

ALVEOLAR DISTRACTION OSTEOGENESIS FOR IMPLANT SITE DEVELOPMENT: A CASE REPORT AND REVIEW OF LITERATURE

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ABSTRACT

Distraction osteogenesis of the edentulous alveolar ridges may be considered an alternative to other augmentation oriented surgical techniques. It is now being widely used for treating severe forms of alveolar ridge atrophy, especially before the placement of dental implants. Vertical Alveolar Distraction System is a vertical alveolar distraction device used for edentulous ridges. In this study, the patient came to us with a chief complain of intra-oral swelling in symphysis region, which was diagnosed as dentigerous cyst and enucleation done followed by platelet rich fibrin placement and recalled him after 3months. After 3months the radiograph revealed uneven healing along with inadequate alveolar bone depth for implant placement. Eventually out of many options we decided to go for Vertical osteogenic alveolar distraction (VOAD), which allows for the augmentation of the alveolar ridge for the placement of dental implants in atrophic alveolar ridges and after 6 months of reviewing we finally got adequate alveolar bone depth for implant placement and we placed the implant. No complications related to the prosthodontics restoration were observed.

KEY WORDS

Bone resorption, Alveolar distraction osteogenesis, Dental implants

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INTRODUCTION

Current standards in implant dentistry are intended to provide natural prosthetic restorations with the finest esthetic and functional outcomes. Several parameters have been suggested to achieve: adequate bone height, width, and anteroposterior projection; adequate soft tissue quantity and quality; preservation of buccal sulcus; and adequate papillae and gingival contour¹. The preservation and reconstruction of the alveolar bone and surrounding soft tissues with the help of bone graft or distraction osteogenesis for the placement of dental implants has become fundamental in the contemporary practice of oral and maxillofacial surgery².

Bone grafting:

Autogenous grafts, allografts, and xenografts are available as bone grafting materials. The current gold standard for bone grafting is autogenous bone, because of its biocompatibility, lack of antigenicity, osteoconductive, and osteoinductive properties³. Autogenous grafts are most commonly harvested from the mandible and offer some advantages over distant donor sites, including convenience of surgical access and proximity of the donor and recipient sites⁴ [Figure-1].

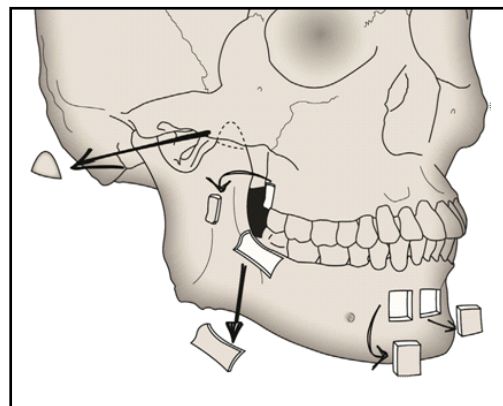


Figure-1: Bone harvesting sites from the mandibular region. Arrows are pointing to bone harvested from various possible harvesting sites⁴.

Distraction osteogenesis:

Distraction osteogenesis is defined as “A biologic process of bone formation occurring between the surfaces of vital bone segments that are gradually separated by incremental traction”. Distraction osteogenesis is based on the principle of "tension-stress," with gradual application of tensile forces stimulating histogenesis. Traction of bone generates tension and stimulates new bone formation parallel to the vector of distraction^{5,6}.

Indication:

Luis G. Vega et al in 2010, suggested some general indications for alveolar distraction osteogenesis, which includes; -moderate to severe vertical alveolar bone defects, segmental deficiencies of the alveolar ridge, narrow alveolar ridges adjunct to other bone graft techniques, gradual vertical movement of an osseointegrated implant together with the surrounding alveolar bone.²

Contraindication:

According to Malet Jet al.2018, the general contraindications for alveolar distraction osteogenesis are, insufficient bone quantity to allow adequate anchorage of the plates which suggests the use of the technique is contraindicated in severely deficient mandibles, which are at risk of neural damage and/or fracture, the presence of maxillary sinus and/or nasal cavities, presence of a thin knife-edge bone, Lack of patient co-operation during the activation process. Nevertheless, the procedure seems well accepted by patients.⁷

Advantages and Disadvantages:

Luis G. Vega et al in 2010, described the advantages and disadvantages of alveolar distraction osteogenesis for implant site preparation. According to their study, the advantages of alveolar distraction osteogenesis for implant site preparation are; simple technique, simultaneous augmentation of bone and soft tissues, less resorption than traditional bone grafts, transport segment can include teeth or implants, facilitating the correction of occlusal or prosthetic defects, elimination of donor-site morbidity, shorter treatment times compared with traditional bone grafting techniques and it allows the implementation of complementary techniques when results are not optimal. On the other hand, the disadvantages of alveolar distraction osteogenesis for implant site preparation are, patient acceptance and compliance, requires careful vector control, interference with occlusion might require the construction of protective appliances, high device cost.

Principles of distraction osteogenesis:

The distraction principles of latency, surgical technique, rate, rhythm, stabilization, and consolidation are the keys to generating new bone and preventing early ossification or fibrosis (Figure-2). Vector control is vital for the precision demanded in implant site preparation. With careful planning, and by following an appropriate list of indications for alveolar distraction, predictable hard and soft tissue regeneration can be achieved⁸.



Figure -2 : Protocol for distraction.⁸

CLASSIFICATIONS :

1. **Extrasosseous** (Figure-3)⁹ devices generally are easier to place because they are applied laterally on the bone, but they may complicate patient comfort and esthetics.

2. **Intraosseous** (Figure-4)⁸ devices generally are placed within the transport segment, making precision placement more critical. Adequate bony thickness is crucial with most intraosseous devices. Both types provide excellent results when used appropriately.



Figure-3:Extrasosseousdevice with vertical stabilizing plate⁹

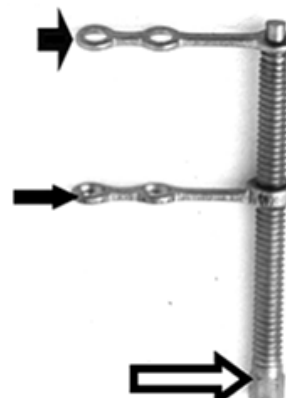


Figure-4 : Intraosseous device with threaded rod (black and white arrow), transport plate (long narrow black arrow), and stabilizing plate (short wide black arrow)³.

CASE PRESENTATION

A 30 year old male patient had operated for dentigerous cysts under general anaesthesia. Cyst was enucleated along with extraction of associated teeth from mandibular right first molar to left lateral incisor followed by placement of platelet rich fibrin. The lower border of the mandible was intact (Figure-5-10).



Figure-5: Pre-operative view (Extra-oral)



Figure-6: Pre-operative view (Intra-oral)



Figure-7: Immediate pre-operative



Figure-8: Intra-operative exposure of cyst

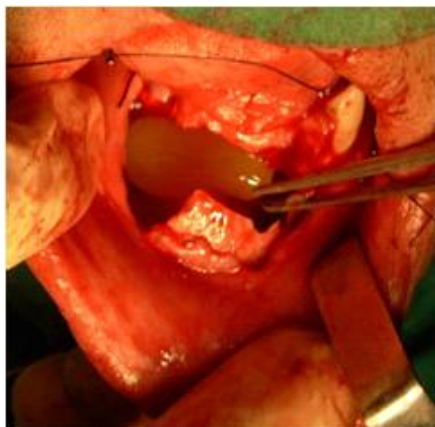


Figure-9: PRF placement after cyst enucleation



Figure-10: Immediate post-operative view

After 3 months of consecutive post-operative periods, the CT scan had revealed an uneven bone healing along with inadequate alveolar bone depth for implant placement (Figure-11&12). Finally out of many options we have decided to go for Vertical osteogenic alveolar distraction (VOAD), which allows for the augmentation of the alveolar ridge for the placement of dental implants in this kind of atrophic alveolar ridges (Figure-13 & 14).



Figure-11: Post-operative intra-oral view after 3month

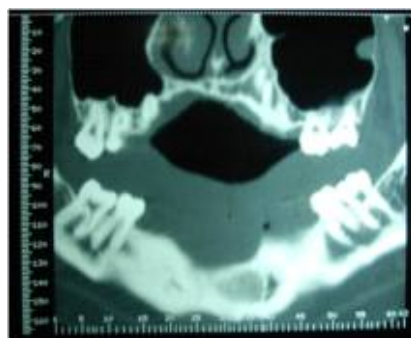


Figure-12: Post-operative coronal section of CT scan revealed uneven healing along with inadequate alveolar bone depth after 3month



Figure-13: Osteotomy is performed



Figure-14: VOAD placed followed by stabilizing plate is fixed to the jaw bone and the transport plate is secured to the transport fragment.

After 6 months of follow up eventually we achieved adequate alveolar bone volume for implant placement (Figure-15 & 16). Now, re-exposure of previous surgical site done followed by removal of distracter and stabilization of fragment by fixation of miniplate for another 3 months followed by placement of 4 implants at the region of 32(13/3.7),42(13/3.7),43(13/4.3) and 45(10/4.3) followed by implant supported prosthetic rehabilitation(fixed partial denture) (Figure-17-19). No complications related to the prosthetic restoration were observed (Figure-20,21).



Figure-15: After 6 months of post-operative follow up

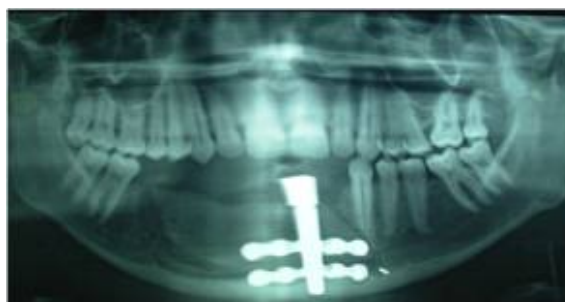


Figure-16: OPG reveals adequate bone depth for implant placement after 6 months of post-operative follow up



Figure-17: Re-exposure for distracter removal

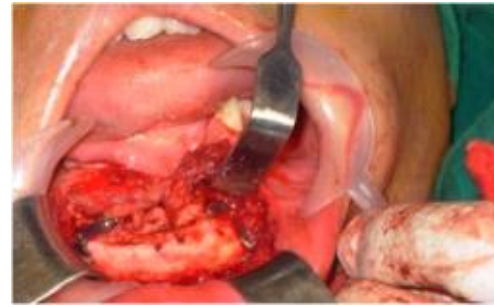


Figure-18: stabilization of fragment by miniplate fixation



Figure-19: Intra-operative view of implant placement



Figure-20: Post-operative radiograph



Figure-21: Post-operative clinical view

DISCUSSION

The replacement of conventional dental prosthesis for implant-supported treatments occurs more frequently and has been consolidated thanks to the emergence of studies that prove its long-term effectiveness¹⁰. Difficulties arise when the conditions of the patient's oral cavity are not appropriate for this treatment. Insufficient height of the residual alveolar ridges often represents a major constraint for the placement of implants. Chiapasco and colleagues,¹¹ in 2004; compared alveolar distraction osteogenesis with guided bone regeneration and autogenous onlay bone grafts subsequently on vertically deficient alveolar ridges. The results suggested that alveolar distraction might offer more predictable long-term results for bone gain maintenance and peri-implant bone resorption. Further more, implant success rates were significantly higher in the alveolar distraction

group. Uckan and colleagues¹² in 2008 also compared alveolar distraction with autogenous onlay graft using complication and implant survival rates. Their results showed a higher complication rate with the alveolar distraction (66.8% vs 33.8%). Data of 181 patients from a recent review by Chiapasco and colleagues¹³ in 2009 showed that the amount of bone gain after distraction osteogenesis had a range of 3 to 20 mm. Saulacic and colleagues¹⁴ in 2008 reported in their systematic review the mean bone gain obtained by different types of distractors: distraction implants, 5.02 (± 0.09)mm; intraosseous distractors, 7.86 (± 0.36)mm; and extraosseous distractors, 9.31 (± 0.45)mm. A clinical study by Mazzone et al¹⁵ in 2005; for the assessment of 40 patients subjected to an extra osseous distraction showed that the bone augmentation average was 9.5 mm in height, showing a 92.5% success rate. Kanno and colleagues¹⁶ in 2007 reported comparable results on bone gain using

extraosseous distractors; they also noted that, during the consolidation period, there was 15% to 25% bone height reduction. These findings are similar to the literature by Luis G. Vega², in 2010 that recommend 20% to 25% over correction in vertical alveolar distraction. Perdijk and colleagues¹⁷ in 2009; pointed out the influence of vector of distraction on vertical gain. They studied 34 cases of alveolar distraction on atrophic mandible in which nearly all patients had lingual tipping of the segment by a mean of 12°. This finding meant that, in those cases, only 87% of maximum vertical bone gain could be achieved. In our case we achieved adequate bone depth for implant placement within 6 months of vertical distracter placement, and the result coincided with the both studies by Chiapasco and colleagues,^{13,11} in 2004 and 2009 along the studies by Mazzonetto et al¹⁵ in 2005; however, the present result is dissimilar with the study by Uckan and colleagues¹² in 2008, where they compared alveolar distraction with autogenous onlay graft, which we did not use in this particular case.

CONCLUSION

In this present case we achieved a satisfactory result with vertical alveolar distraction; however it is a technique in constant evolution. Most of the studies within the past 14 years reveal that, there are some indications for the vertical alveolar distraction, with outcomes almost similar to and sometimes even more predictable,¹¹ than the traditional bone grafting techniques in preparation for implant placement. Although, some authors¹² suggested that, onlay grafts could give a better result in comparison to alveolar distraction technique complications exist with alveolar distraction, it seems that most are minor and easy to manage. Nevertheless appropriate patient selection and a better understanding of the technique are paramount in successful bone regeneration with alveolar distraction osteogenesis.

We are still continuing the study for a longer period with the accommodation of a greater number sample size to achieve an optimal clinical result.

Consent : A written informed consent obtained from the patient for the publication of this case accompanying with images.

Conflict of interest:-- None

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