

## Case Report

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# Interdisciplinary Management of Malocclusion with Alveolar Distraction as A Modality for Rehabilitation of Anterior Mandibular Ridge: - A Case Report

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## ABSTRACT

Restoration of function and esthetics simultaneously is a great challenge for the orthodontist. Oral rehabilitation with prosthetic implants requires a good quality and quantity of bone. The anterior region, being the most aesthetic region of the face, requires special consideration in terms of position of the implant, color, shape and size of the prosthesis. For the successful regeneration of the bone to hold the implant, the technique of alveolar distraction osteogenesis is used with great success nowadays. Alveolar distraction follows the principle of distraction osteogenesis which was proposed as an alternative method for the reconstruction of the defects of the jaws as proposed by Ilzarov in 1989. It seems to be a promising method for reconstructing segmental bone defects in the jaws.

## INTRODUCTION

The restoration of function and esthetics simultaneously is of prime importance for successful completion of orthodontic treatment. These two factors have been of a great challenge for both the novice and experienced orthodontists. Many a times, orthodontists are encountered with problems so severe that many specialities are called upon to meet all the objectives and obtain the most appropriate results. The term multidisciplinary is used where the act to be performed is accomplished by several different specialities but there is no interaction of any kind amongst the involved disciplines. Interdisciplinary intervention on the other hand indicates an interaction amongst the involved disciplines both in planning phase and during treatment so as to get the best possible results for the patient. The anterior region, being the most aesthetic region of the face, requires special considerations when rehabilitation is required in this area in terms of position, color, shape and size of the prosthesis being built upon it thus necessitating the interdisciplinary approach. The oral rehabilitation procedures based on prosthetic implants require a good quality and quantity of bone for their placement.<sup>1</sup> There have been numerous case reports citing the methods to increase the bone available for implant placement.<sup>2,3</sup> The use of bone grafts and platelet rich fibrin have been very successful in the past. The technique of distraction osteogenesis has been proposed as a viable alternative to such therapies and has made its niche as a

potential modality to increase the available bone for implant placement<sup>4</sup>.

Ilzarov (1951) had proposed distraction osteogenesis as an alternative method for the reconstruction of the bony defects.<sup>5</sup> In 1989, McCarthy et al were the first to clinically apply the technique of extraoral osteodistraction on four children with congenital craniofacial anomalies.<sup>6</sup> Distraction osteogenesis is based on the manipulation of a healing bone, stretching an osteotomized area before calcification has occurred in order to generate the formation of additional bone and investing soft tissue. It enables the clinician to lengthen and widen bone and fill in gaps between bones without the need for bone or soft tissue grafts.<sup>7</sup>

The initial work on alveolar ridge distraction to increase the available bone was done in dog experiments by Block, Chang, and Crawford (1996), who demonstrated histological evidence of regenerated bone formation during alveolar ridge distraction.<sup>8</sup> Since then it has shown promising results for reconstructing segmental bone defects in the jaws. The present case report shows the interdisciplinary management of a case with periodontally compromised lower anteriors, atrophic lower anterior ridge with spacing & crossbite.

## CASE REPORT

A 24 year old post pubertal female patient reported to the department with the chief complaint of spacing in the upper and lower front teeth region. The spacing was reported to increase in

last 4-5 years. There was no significant medical history, whereas the patient had a positive dental history of localized periodontitis in the lower anterior segment for which patient had undergone prophylaxis earlier.

The initial extra oral views showed a mild asymmetric face with chin deviated towards right side with straight profile. (Fig:1a to c)



**Fig 1:** a) to h): Pretreatment Intraoral and Extraoral Photographs

Intraorally, Permanent molars displayed an Angle's class I relationship on the right and left side. The canines followed the same relationship as molar on the left side and end on relation on the right side. Upper buccal segment was in crossbite w.r.t lower buccal segment on right side. Incisors were in edge to edge relationship. Spacing was present w.r.t 11, 12 and 41, 42. The lower dental midline was shifted towards right by 2mm w.r.t upper dental midline. Recession could be appreciated w.r.t 31 and 41 and 42 with grade III mobility. (Fig.1 d to h)

On radiographic evaluation, the panoramic radiograph showed generalized bone loss in both the arches with excessive bone loss in lower anterior region and pathologic migration of lower anterior teeth.(Fig.1 i) The pre-treatment lateral cephalogram showed a class III skeletal relationship with orthognathic small sized maxilla and mandible with horizontal growth pattern.(Fig.1 j) The maxillary incisors were labially inclined and mandibular incisors were upright. (Table 1)

## TREATMENT OBJECTIVES

The treatment objectives were-

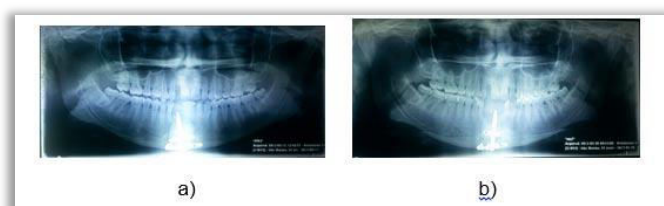
1. To correct spacing in the upper and lower anterior segment.
2. Extraction of mobile 31, 41 & 42 and replacement with prosthesis after appropriate ridge rehabilitation.
3. To correct crossbite in the right posterior segment.
4. To treat narrow maxilla and wide mandible.
5. Obtain ideal dental, hard tissue & soft tissue balance.

## TREATMENT PROGRESS

Noticing the mobility of 31,41 and 42 and bone loss in the lower anterior segment, the patient was advised scaling and debridement with deep curettage. Subsequently 31, 41 & 42 were extracted due to grade III mobility. The patient was referred to the department of oral and maxillofacial surgery where alveolar distraction osteogenesis was performed for ridge augmentation in lower anterior segment. An internal distractor was placed for the vertical lengthening of the mandibular anterior alveolar ridge (Fig 2. a). On the 5th day of placement of the device, the distractor was activated 0.5mm twice a day for 1 week until desired lengthening took place. An OPG was taken to confirm the appropriate activation before cessation of the distraction process. (Fig. 2 b).



**Fig 1.** i) & j): Pretreatment Orthopantomogram & Lateral Cephalogram



**Fig. 2:** a) OPG at the time of distractor placement & b) OPG after the distraction completion.

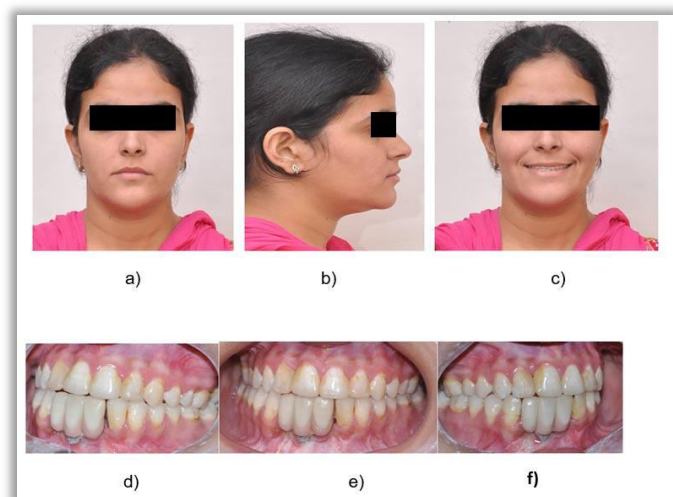


**Fig. 3):** 0.018" A J Wilcock Wire With Anterior Omega Loop In Mandibular Anterior Region.

The distractor was left in place for 5 months after distraction was complete to consolidate the bony segment. Afterwards, the distractor was removed and two endosseous implants were placed in the region of 31 and 41. By the time, implants were left to osseointegrate, orthodontic treatment was started in the upper arch first. Brackets and bands were placed on upper teeth (0.022x0.028 slot 3M Unitek™ Gemini series). Leveling and aligning was started on 0.014 Niti wires. Semifixed acrylic bite block were cemented on lower posterior segments bilaterally because of crossbite. Subsequently, lower arch was strapped up and leveling and alignment phase was started on 0.014 NiTi wire. A tissue guard was placed in the anterior region in order to avoid discomfort to the patient with wire in edentulous span.

A removable expansion plate for upper arch with an off-centered expansion screw (towards right side) was fabricated and given to the patient for self-activation with instructions for full time wear. The second quadrant was fully consolidated so as to obtain the maximum expansive effect on the right side. In the lower arch following alignment, an 0.018" A J Wilcock wire with an anterior omega loop was fabricated for the construction of the lower arch.(Fig. 3) Simultaneously, palatal buttons were bonded on 13, 14 and 15 and cross elastics were started for crossbite correction making use of reciprocal anchorage.

After the correction of crossbite, the wires were sequentially upgraded from round and rectangular NiTi wires to the stainless steel. On progression to 0.019 X 0.025" stainless steel wires, buccal root torque was placed in upper wire and light class III elastics (4 ounce) were started for settling of the buccal occlusion.

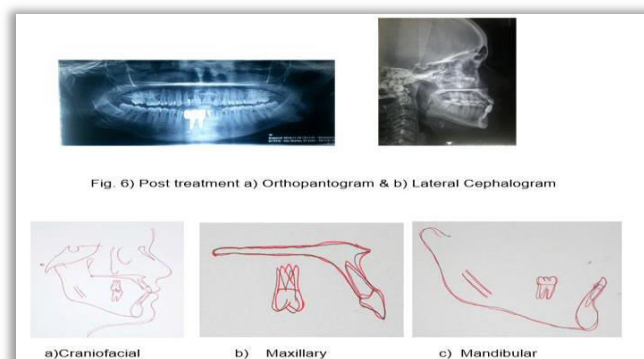


**Fig.4 a) to f)** Post treatment Intraoral & Extraoral photographs

Before debonding the case, the implant supported prosthesis was placed in the region 31,41,42. After that the case was debonded with class I molars and canines on both sides and normal overjet and overbite (Fig:4 a to f ). Bonded lingual retainer was given in both upper and lower arches. A removable Hawley's retainer with crib was fabricated for upper arch as some incomplete bite was noticed in the anterior region.(Fig. 5) Post treatment OPG, lateral cephalograms (Fig: 6) and superimpositions (Fig: 7 a to c) depict the changes taken place as a result of treatment. The patient had a follow up of 1 year with almost no change in the result achieved at the time of debonding. (Fig: 8 a to h)



**Fig. 5):** Bonded Lingual retainer wrt a) maxillary and b) mandibular arches.



**Fig. 6)** Post treatment a) Orthopantomogram & b) Lateral Cephalogram



**Fig: 6)** Post treatment a) Orthopantomogram & b) Lateral Cephalogram. **Fig: 7a) to c):** Superimpositions



**Fig. 8 a) to f):** Post treatment Intraoral and Extraoral photographs (At 1-year follow up)

than one specialty with a single modality. As in the present case report patient presented with spacing, missing teeth, crossbite and reduced bone support. The treatment for the case had to be accomplished in collaboration with orthodontist, periodontist, oral surgeon and prosthodontist.

In mandibular anterior region, patient was found to have compromised alveolar ridge with pathologic migration of teeth secondary to aggressive localized periodontitis. Because of poor prognosis 31, 41 & 42 were extracted and later on prosthesis was planned. For final prosthesis placement, the operator has an array of options including Fixed and removable partial dentures, implant supported prosthesis, cast partial denture etc. Fixed partial denture possibility was ruled out owing to reduced alveolar bone support of adjacent teeth. Out of other options, patient chose implant supported prosthesis for replacement of missing teeth. However, compromised alveolar ridge needed ridge augmentation before placement of implants. Current modalities for ridge augmentation include autogenous grafting materials, guided bone regeneration, alloplastic grafting materials, ridge expansion and ridge splitting, guided bone regeneration and alveolar distraction osteogenesis.<sup>9</sup>

**Table 1:** Comparison Of Pre And Post Treatment Cephalogram .

PARAMETERS	PRE TREATMENT VALUE	POST TREATMENT VALUE
SNA	82 <sup>0</sup>	83 <sup>0</sup>
Maxillary base length	54	54
N <sup>⊥</sup> - A <sup>⊥</sup> (FH)	0	0
SNB	83 <sup>0</sup>	81 <sup>0</sup>
Mandibular base length	75	76
Pog <sup>⊥</sup> to N <sup>⊥</sup> (FH)	-4	-2
Ascending ramus	52	55
ANB	-1 <sup>0</sup>	+2 <sup>0</sup>
Wits Appraisal	-4	-1
Maxillo-mandibular differential	25	26
Maxillary base: Mandibular base	0.72	0.71
Jarabak ratio (PFH/AFH)	70	66
SN- [Go-Gn]	24 <sup>0</sup>	25 <sup>0</sup>
FMA	24 <sup>0</sup>	25 <sup>0</sup>
Y – axis (N-S-Gn)	59 <sup>0</sup>	62 <sup>0</sup>
Basal Plane Angle	23 <sup>0</sup>	24 <sup>0</sup>
U1-NA (°/mm)	38 <sup>0</sup> /10mm	32 <sup>0</sup> /6mm
IMPA	91 <sup>0</sup>	93
L1-NB (°/mm)	25 <sup>0</sup> /7mm	26 <sup>0</sup> /6mm
Interincisal angle	120 <sup>0</sup>	121 <sup>0</sup>
Nasolabial angle	96°	102°
E-LINE, A. Upper lip, B. Lower lip	-4,-3	-4,-3

## DISCUSSION

Interdisciplinary approach for treating cases is required in patients when accomplishment of objectives cannot be met with single modality which requires the collaboration of more

Autogenous bone grafts are still considered the gold standard in bone regeneration procedures. However, drawbacks of autografts include donor site morbidity, unpredictable stability concerns. Especially, extraorally harvested bone grafts are associated with clinically significant morbidity and risk of complication.<sup>10</sup> Nowadays the most frequently applied bone

augmentation techniques related to implant dentistry are guided bone regeneration (GBR) procedures. In GBR procedures, a barrier membrane is utilized to allow bone to form without the interference of fibrous and epithelial tissues. Wound dehiscence is often seen as a complication of GBR. It is also technique sensitive.<sup>11</sup> Alloplastic graft bone graft is a synthetic bone substitute made up of bioactive glass or calcium phosphates. The disadvantage of alloplastic graft is risk of rejection owing to stability concerns.

Alveolar distraction osteogenesis was first reported by Chin and Toth in 1996. The process of distraction avoids bone grafting procedures from other body parts and its associated complications. It has also an added advantage of recreation of soft tissues along with the hard tissues. For the present case, alveolar distraction was considered as the procedure of choice for ridge augmentation after discussing the merits and demerits of other procedures with the patients. Distraction Osteogenesis involves gradual, controlled displacement of surgically created fractures (subperiosteal osteotomy) by incremental traction, resulting in simultaneous expansion of soft tissue and bone volume due to mechanical stretching through the osteotomy site.<sup>9</sup> Clinically distraction osteogenesis consists of 5 sequential phases; 1. Osteotomy phase; 2. Latency phase; 3. Distraction phase; 4. Consolidation phase; 5. Remodeling phase. For the present case a vertical cut was placed between the alveolar ridge resulting in a loss of continuity & mechanical integrity and a vertical distractor was placed. The procedure has been advocated.<sup>12</sup> A latency phase of 5 days was adequate for maturation of the callus. The distraction process was initiated by applying traction forces to the osteotomized bone segment as suggested by Rajat Mohanty<sup>9</sup>. The distraction process was initiated on the fifth post-operative day with a frequency of twice daily. The pitch of the distractor screw was 0.5mm and activation was done twice daily hence vertical ridge augmentation was achieved at a rate of 1mm/day as suggested by Suchita Daokar<sup>12</sup>. After completion of distraction, the segment was allowed to consolidate for 3-5 months to allow corticalization of bone followed by removal of distraction and implants placement. In this period of 3-5 months, cessation of traction forces & the removal of the distraction device took place. This allowed for the maturation & corticalization of the regenerated tissue.

For correction of crossbite and expansion in upper arch, a removable expansion plate with off centered placed jackscrew was used. Along with this, crossbite elastic were given to the patient from palatal aspect of upper teeth to buccal aspect of lower posterior teeth on right side. Later on buccal root torque was added in upper right posterior segment in order to bring the roots in line with crowns which tilted buccally after expansion.

Finally prosthesis of lower anterior teeth was placed with implant supported crown in place of 31 and a cantilever replacing 41 and 42 supported on implant in 41 region.

After 1 year of follow up there was stability of the case. Though there were some undesirable changes such as slight

spacing between lateral and central incisor on left side.

## CONCLUSION

Treatment of impacted teeth requires thorough analysis of patients' records, correct diagnosis, and a treatment plan with good interdisciplinary efforts that can cater maximal benefit to the patient.

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