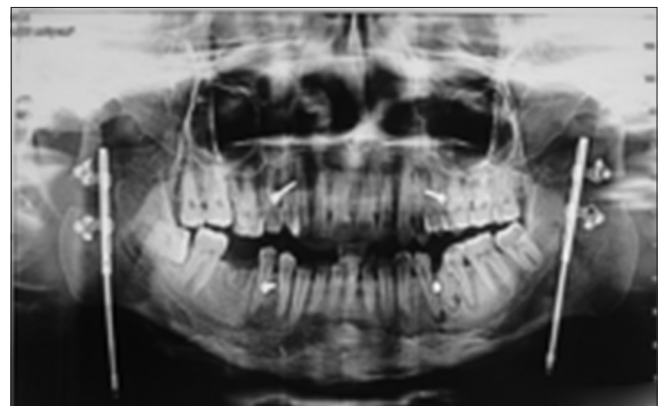
In 1997, Stucki-McCormick was the first to apply transport DO for TMJ reconstruction in two cases of tumor involving the condyle. The technique involves creating a transport disc of bone from the ramus of the mandible with a reverse L osteotomy while, preserving the medial periosteum and muscle attachments to ensure an intact blood supply. The transport disc, after a latency period of 7 days, is advanced 1.0 mm/day (0.5 mm twice daily) until contact is made with the glenoid fossa and proper ramus height is established. In



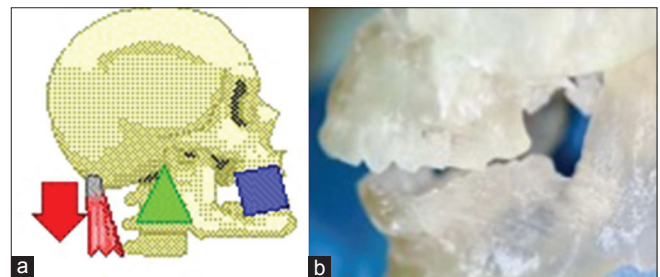
**Figure 5:** Zurich Pediatric Ramus Distractor (KLS Martin, Tuttlingen, Germany) was placed across the osteotomy site



**Figure 7:** One year postoperative clinical picture showing mouth opening of 38 mm



**Figure 6:** Orthopantomogram taken at the end of distraction



**Figure 8:** (a) Diagram showing how mandible acts as Class 1 lever. (b) Diagram showing how mandible converts from Class 3 lever to Class 1 lever when the ankylotic mass is removed

our patient, 8mm of distraction was carried out. We remained short of contact with glenoid fossae to minimize chances of reankylosis. The distraction device is then held in place for 12 weeks until there is radiographic evidence of mineralization at the trailing edge of the transport disc resulting in the bridging of the defect. The leading edge of the transport disc tends to remodel and become rounded to form a neocondyle. During distraction and consolidation period active jaw exercise were carried out. We used light elastic traction during the phase of consolidation to settle occlusion.

Transport distraction of the mandibular ramus is a good and effective therapeutic option in the treatment of ankylosis.<sup>[9]</sup> The mandibular lengthening obtained by gradual distraction can result not only in the expansion of the mandibular bony tissue but also in the proportional and harmonic modification of the muscles and the surrounding soft tissues.<sup>[10,11]</sup>

However, using DO for TMJ reconstruction has some disadvantages such as requirement of second surgical intervention for removal of the distraction device, pain during distraction phase, technique and instrument sensitive surgery, long treatment period, skin scars, and the high cost of the instrument.

## CONCLUSION

Osteoarthrectomy and transport DO of the mandibular ramus is a good and effective therapeutic option in the treatment of ankylosis Zurich pediatric distractor gives predictable results in reconstruction of RCU thus avoiding postoperative open bite. It is an excellent alternative to autogenous bone grafting and prosthetic reconstruction. DO gives optimum functional outcome and esthetics to patients operated for TMJ ankylosis.

### 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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