

Distraction Osteogenesis In The Management Of Temporomandibular Joint Ankylosis : Series of cases.

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Abstract

Patients with temporomandibular joint ankylosis commonly present with mandibular hypoplasia as a result of trauma to the temporomandibular joint, middle ear infection or due to various syndromes. There is a wide acceptance of the conventional osteotomies for treating temporomandibular joint ankylosis, but there are certain limitations pertaining to them. In order to overcome these limitations several new approaches with modifications have been introduced. One among these is the method of gradual bone elongation known as distraction osteogenesis. This process induces new bone formation along the vector of distraction force without requiring the use of a bone graft. This study was conducted on four patients (2 females and 3 males within the age group of 16-30 years) in which 3 patients had bilateral temporomandibular joint ankylosis and one patient with unilateral temporomandibular joint ankylosis.

These patients underwent surgical correction of temporomandibular joint ankylosis and mandibular hypoplasia using distraction osteogenesis with extra-oral distraction device under general anesthesia.

In this study we have used extraoral device to achieve distraction more than 20 mm and to overcome the limitations of intra oral devices. This study concluded that distraction osteogenesis is the treatment of choice for the temporomandibular joint reconstruction and anterior linear advancement of the hypoplastic mandible in whom the mandibular advancement is highly difficult to be achieved by the conventional osteotomy procedures. The relapse rate over a period of 5 year is very minimal.

KEYWORDS: Mandibular hypoplasia, Extra-oral mandibular distraction device, Distraction osteogenesis, Temporomandibular joint ankylosis.

Introduction

Distraction osteogenesis was originally reported by Codivilla in 1902 and further refined by the soviet surgeon Ilizarov in 1950s to correct various extremity deformities.¹ McCarthy et al in 1992 developed the technique for Mandibular elongation with extra oral distractors.²

Distraction osteogenesis has recently become a mainstay for reconstruction of temporomandibular joint ankylosis with mandibular hypoplasia. Where as the standard bone grafts. However, unpredictable and unsatisfactory results such as re-ankylosis, growth disturbance, facial asymmetry and donor site morbidity is seen. Advancement of the mandible greater than 7 mm becomes increasingly more unstable with traditional osteotomies. Large advancements of the mandible are a relative indication, but when technical difficulties with a thin ramus or relapse after a previous sagittal split are accompanied with a large movement, then distraction is a reasonable alternative.³ Hence to overcome these drawbacks of conventional procedures distraction osteogenesis as become modified surgical procedure for temporomandibular joint ankylosis.

MATERIALS AND METHODS

This study was conducted on five patients (2 females and 3 males within the age group of 16-30 years) in which 4 patients had bilateral temporomandibular joint ankylosis and one patient with unilateral temporomandibular joint ankylosis. These patients underwent surgical correction of temporomandibular joint ankylosis and mandibular hypoplasia using distraction osteogenesis with extra-oral distraction device under general anesthesia.

The study records clinical photographs, orthopantomogram and lateral cephalogram were made at the pre-distraction period, at the end of active distraction and 5 years post-distraction for the study purpose.

Distraction protocol:

- ❖ Activation of the distraction was started on 7th post operative day two turns (0.5mm twice in a day) per day.
- ❖ Upper and lower arch bar was fixed to upper and lower dentition.
- ❖ Day 12- Soft elastics were placed to upper and lower arch bar. To minimize anterior open bite and to maintain maxilla and mandibular relation.
- ❖ Day 15- activation of the distraction was increased to 1.5mm/day (0.75mm two turns per day).
- ❖ Day 25- activation of the distraction stopped and Arch bar and elastics are removed.
- ❖ Mouth opening was maintaining about 24 mm.

Patient was given intravenous antibiotics for 5 days and kept on nasogastric feed for a week. Post-operative anterior open bite was 7-8 mm. Patient was satisfied with the facial profile and mouth opening. He was able to tolerate the pain during active distraction period. (fig1-6)

RESULTS

The results indicated that there was an effective horizontal advancement of mandible which was clinically significant as noted by increase in the Go-Pog length (average increase by 12mm) and angle of Ar-Go-Pog (average increase by 16°). There was an increase in the lower facial height, ANS-Pog. (average increase by 6mm). There was a positive correction of overjet (average increase by 8.5mm). In all patients mouth opening was well maintained with an average of 21mm. The 5 years post distraction evaluation indicated a very minimal degree of relapse of both the hard tissue and soft tissue profiles which was clinically in significant. (Table 1)

DISCUSSION

Ilizarov popularised distraction osteogenesis. Mandibular lengthening by distraction osteogenesis was originally successful in experimental studies and then was adapted to the human mandible by McCarthy et al. All these investigators used extraoral devices, they offer the advantage of better control of the distraction vector.⁴

Patients with TMJ ankylosis have various functional and esthetic facial deformities. It is characterized by retrognathic mandible; chin deviation towards the affected side, limitation of manadibular movements, sleep apnea syndrome, facial muscle atrophy and occlusal plane cant⁵. Ankylosis release and costochondral graft reconstruction continue to be used as the standard procedures to treat TMJ ankylosis. The complications associated with these procedures are excessive and unpredictable growth or the necrosis and resorption of the costochondral graft. Also costochondral graft does not release the tension caused by the atrophic facial muscles against the graft. Relapse is more accentuated in micrognathic patients presenting with the typical "Bird face" deformity, having deficient soft tissue of the lower third of the face and at the neck, absence of the neck angle and shortened suprahyoid muscles. If a conventional mandibular advancement by osteotomies and bone grafts is performed in this type of patients, the muscles and the tight skin envelop results minimal esthetics. With bone distraction all the tissues from skeleton to skin are simultaneously elongated with optimal esthetic results.⁶ Conventional surgical procedures are extensive and are not advocated in early childhood due to their associated high risk.

The other disadvantages of conventional osteotomy procedures are: Surgical neurosensory complication, Condylar resorption, Post-operative relapse, Bone graft failure, Bone graft donor site morbidity, Bone formation by secondary healing. To overcome these problems distraction osteogenesis is the treatment of choice for the reconstruction of temporomandibular joint ankylosis and Mandibular hypoplasia. The two major strengths of distraction osteogenesis in the Mandibular reconstruction are the ability to provide strong bone with excellent blood supply and the ability to provide effective expansion of the soft tissue envelope called distraction histogenesis. By this technique elongation of the mandible using corticotomies at the angle of the mandible that preserves the integrity of the nerve and vascular supply. The position of the pin placement will determine the distraction vector. The distraction vector is different in each patient according to the grade of mandibular hypoplasia. These enhance the contour and position of the soft tissue. This approach enables the reconstructive team, through a minimally invasive procedure, to manage patients with severe mandibular hypoplasia from childhood to adulthood with excellent and predictable functional and esthetic outcomes.

Clinically we have 5 sequential periods, each having its own significance. They are Osteotomy, Latency, Active distraction period, Consolidation period and Remodeling period.⁷

In this case we have adopted an extra oral distraction technique to overcome intra oral distraction limitations, such as: Placement of distraction device is technically difficult, activation of the device is taxing both to operator and patient, difficulty in maintaining oral hygiene, high possibilities of device acting as a fixator thereby preventing pseudoarthrosis, placement of intra

Table 1. Master chart of this study

Sl. No.	Patients name, age, sex	Amount of distraction	Site of distraction	Intra oral		Mouth Opening	
				Over jet Pre	Post	Pre	Post
1	XY,17yrs/male	15mm	Bilateral angle mandible	12	6	5	23
2.	NY,18 yrs/female	17mm	Unilateral Left angle mandible	14	5	5	23
3	AG,16yrs/male	24 mm	Bilateral angle mandible	13	2	23	28
4	QR,30yrs/female	22 mm	Bilateral angle mandible	24	-	2	30
5	PT,15yrs/male	17mm	Bilateral angle mandible	9	2	3	30



Figure -1 showing frontal profile and the pre operative mouth opening



Figure -2 lateral cephalogram showing prognathic profile

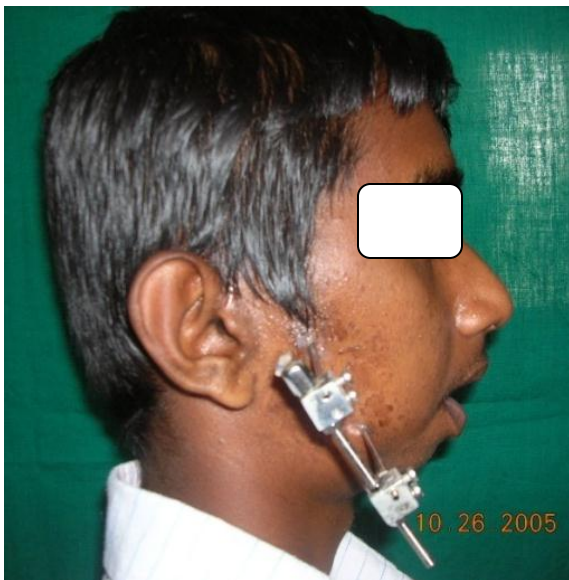


Figure -3 showing extraoral distractor placed.

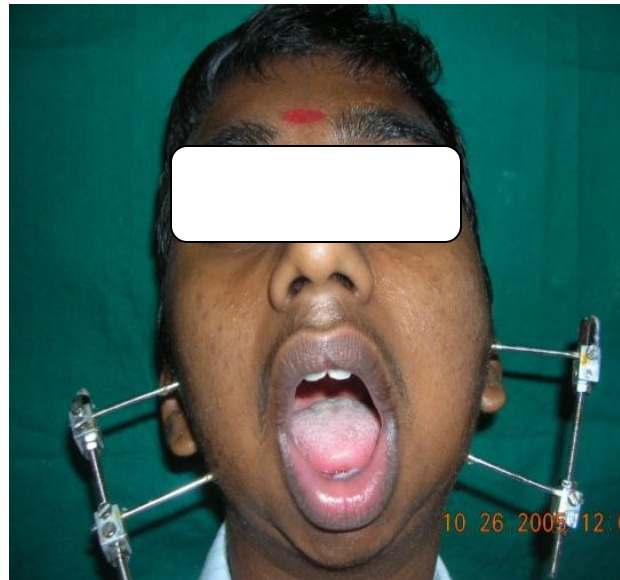


Figure -4 showing post operative maximum mouth opening



Figure-5 Showing postoperative lateral profile view.



Figure -6 Showing postoperative lateral profile view cephalogram.

oral device may lead to injuries to unerupted tooth, roots of erupted teeth, and second surgical procedure is required to remove the distractor.

The advantages of extra oral distraction osteogenesis are: Hardware is easy to place, activation is simple and can even be activated by the patient, lesser chances of infection, easier to maintain oral hygiene, mandible lengthening more than 20 mm is feasible, multiplanar and bi-directional devices are largely successful in lengthening the mandible.

The disadvantages of extra oral distraction osteogenesis are: Device looks bulkier to the patient, depressed pin scars along the pin tracts, Pin tract infections ever exist possibility.

Distraction osteogenesis of a mandible with an ankylosed temporomandibular joint can result in healing with fibrous union, presumably because of movement at the distraction site when masticating. This can result in a pseudo "temporomandibular joint" at the distraction site. Hence it also establishes mouth opening without releasing temporomandibular joint ankylosis.⁸

Fernando Molina⁹ reported a modified distraction technique. We have adopted this technique for our cases. A modified oblique osteotomy procedure is carried out via a small intra oral incision, preserving the lingual periosteum and thus permitting maximum osteogenic potential. This technique involves complete buccal corticotomy followed by fracture of the lingual cortex with preservation of continuity of neurovascular bundle. The advantages of are: It is a simple technique, protection and preserve the integrity of inferior alveolar neurovascular bundle, It helps in preservation of intramedullary and periosteal blood supply, There is a minimal chance of relapse due to unfavorable muscular forces. It helps in fixation of device under direct vision.

CONCLUSIONS

In the present study, distraction osteogenesis is effectively used for the reconstruction of the temporomandibular joint ankylosis. Distraction osteogenesis is always the treatment of choice for the anterior linear advancement of the hypoplastic mandible and to create pseudo fibrous joint in the osteotomy site to improve the mouth opening without release of TMJ ankylosis. Mandibular elongation and remodeling by corticotomies and distraction are simple procedures with minimal morbidity and complications.

REFERENCES

1. Xing Wang, Xiao-xia Wang et al; Distraction osteogenesis in correction of micrognathia accompanying obstructive sleep apnea syndrome: *Plast. Reconstr. Surg.* 112: 1549, 2003.
2. Maria B. Papageorge, Charalabos Apostolidis: Simultaneous mandibular distraction and arthroplasty in a patient with temporomandibular joint ankylosis and mandibular hypoplasia. *J Oral Maxillofac Surg* 57: 328-33, 1999.
3. Marianela Gonzalez, DDS, MS, MDa,b*, Mark Egbert, DDS, Cesar A. Guerrero, DDSa,d, Joseph E. Van Sickels, DDS. Vertical and Horizontal Mandibular Lengthening of the Ramus and Body Atlas Oral Maxillofacial Surg Clin N Am 16 (2008) 215-236
4. A.F. Ayoub, W. Richardson, J.C. Barbenel. Mandibular elongation by automatic distraction osteogenesis: The first application in humans *British Journal of Oral and Maxillofacial Surgery* 43 (2005) 324-328

5. H-J Yoon, H-G Kim, Intraoral mandibular distraction osteogenesis in facial asymmetry patients with unilateral temporomandibular joint bony ankylosis: Int. J. Oral Maxillofac.Surg.31: 544-48: 2002.

6. Gavril A. Ilizarov,AM, Part-1 The tension – stress effect on the genesis and growth of tissues: Clin and Related Research, June 1989:238,p 249-81

7 Samchukov ML, Cherkashin AM, Cope JB. Distraction osteogenesis : Origins and evolution. IN : McNamaru Jr JA, Trotman CA. Distraction of osteogenesis and tissue engineering, Volume 34. ANN Arbor, Michigan :

Centering for human growth and development, the University of Michigan. 1998 : 1 - 35.

8. Cemon J Thomas, Martin J.W. Rees: Fibrous ankylosis after distraction osteogenesis of a costochondral neomandible in a patient with grade III hemifacial microsomia: J Craniofac Surg,12(5), 2001.

9.Fernando Molina; Fernando Ortiz Manasterio; Mandibular elongation and remodeling by distraction: A farewell to major osteotomies.Plast Recon Surg; 96(4),1995, p 825-40.