

Treatment of Facial Asymmetry and Temporomandibular Joint Ankylosis by Distraction Osteogenesis: A Case Report

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ABSTRACT

Facial asymmetry and functional problems due to dentofacial discrepancy and soft tissue disparities are commonly managed by orthognathic surgery and augmentation procedures. Distraction osteogenesis is a relatively new technique of bone generation and reconstruction. A patient reported with the chief complaint of asymmetry of face and deviated chin; had temporomandibular joint ankylosis. Distraction device was applied with simultaneous release of ankylosis by gap arthroplasty. For management of mandibular deformity and discrepancy of the dentition, orthodontic therapy was done using MBT 0.022" prescription. Distraction was stopped when the midline of upper central incisor coincided with the midline of lower central incisor followed by stabilization period of ten weeks. The functional and esthetic results achieved were acceptable.

Key words: distraction osteogenesis, facial asymmetry, TMJ ankylosis

INTRODUCTION

Abnormalities of the mandible can be a major concern as it could lead to facial asymmetry and functional problems. Mandibular abnormalities may occur due to variable etiologies such as asymmetrical growth associated with temporomandibular joint ankylosis, congenital deformities, posttraumatic residual deformities involving condylar fractures etc. Abnormality can cause malaligned dentition, deformity in dentition and/or adjoining skeletal deformity. Facial asymmetry and functional problems due to dentofacial discrepancy and soft tissue disparities are commonly managed by orthognathic surgery and augmentation procedures. However these procedures are inadequate because they are not able to achieve an appropriate synergy between the mechanical and biological factors.

Distraction osteogenesis is a relatively new technique of bone generation and reconstruction, which presents a unique form of clinical tissue engineering, in which by using easily controlled mechanical conditions (i.e. slow gradual distraction of the osteotomized bone fragments); we are able to guide the formation of new bone and its spatial orientation to form a structural part of the distracted bone. It was first used by Codivilla in 1905¹ for femoral lengthening and was popularized by Gavriil Ilizarov, a Russian orthopedic surgeon in 1950's,^{2,4,5,6} McCarthy and colleagues^{2,3} were the first to apply distraction osteogenesis to the craniofacial skeleton in 1989 in children having congenital craniofacial anomalies.

Distraction Osteogenesis is a unique biologic process of new bone formation between the surfaces of bone segments

that are gradually separated by incremental traction.⁷ The principle behind osteo-distraction is the application of defined mechanical strains to the reparative callus forming in osteotomy gap. New bone formation is initiated when a traction force is applied to the bone segments, thereby interrupting the process of fracture healing and placing callus under tension.⁸ As the callus is stretched, new bone is generated parallel to the direction of traction. During this stretching, the soft callus is maintained at the center of distraction gap while routine fracture healing occurs at the periphery of segments.

As compared to other procedures that correct facial deformities, distraction osteogenesis requires less surgical expertise and is free from complications like failure of graft, morbidity of donor site, relapse of advancement etc.^{8,9}

Distraction osteogenesis is indicated in unilateral/bilateral mandibular hypoplasia in operated cases of TMJ ankylosis,¹⁰ unilateral mandibular hypoplasia due to hemifacial microsomia,¹¹ mandibular hypoplasia associated with agenesis of condyle with severe dental malocclusion,¹² Treacher Collins syndrome, and cleft lip & palate cases with midface retrusion.

Case Report

The patient was referred to Department of Orthodontics & Dentofacial Orthopedics from the Department of Oral & Maxillofacial Surgery, Government Dental College, PGIMS, Rohtak, India with the chief complaint of asymmetry of face and deviated chin. The patient was admitted for the required procedure and consent was taken. Routine blood

investigation and chest X-ray PA view was done for pre-anesthetic evaluation. A thorough medical history was taken to identify any possible factor contributing to the development of facial asymmetry or to identify any associated syndrome. Photographic evaluation of patient was done; frontal and profile views of the patient were taken preoperatively (Figure 1), intraoperatively (Figure 2), postoperatively (Figure 3) to evaluate lateral nasal, chin, forehead and zygoma projections, mandibular plane angle and for comparing the sides.

Lateral cephalograms were taken and used for analyzing the discrepancy in mandibular body and ramus region. Both hard tissue and soft tissue analysis were carried out for measuring the changes during different phases of the treatment. Postero-anterior cephalometric analysis was carried out to assess asymmetry. These radiographs were taken before starting the procedure, seven days after starting distraction, after completing the distraction and on regular follow-ups at one month, three month and six months to evaluate relapse or to assess the requirement of additional surgical procedure. Orthopantomogram was taken for diagnosing the case of ankylosis. It was used for surgical consideration to determine

the location of osteotomy, to evaluate the position of third molar in relation to osteotomy site, and to determine the position of inferior alveolar canal. OPG was also taken during the distraction period and post operatively to observe the position of pin and to detect any change with the pin position.

Procedure for Distraction: Extraoral mandibular distraction device was used in the patient. As the patient had TMJ ankylosis, distraction device was applied with simultaneous release of ankylosis by gap arthroplasty which is a useful and effective technique for management of mandibular deformity with TMJ ankylosis.

Latency Period: The latency period was 5 days and it was the time for initial fracture healing to bridge the cut bony surfaces. It was the period from bone division to onset of traction and represented the time required for reparative fibrous callus formation between the osteotomized bone segments.

Distraction Period: Distraction period was the time when a traction force was applied to bone segments and new bone regenerate was formed within inter-segmentary gap created by distraction of the segments. Active distraction was initiated by opening the screw at a rate of 1 mm/day in two

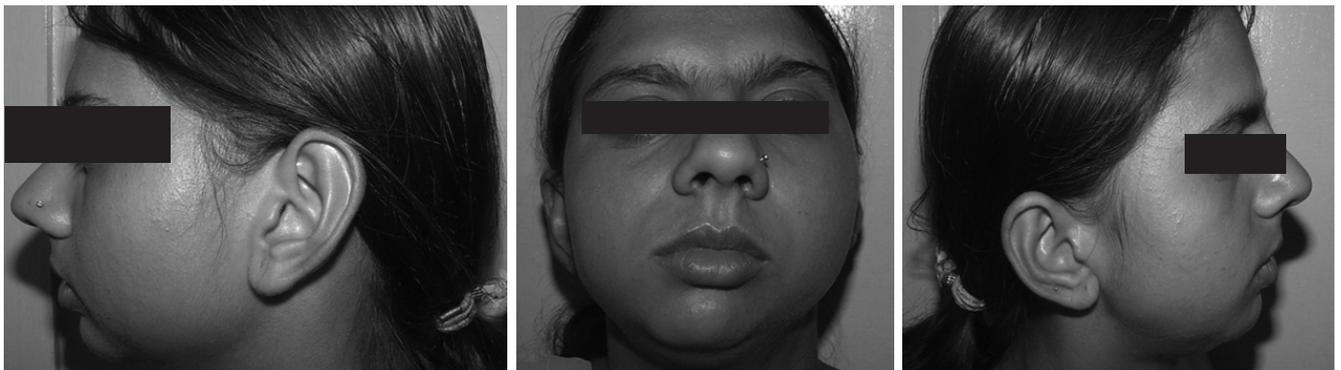


Figure 1: Pretreatment extraoral photographs



Figure 2: Mid treatment extraoral photographs with distractor device

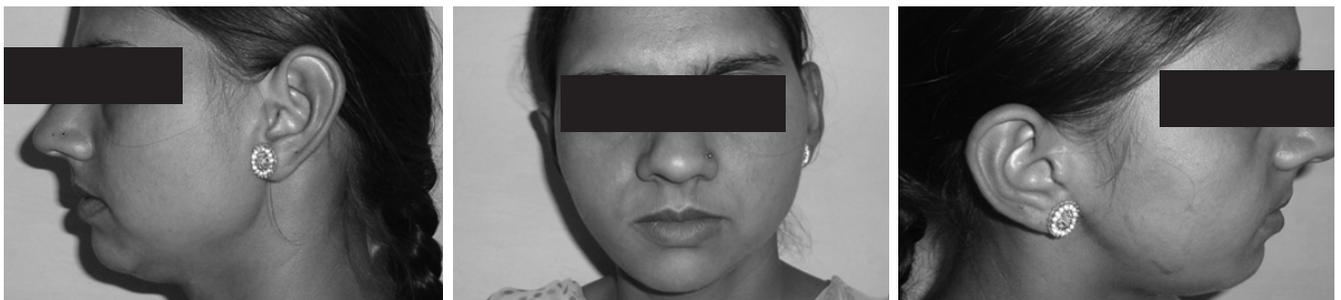


Figure 3: Post treatment extraoral photographs

increments. The distraction was stopped when the midline of upper central incisor coincided with the midline of lower central incisor.

Consolidation Period: This period began after achieving the desired amount of lengthening when traction forces were discontinued. This stabilization period was 8-10 weeks, which allowed mineralization of the newly formed bone tissue prior to distraction device removal.

Post Operative Management: Analgesics and antibiotics were given post-operatively for 5-7 days. Patient was advised to take liquid diet on the first postoperative day; then gradually switched over to semisolid diet. Patient was advised to maintain good oral hygiene and not to chew hard food material. Both active and passive physiotherapy was started from the first postoperative day.

Orthodontic Management: After complete evaluation and discussion with oral surgeon, all first premolar were extracted. Orthodontic treatment was done using 0.022 preadjusted edgewise appliance (MBT prescription). Initial leveling and aligning was done with round 0.016 NiTi wire for both upper and lower arches which was followed by 0.018 ss wire (Figure 5), gradually changed to 0.017 x 0.025 NiTi, and 0.017 x 0.025" ss wire. Space closure was done with NiTi closed coil spring.

Final arch coordination was accomplished with successively larger rectangular arch wires until 0.019 x 0.025 ss wires were placed. Settling was done with 0.014 ss wire with vertical elastics. Slight dental midline deviation was present but it was acceptable esthetically. TMJ examination to ensure the success of treatment and functional movements like lateral excursions, protrusion were also checked and then finally debonding was done.

Appointments were at four weeks interval and steady progress was noted throughout the course of treatment. The oral hygiene and cooperation of the patient were very good. The functional and esthetic results achieved for this patient were acceptable. An external distractor required an incision for fixation and active distraction left a scar. Fortunately, the scar in this patient resolved satisfactorily and no cosmetic revisions were required.

The treatment result showed a considerable increase in the length of affected mandibular body. During three years of orthodontic therapy, a balance on both sides was achieved. At the end of treatment, the patient showed good facial & frontal profile (Figure 3), balanced lip line, and an acceptable occlusion (Figure 5). Dental arches were aligned and leveled with an ideal overjet and overbite relation.



Figure 4: Mid treatment intraoral photographs



Figure 5: Post treatment intraoral photographs

DISCUSSION

Bone lengthening has become an accepted technique in the management of congenital deficiencies and post-traumatic deformities (non-union and skeletal defects).^{10,11,13} Surgical orthodontic treatment combined with mandibular distraction osteogenesis may be an effective method for improving occlusion, skeletal asymmetries, facial profile, and stomatognathic function.

Facial deformities can be effectively corrected by distraction osteogenesis which is relatively free of complications like failure of graft, morbidity of donor site, relapse of advancement etc. Thus the distraction osteogenesis can be used effectively in the management of TMJ ankylosis; which will potentially shorten the treatment time and offer an option to supplement conventional treatment.



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