



Retrospective Study on Distraction Osteogenesis in Temporomandibular Joint Ankylosis - Our Experience

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Citation this Article: Shreya Chitkara, Niranjana Prasad Indra B, S. Gokkulakrishnan, Anurag Yadav, Archana Chaurasia, “Retrospective Study on Distraction Osteogenesis in Temporomandibular Joint Ankylosis - Our Experience”, IJMSIR- April - 2023, Vol – 8, Issue - 2, P. No. 08 – 14.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Distraction osteogenesis (DO), also known as callus distraction, callotaxis, osteo-distraction, and distraction histogenesis, is a method used to address cranio maxillofacial deformities that require skeletal expansion. This study includes all the patients with maxillofacial deformities, post- traumatic growth disturbances, developmental micrognathia that were diagnosed with TMJ ankylosis and were treated with linear distraction in our institution over the given time with a proper follow up record.

Materials and Methods: A total of 26 patients diagnosed with tempo ro mandibular joint ankylosis and treated with distraction osteogenesis in our institution over 12 years were included in the study. These patients were evaluated based on various parameters such as age,

gender, area of mandibular lengthening, type of distraction, site of distraction and various complications related to the procedure.

Results: Out of 26 patients, there was a slight male predilection in our study. In our study, most of the patients were operated with unilateral distraction constituting of 18 patients (69.2%), while only 8 patients were operated for bilateral distraction (30.8%); in which all the patients were operated for body lengthening. We observed that the most commonly occurring complication in the patients was hypertrophic scarring in 14 patients each (53.8%) and infection of the surgical site in 8 patients (30.8%).

Conclusion: With an impressive success rate reported in this study intra oral D.O is definitely a feasible option for treating ankylosis of TMJ. Though it is a technique

sensitive and skilled procedure, but it is possible to carry out D.O with minimal complications and acquire good results.

Keywords: Distraction Osteogenesis, TMJ ankylosis, trauma, Mandibular D.O.

Introduction

Maxillofacial abnormalities are always physically and mentally upsetting for the patients, and they present a difficult surgical challenge. There may be loss of bone due to trauma, tumour resection, and developmental insufficiency and even periodontal conditions. In these conditions, to recreate the optimal facial contour and features, the bone volume is to be increased. Various methods like osteotomy and bone grafting with allogenic and autogenic materials have been used.

Temporomandibular joint (TMJ) ankylosis, which is the bony or fibrous adhesion of the anatomic joint components, is a common cause of acquired mandibular deformity. With long-standing ankylosis especially in the growing phase, there is a deficiency of not only the bone but also of the soft tissues on that side. In extreme cases, severe airway compromise can be present obviating the need for tracheostomy. Hence an excision of the ankylotic mass may just not be sufficient even to restore the full range of mouth opening. Also, such a joint release may even shorten the posterior facial height. When a graft is used in such a situation to restore the ramal height, strong tension by the surrounding muscles may lead to relapse. So ideally, beside achieving a stable mouth opening, a compensatory return of growth lag to correct deficient facial dimensions should also be considered.

The simultaneous lengthening of both hard and soft tissue provides physiologic environment and forces, that further facilitate remodelling and is thus considered a ray

of hope towards achieving an ideal solution in ankylosis patients.

Distraction osteogenesis (DO), also known as callus distraction, callotaxis, osteo - distraction, and distraction osteogenesis, is a method used to address cranio maxillofacial deformities that require skeletal expansion.¹

It is the process of generating new bone in a gap between two bone segments in response to the application of graduated tensile stress across bone gap. Using easily controlled mechanical conditions; it is possible for the formation of new bone and its spatial orientation to form a structural part of bone. Specifically, this process is initiated when traction force is applied to the bone segment and it continues as long as the callus tissues are stressed.²

Even though the concept of D.O was first described by Codi villa in 1905, the biologic principle for generating hard and soft tissue was further developed as “a law of tension stress effect” by Illizarov and mandibular corpus distraction was first performed by McCarthy et al using an extraoral unidirectional distraction device.

Internal devices are more comfortable to young patients as they do not result in visible buccal scars as seen with external devices. External devices allow for greater distraction length and are easily removed with no need for a second operation. The process of D.O can be applied to correct deformities in the very young child as early as 2 years of age. Compared to the significant relapse in traditional orthognathic surgery procedures, there is minimal relapse in D.O, reason being there is gradual distraction and lengthening of the soft tissue and the functional matrix surrounding the bony skeleton along with the bony lengthening, which allows the soft tissue matrix to adapt leading to extremely stable results post-operatively.³

However, these devices may cause accidental mandibular fracture during placement of device, tooth injury, inappropriate distraction vector, facial skin scars, local infection, pin loosening, device dislodgment, device failure, facial nerve paralysis, failure to improve airway, and relapse.⁴

However, there are few disadvantages and limitations of this procedure. It cannot be implied in dysplasia cases due to excessive growth and if external approach is implied, it results in scarring with an increased risk of infection.

Materials and Methods

This is a retrospective study of 14 years starting from March 2008 to March 2022, conducted in the department of Oral and Maxillofacial Surgery, consisting of patients who reported to the department with TMJ ankylosis that required distraction for the same.

This study includes all the patients with maxillofacial deformities, post-traumatic growth disturbances, developmental micro gnathia that were diagnosed with TMJ ankylosis and were treated with linear distraction in our institution over the given time period with a proper follow up record. Those patients that were treated with bifocal or transport distraction or those treated in other institutions were excluded in our study and cases that were previously operated with gap or interposition Al arthroplasty etc. for TMJ ankylosis or those patients that were lost to follow up, or had incomplete records were not included.

During the treatment planning, both cephalometric analysis on lateral cephalogram and CT scan were done to determine the extent and plane of deficiency.

Mandibular distraction procedure included exposure of the mandible according to the planned osteotomy.

An osteotomy was performed in the required site and intra oral distraction devices were mounted across the

osteotomy on both sides, one on each side of the mandible in case of bilateral distraction.

After the latency period for primary callus organization, gradual lengthening of the mandible was performed bilaterally by activation of the distraction devices at a rate of 1 mm/day i.e., 0.5 mm twice a day. In our cases, distraction was started on the 4th- 7th day depending on the age of the patient.⁵

In order to enable bone mineralization with load bearing, the device was left for 3-4 additional months (consolidation phase) after active distraction was finished and were removed later.

As a general rule, the consolidation period should be at least four times as long as the activation phase of distraction (usually 8 weeks).⁶

The patients were assessed post operatively and length of the body of mandible was evaluated using cephalometric analysis and CT scan and ortho pan tomogram. (Figure 1,2,3)

The posterior pharyngeal space was measured using lateral cephalograms pre and post operatively along with facial symmetry and chin prominence were also assessed on clinical examination.



Fig 1: Pre- and Post- distraction profile of a 15-year-old female patient with retrognathic mandible and Andy Gump deformity.

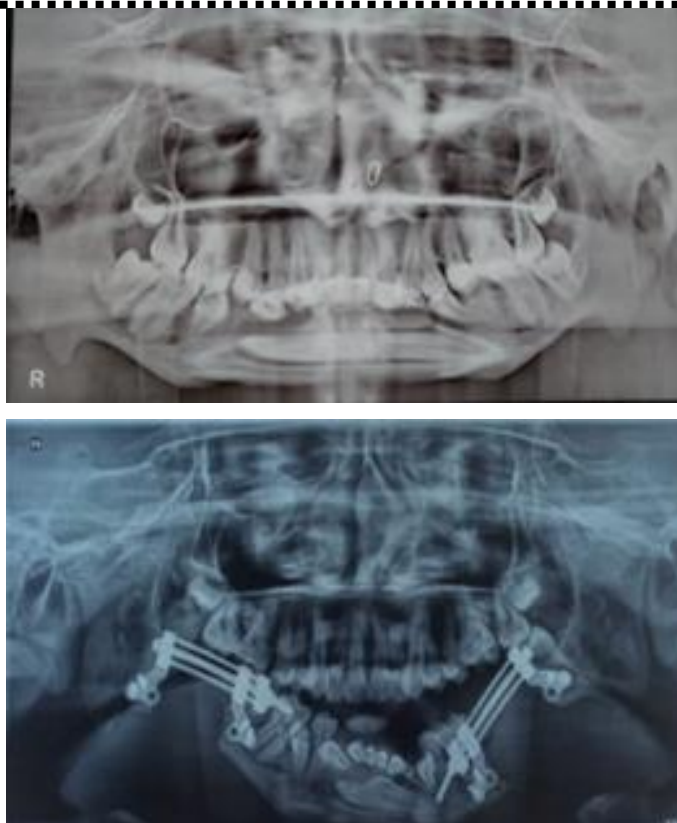


Fig 2: Pre- and post- operative radiographs depicting distraction of 25 mm.



Fig 3: Pre- and post- operative lateral profile of the patient after distraction.

Results

A total of 26 patients diagnosed with temporomandibular joint ankylosis were included in the study and were evaluated based on all the parameters. Out of these, 14 were male and 12 were female which was suggestive of slight male predilection in our study. Most of the patients ranged from 10-15 years of age. (Table 1,2)

In our study, most of the patients were operated with unilateral distraction constituting of 18 patients (69.2%), while only 8 patients were operated for bilateral distraction (30.8%); in which all the patients were operated for body lengthening. (Table 3)

The airway analysis was done pre- and post- operatively for the assessment of the airway gained after the procedure through CT scan and lateral cephalogram. The mean airway space gained, as evaluated in the CT scan was 6.72% (p value <0.001) and in lateral cephalogram, the mean airway space gained was 5.81 (p value <0.001), which were highly significant, while comparing with the pre- operative value. (Table 4,5)

All the patients were assessed for complications post-operatively and throughout the follow up period. We observed that the most commonly occurring complication in the patients was hyper trophic scarring in 14 patients each (53.8%) and infection of the surgical site in 8 patients (30.8%). Device failure and hardware failure was observed in 3 and 1 patient respectively.. (Table 6)

Table 1: Age Distribution

Age in years	Frequency	Percentage%
7	2	7.7
8	2	7.7
10	3	11.5
11	4	15.4
13	3	11.5
14	2	7.7
15	3	11.5
16	1	3.8
17	2	7.7
19	1	3.8
20	2	7.7
25	1	3.8
Total	26	100.0

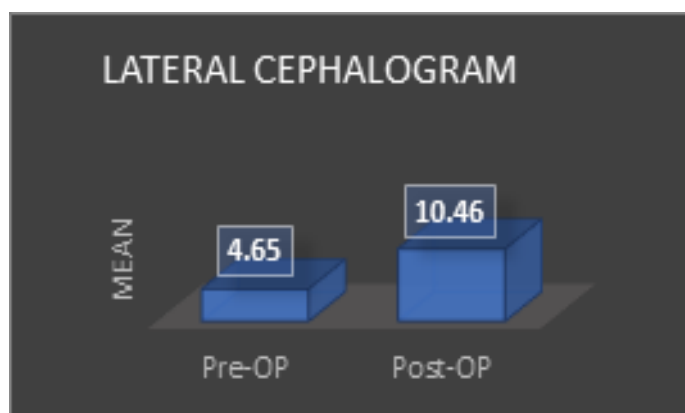
Table 2: Gender Distribution

Gender	Frequency	Percentage %
Female	12	46.2
Male	14	53.8
Total	26	100.0

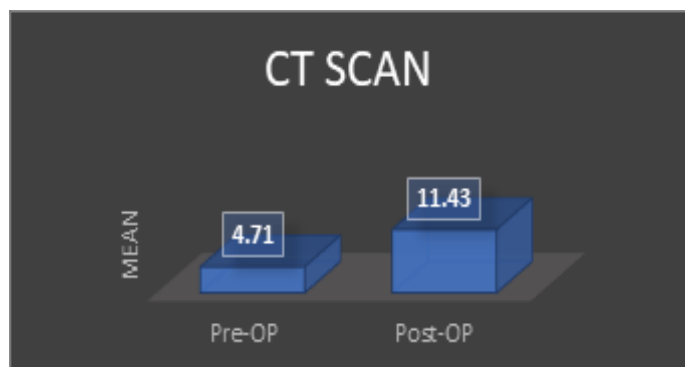
Table 3: Distraction Type.

Distraction Type	Frequency	Percentage%
Bilateral	8	30.8
Unilateral	18	69.2
Total	26	100.0

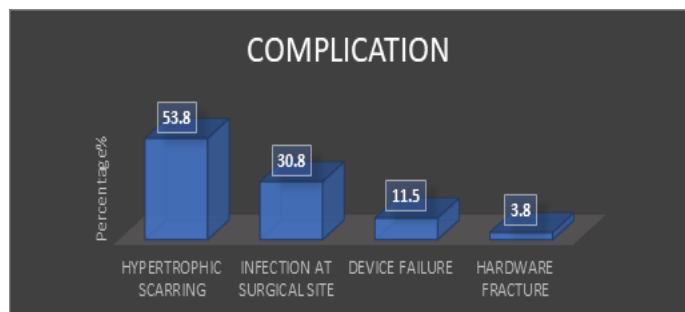
Graph 1



Graph 2



Graph 3



Discussion

Mandibular deficiency is a common dentofacial deformity having adverse functional and aesthetic effect. Mandibular corpus lengthening is carried out conventionally by vertical sub- sigmoid osteotomy or recently by D.O.

We observed that most of the patients in our study were in the age range from 10 to 15 years with a slight male predilection, which mimics the data given by Joseph G. McCarthy⁷ and Youssef⁸. In a study given by C.K. Kolstad⁵, he successfully treated neonates as young as 5 days old.

The most common aetiology for mandibular deficiency requiring D.O was TMJ ankylosis secondary to trauma, otitis media, genetic factors or odontogenic space infections. However, in our case it was only trauma.

Most of the patients were treated with unilateral distraction, which was in coordination with other studies done by various authors such as Tamer Turk⁹, Andrew T. C.¹⁰ and Imola et al¹¹. On the contrary, Andrew T. C.¹⁰ in his study performed bilateral distraction on 646 patients while only 539 patients were treated with unilateral distraction.

In all the cases, the area of the mandible that was operated with D.O was body of the mandible similar to studies given by W. H. Bell¹², C. A. Guerrero¹³ and Joseph G. McCarthy⁷; while Gate no¹⁴ in his study performed D.O in midface and maxillary region.

Mandibular D.O is a viable option for the paediatric patient with upper airway obstruction due to mandibular deficiency and fused joint. Mandibular DO treats the aetiology of the disease process and may allow for future growth such that the airway space gained helps resolving the apnea as well. In our study, the mean airway space gained in the CT scan and lateral cephalogram was 6.72 mm and 5.81mm respectively, which was similar to

studies done by Denny AD¹⁵ and Youssef⁸. On the contrary, Michael Miloro¹⁶ reported a mean increase in posterior airway space by 12 mm. After an average period of 5-6 months post consolidation, all the patients were then planned for ankylosis release. All our patients had repeated snoring (apnea) pre- distraction which was eliminated post distraction.

In our study, we observed that the most commonly occurring complication was hypertrophic scarring and infection of the surgical site followed by hardware failure and device failure. All these findings were similar to studies done by Pamela R. Hanson¹⁷, Sven Erik Nørholt¹⁸ and A. H. R. W. Simpson¹⁹ and were in contrast to studies given by MJ Troulis²⁰ and Andrew T. C.¹⁰.

Conclusion

With an impressive success rate reported in this study intra oral D.O is definitely a feasible option for treating ankylosis of TMJ. Though it is a technique sensitive and skilled procedure, but it is possible to carry out D.O with minimal complications and acquire good results. However, D.O requires a skilled surgeon for accurate treatment planning and execution of the treatment to achieve best results.

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