Mandibular Deformity Correction by Distraction Osteogenesis

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Abstract:
Distraction osteogenesis (DO) is a biological process of new bone formation. It could be used as an alternative treatment method for the correction of mandibular hypoplastic deformity. Modern distraction osteogenesis evolved primarily from the work of Gavriel llizarov. DO has been first applied to craniofacial region since McCarthy et al. In this case report, the patient was 17 years old male with bird face deformity due to hypoplasia of mandible resulted from bilateral TMJ ankylosis due to the fracture of both condyle at the age of 4 years. Patient's intraincisal opening was absent 1 year back. He underwent condylectomy in both sides to release the ankylosis and to increase intraincisal opening. His mandibular length was markedly short. To increase his mandibular antero-posterior length, mandibular body distraction was done in Oral and Maxillofacial Surgery department, BSMMU. Through this procedure length of the body of mandibule was increased by 10 mm, occlusion was edge to edge and his lower facial appearance increased markedly. Mandibular body distraction osteogenesis was considerably effective when performed in a hypoplastic mandible to facilitate post-operative functional and esthetic restoration. Long term follow-up is necessary to evaluate relapse and complications.

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Introduction:
Distraction osteogenesis (DO) is a biological process of new bone formation between the surfaces of bone segments that are gradually separated by incremental traction[1]. A callus forms between the separated bone segments and as long as the traction proceeds, callus tissues are stretched inducing the new bone formation[2]. DO was first introduced by Codivilla at the beginning of twentieth century and during 1950s. Modern distraction osteogenesis evolved primarily from the work of Gavriel llizarov. The studies of Ilizarov made a contribution in the development of the technique by elucidation the biological and mechanical principals in the formation of new bone[3-4]. DO has been first applied to craniofacial region since McCarthy et al. In the lengthening of the hypoplastic mandible, external or intraoral devices have been used. Extra oral distraction device fixes extra orally so are not convenient socially and leave residual skin scars but intraoral distraction device are more convenient socially and leave no residual skin scars. In this case report, we intended to present the treatment of a 17 years old male who had severe mandibular deficiency. An intra-oral distractor was used to achieve independent horizontal distraction of the mandibular body. Amount of lengthening was determined by models and lateral cephalometry analysis.

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Surgical technique:
Because the operating area was in the lower jaw, nasotracheal intubation was performed. With all aseptic precaution, under general anesthesia intraoral degloving incision was given from right lower second molar to left lower second molar, mucoperiosteal flap was reflected and exposed the cortex of mandibular body. According to plan of surgery the cortex was marked for the placement of device on the both side of the vertical line running through between lower first and second molar. The mandibular osteotomy was then performed with round and fissure burs and osteotomes. One osteotomy on each ipsilateral side was done in between lower first and second molar. Then the device was fixed to the mandible via 6 screws on previously marked area. After the completion of fixation of screws, the distractors were tested. Then the incision was primarily closed.

Patient waited for 7 days for callus formation. Afterwards, distraction was performed at a rate of 0.5mm, twice a day; Distraction was continued for 10 days. Once the over jet reduced and bite became edge to edge, 3 months of consolidation was allowed. New bone generation at the distracted site could be seen on follow-up X-rays. Following the consolidation phase the distractor was removed under local anesthesia and intra oral wounds were debrided and primarily closed and left for recovery. The patient was followed up for one month in order to determine whether relapse would occur. The total treatment time was 20 weeks.

Case report:

A 17-years old male had been diagnosed as bird face deformity with receding chin. The patient was previously operated case of bilateral TMJ joint ankylosis for improving mouth opening which was nil before previous surgery. He gave history of fracture of both condyles at the age of 4 years. One year back he underwent both condylactomy for increasing intra-incisal opening. His intra-incisal opening increased by 35mm but his mandibular body length remains markedly reduced. His mandible was symmetrical but micrognathic, neck chin angle was markedly reduced, antegonial notch was well defined bilaterally, class II malocclusion, over jet was 10mm. Diagnosis was conformed by orthopantomograph and CT scan. Amount of lengthening determined by lateral cephalometry analysis. So to increase mandibular body length horizontal distraction of both mandibular bodies was performed under general anesthesia. After seven days of latency phase, the device was activated at a rate of 0.5mm, twice a day; Distraction was continued for 10 days. Once the over jet reduced and bite became edge to edge, 3 months of consolidation was allowed. New bone generation at the distracted site could be seen on follow-up X-rays. Following the consolidation phase the distractor was removed under local anesthesia and intra oral wounds debrided and primarily closed and left for recovery. The patient was followed up for one month in order to determine whether relapse would occur. The total treatment time was 20 week.

Fig.-1: *Pre-operative (Front view)*

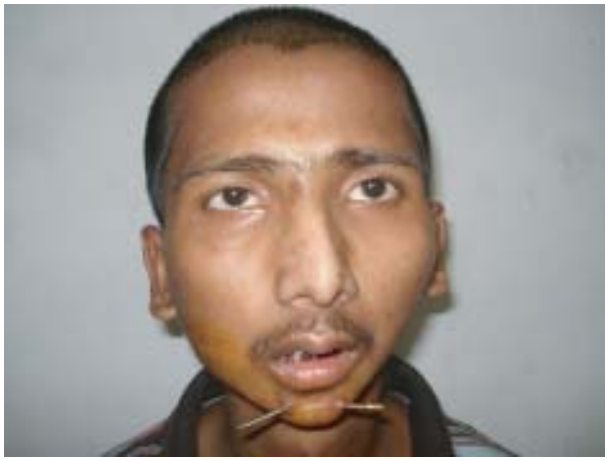

Fig.-2: *After completion of distraction device (Front view)*

Fig.-2: *X-Ray after distraction. (Front view)*

Fig.-3: . *X-Ray after distraction. (Lateral view)*

Fig.-4: *Post-operative (Front view)*

Fig.-5: *Post-operative (Lateral view).*

Discussion:

Conventionally, additional bone grafting has been applied to bone augmentation on the reconstructed bone[5]. Although bone grafting is a powerful tool, the procedure carries the risk of donor site morbidity and severe bone resorption. Bone harvesting also affects the patient with donor site pain. In addition bone grafting requires enough soft tissue to consistently cover the tissue to prevent surgical site infection. Distraction osteogenesis enables soft tissue adaptation and bone augmentation.

On the other hand orthognatic surgery has relapse risk in severe mandibular deficiency and also relatively contra indicated in growing age.

For this region we prefer distraction osteogenesis in treatment of the patient for augmentation of the mandible. During distraction osteogenesis active histogenesis occurs in different tissue including gingiva, blood vessel, ligaments, cartilage, muscle and nerve[6-7]. These adaptive changes in the soft tissues decrease the relapse risk and allow the treatment of severe facial deformity. Also severe mandibular hypoplasia can lead to a reduction of oropharyngeal capacity and glossoptosis because of the posterior location of the insertion of the suprahyoid muscles into the mandible. As a result upper airway obstruction, feeding difficulties, gastroesophageal reflux may occur. Several authors have reported that these conditions could be resolved by the help of mandibular distraction[8-9]. Similarly, following the advancement of the mandible, respiratory problems, snoring and difficulties during feeding and talking was improved in our patient.

DO has also some risks such as infection, loosening of the distractor, paresthesia and excessive skin damage caused by the pins of the extra oral device. Strategic mistake such as inappropriate configuration or inadequate calculation of distraction parameters and technical mistakes like misalignment of the distractor leading to displacement of the bone segment, insufficient rate of the lengthening, premature consolidation may cause undesired result. These complications are usually related with the experience of the surgeon[11-13]. In the present case wound dehiscence was observed which was controlled by proper wound dressing. Also for inappropriate distractor configuration the shaft of activation arm was came extra orally in the chin area.

The optimal time for starting distraction is under debate[14]. In this case, distraction was carried out at 1mm per day followed by a 3-month retention period. Horizontal distraction osteogenesis of mandibular body is considered to be useful to augment mandibular body in severe hypoplastic mandible and to increase functional and esthetic appreance.

Conclusion:

Mandibular body distraction was considerably effective when performed in a hypoplastic mandible to facilitate post-operative functional and esthetic restoration.

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