Enhancement of support for mandibular complete denture prosthesis: A preprosthetic ridge augmentation procedure by distraction osteogenesis

Clinical Report

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ABSTRACT

Poor and resorbed mandibular residual alveolar ridge result from periodontal disease, trauma or disuse atrophy, which complicate the clinical procedures of fabrication and limit the support for the complete denture prosthesis. Reconstruction of the residual alveolar ridge is challenging because the deformity involves deficiency in both the bone and the mucosa. Alveolar distraction osteogenesis is a relatively recent method that, compared with onlay grafts or guided bone regeneration, has less morbidity, better previsibility, and less bone resorption. Compared with other techniques of regeneration, alveolar distraction osteogenesis permits less treatment time because the distraction segments are well formed in 12 weeks. This article presents a case report of a successful alternative approach prior to prosthodontic rehabilitation of a patient with poor and resorbed mandibular ridges, using alveolar distraction osteogenesis as a preprosthetic procedure and further discusses the merits and demerits of this novel procedure when considering implant placement.

KEY WORDS: Alveolar distraction osteogenesis, guided bone regeneration, onlay grafts, preprosthetic procedure, resorbed mandibular ridges, support

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INTRODUCTION

The techniques traditionally used in patients who present with alveolar ridge atrophy to achieve adequate bone height for support of the prosthesis are mainly based on the use of autogenous bone grafts and alloplastic materials. High morbidity rate and bone resorption have been widely described in the literature for these techniques.[1]

A multidisciplinary approach involving an Oral and Maxillofacial Surgeon and a Prosthodontist to achieve adequate bone height for support of the prosthesis in a patient with vertically deficient alveolar ridge, in a short span of three months, with distraction osteogenesis was used as an alternative procedure for ridge enhancement.

Historical perspective

Codivilla in 1905 gave the first description of distraction osteogenesis and in 1989 Russian traumatologist, G. Illizarov, is credited with having defined and established the biological basis for the clinical use of this technique. In 1996, Chin and Toth reported the clinical use of alveolar distraction osteogenesis as a treatment in alveolar ridge deficiencies in the maxillary arch.[2]

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CASE REPORT

A 45-year-old male patient, edentulous since 5 year with a history of two previous complete mandibular dentures, reported to the out patient department of Prosthodontics, A.B. Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, Karnataka, India with the chief complaint of loose and ill fitting mandibular dentures, difficulty in chewing,concerned about his appearance and speech.

There was no relevant systemic history. He was a healthy patient with vertically deficient mandibular alveolar ridge due to loss of teeth resulting from advanced periodontitis.

The mandibular anterior region had normal resilient mucosal tissue and residual alveolar ridge showing low well-rounded bone. When evaluated radiographically the bone was seen to have good quality. The bone had good width but inadequate bone height, which is essential for good retention support and stability of the prosthesis [Figure 1]. The tongue size was normal with a class II lateral throat form.

On examination, the interarch distance was found to be excessive, measured as 26 mm, in the anterior region. After considering the anterior alveolar ridge inter arch space required to accommodate the suitable maxillary and mandibular anterior teeth, it was estimated to increase the anterior mandibular alveolar ridge height vertically by 8 mm. The patient consent was obtained and the procedure of mandibular distraction osteogenesis was decided to be under taken in coordination with the Maxillo facial surgery department for the enhanced support of the mandibular prosthesis.

Procedure

Distraction was carried out in two stages.

Stage 1: Placement of the distraction device and the distraction [Figure 2].

0.5 mm distraction twice daily carried out for 7 days, once in the morning and at night (half turns twice daily).

In the distraction process, there are three fundamental sequential phases:

1. ***Latency phase*** is the period ranging from 0 to 7 days during which soft callus is formed.
2. ***Distraction phase*** usually lasts 1-2 weeks during which traction is applied to the transport bone fragment and the tension favors formation of new immature woven and parallel-fibered bone commences.
3. ***Consolidation phase*** is the period that allows the maturation and corticalization of the regenerated bone. A 12-week period is recommended for adults.

Stage 2: Surgical removal of the distraction device after the consolidation phase. Soft tissue closure was once again done in a similar manner.

New bone formation is similar to fracture healing. Eventually the distraction regenerate is remodeled to mature bone.[3]

Radiographic analysis

Two panoramic radiographs were performed in the patients, immediately following placement of distractor, and one after the consolidation period, 12 weeks postoperatively [Figure 3].

The radiographic analysis consisted of obtaining the vertical bone gain using the Magnification Factor. The increased radiopacity of the distracted region could be observed in the 12-week period after surgery. The alveolar distraction achieved was 8.3 mm in the anterior mandible [Figure 4].

Prosthetic phase

The patient then underwent routine clinical prosthodontic procedures of:

- Primary impression was made using irreversible hydrocolloid,
- Secondary impression with open window technique was made using fast setting plaster to record the mandibular anterior region.
- Jaw relation was recorded,
- Try-in of waxed up denture and
- Fit and insertion of the complete denture prosthesis
- Patient review and after care [Figure 5].

DISCUSSION

The reconstruction objective is to obtain a normal stable mandibular denture bearing area with normal morphology of the cortex, medullary space, periosteum, and mucosa. This process enables to increase the alveolar ridge height via secondary osseous healing along with the lengthening of the soft tissues and vessels by histiogenesis.

Under the control of the distraction device, the mobilized alveolar segment is transported coronally in a slow, incremental manner. The increase in the bone volume is due to regeneration of the distant, distraction zone that acts as a regeneration chamber. The site bearing the prosthesis is primarily transported as mature bone hence a stable denture bearing area

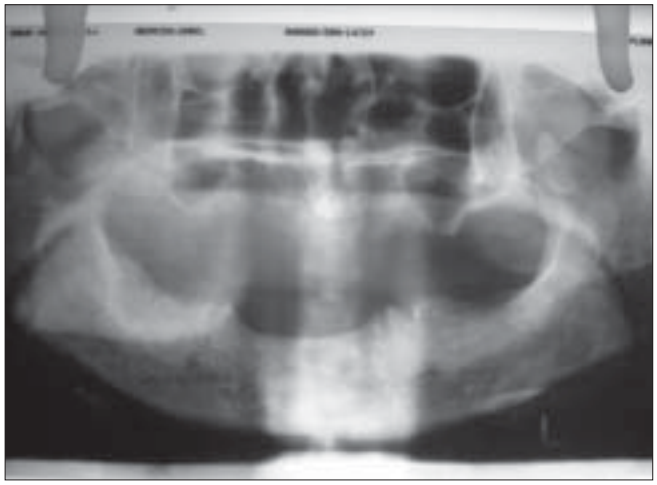

Figure 1: Preoperative OPG

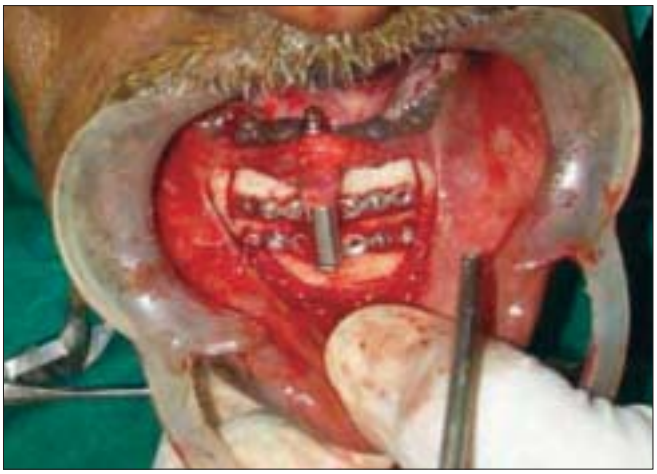

Figure 2: Distractor device being placed

Figure 3: Post distraction OPG

Figure 4: Post distraction intra oral view

Figure 5: The complete denture prosthesis after 3 months of denture insertion

Figure 6: Preoperative intra oral view

that is less prone to residual ridge resorption than onlay grafts is seen. There is also no requirement of bone harvesting from donor sites in a well-planned surgery and prosthetic phase.[4]

A preliminary morphologic classification of the alveolar ridge after distraction osteogenesis was devised to provide a useful basis for decision making regarding implant placement where class I is ideal and is best indicated for any prosthodontic restoration.[5] Histological analysis confirmed that both quality and quantity of bone after 1 year reached a degree of maturation that mimics natural bone. It can be loaded under function after the consolidation phase.[3]

The disadvantages of this technique would include patient discomfort with externally directed intra oral distracters,[6] difficulty with rigid control of the segments during distraction,[7] and lingual deviation of the transport segment.[5] Distraction implants are now being used to overcome these complications.[8]

SUMMARY

In the present case, taking into consideration the patient compliance, oral hygiene, and systemic fitness, the patient with vertically deficient mandibular alveolar ridge could undergo distraction osteogenesis as part of preprosthetic procedure to receive a stable, retentive prosthesis.

The patient has already undergone a soft tissue procedure and was not happy with the results hence opted for the procedure of distraction osteogenesis. The patient is still using his mandibular complete denture prosthesis without any problems with adequate retention stability and support.

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