Reconstruction of a Severe Mandibular Atrophic Ridge with Autogenous Iliac and Rib Bone Grafts

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Introduction: Prosthetic rehabilitation requires sufficient hard and soft tissues. In this article, a case of severe mandibular atrophic ridge is presented, which has been treated with autogenous iliac and rib bone grafts and simultaneous nerve transposition with an extraoral approach. **Case Report**: The patient was a 56-year old female with severe mandibuar atrophic ridge. The prosthetic rehabilitation for this patient was performed in four stages: 1) reconstruction of mandibular atrophic ridge using autogenous iliac and rib bone graft with simultaneous inferior nerve transposition through an extraoral approach, 2) insertion of four implant fixtures in reconstructed mandibular ridge after six months, 3) buccal and lingual vestibuloplsty and free gingival graft and loading of healing abutments, three months later, and 4) prosthetic rehabilitation after two months. Following stage four, a mandibular hybrid prosthesis on four implants with a maxillary removable complete denture were delivered to the patient. **Results**: Following four stages of surgical and prosthetic procedures, rehabilitation of a severe mandibular atrophic ridge was done with autogenous iliac and rib bone grafts, simultaneous inferior alveolar nerve transposition and a mandibular hybrid prosthesis on four implants. Further follow up of the patient will reveal the outcomes of this procedure. **Conclusion:** This procedure can be suggested in the case of severe mandibular atrophic ridges which need inferior border augmentation and superior border vertical and horizontal augmentation at the same time.

Keywords: Autogenous Bone Grafts; Dental Implants; Nerve Transposition

Introduction

Prosthetic rehabilitation requires sufficient hard and soft tissues. Advanced techniques and biomaterials for hard tissue augmentation and implant micro/macro designs help the clinicians to treat more challenging cases. One of the most challenging scenarios among oral and maxillofacial surgeons and prosthodontists is rehabilitation of an atrophic mandibular ridge. This occurs due to three major factors: 1) uneven bone morphology, 2) more cortical bone composition with limited blood supply and 3) difficult primary soft tissue coverage. Vertical bone augmentation has been performed using various techniques including inlay and onlay bone grafts, guided bone regeneration and distraction osteogenesis (1).

Autogenous bone has long been considered the gold standard of graft materials from both historical and biologic perspective (2). It can be harvested from mandibular ramus, symphysis and maxillary tuberosity intraorally or calvarium, rib, ilium, tibia, fibula, scapula and radius from extraoral donor sites (3, 4). Rib grafts in treatment of atrophic mandibles had been used previously (5-13). The use of these grafts in the inferior border for reconstruction of an atrophic mandible to avoid atrophic fractures has been showed previously with reasonable outcomes (10, 13). According to our literature search, we could not find any technical note or case report regarding the use of both autogenous iliac and rib bone grafts for reconstruction of atrophic mandible with extraoral approach. In this article, a case of severe mandibular atrophic ridge is presented, which has been treated with autogenous iliac and rib bone grafts and simultaneous nerve transposition with an extraoral approach.

Case Report

The patient was a 56-year old female with severe mandibular atrophic ridge Class VI Cawood and Howell classification (14). She had used her mandibular and maxillary complete dentures for almost 20 years and now has problem with her dentures because of poor retention and stability. Full evaluation of the patient's chief complaint, medical and dental history and clinical examinations were accomplished and records including radiographies and photographs were obtained. Figure 1 shows panoramic view of the maxillary and mandibular ridges. The whole procedure had been presented to the patient and an informed consent form was obtained from the patient.

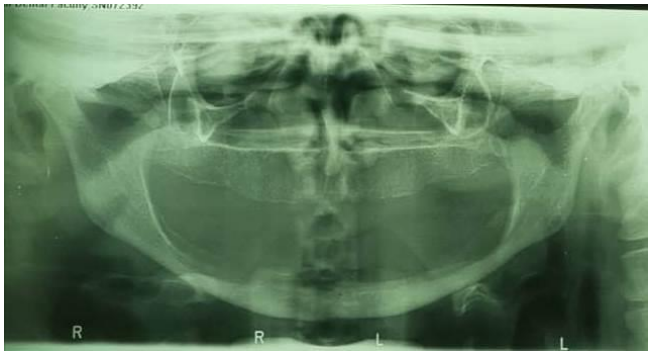

Figure 1. Panoramic view of the maxillary and mandibular ridges of the patient

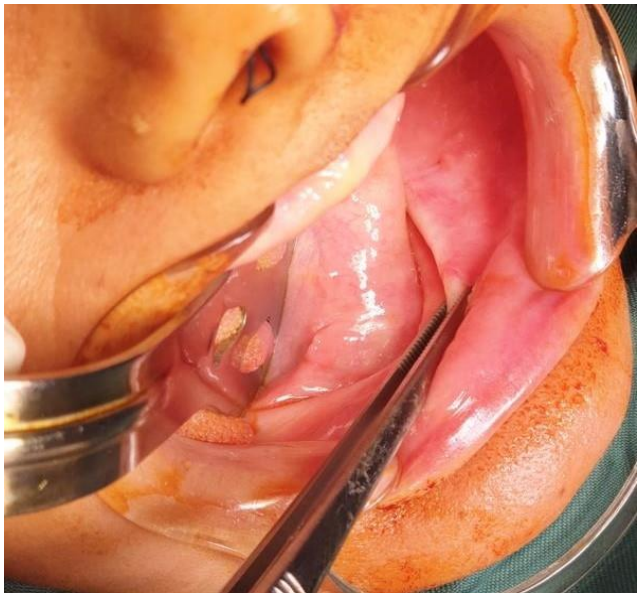

Figure 2. Fibroplastic tissue on the mandibular ridge between two retromolar pad

Intraoral examination revealed a severely atrophic ridge. A fibroplastic tissue on the mandibular ridge between two retromolar pad was also observed and considered to be the only structure which was providing retention and stability for previous denture (Figure 2).

Prosthetic consultation was performed before the surgery and due to the financial status of the patient, a mandibular hybrid prosthesis on four implants with a maxillary removable complete denture was suggested for this patient.

Surgical and prosthetic procedures

The prosthetic rehabilitation for this patient was performed in four stages. In the first stage and under general anesthesia, the reconstruction of mandibular atrophic ridge was done with an extraoral approach through a transverse collar incision (Figure 3). The rib graft was harvested in cooperation with a thorax surgeon.

Figure 3. Extraoral approach through a transverse collar incision showing mandibular body

Figure 4. Harvested autogenous iliac and rib bone grafts stored in normal saline

Through a curved submammary incision, the fifth rib from the right side was harvested. After confirming that the pleura was intact, vacuum drainage was activated and the wound was closed in layers. Using fine osteotome and manual pressure the rib was divided in to three separated blocks. Harvesting bone graft from anterior iliac crests started with a skin incision following the skin lines in a posterolateral direction starting from 3 to 4 cm medial to the iliac crests. The dissections are performed with great attention to avoid laceration of the fascia lata. A monocortical corticocancellous bone graft sized 3 cm in height and 5 cm in length was harvested. The donor sites are closed in layers with special attention to the first layer the fascia lata. Activated vacuum drainage was positioned between the fascia lata and the muscles until the patient was mobilized. The iliac bone graft was also divided to four separated blocks using fine osteotome. The grafts were stored in 500 mL normal saline (Figure 4).

Prior to grafts fixation, inferior alveolar nerve transposition was performed. Mandibular inferior border augmentation was done using rib bone blocks and iliac bone blocks were used on the superior border of mandibular ridge. Lag screws were used for blocks fixation (Figure 5). Irrigation

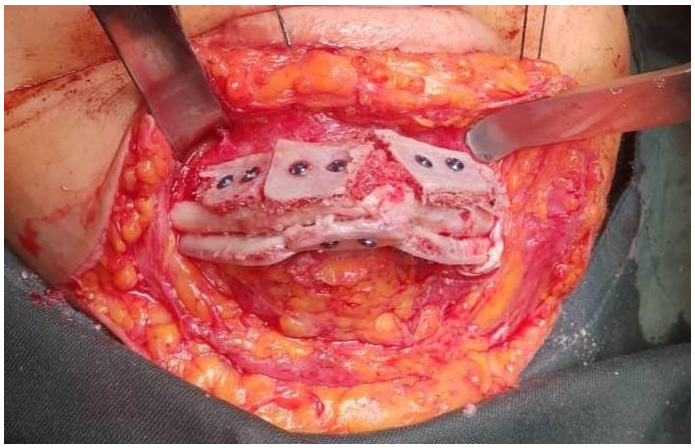

Figure 5. Fixation of autogenous bone blocks with lag screws. Mandibular inferior border augmentation was done using rib bone blocks and iliac bone blocks were used on the superior border of mandibular ridge

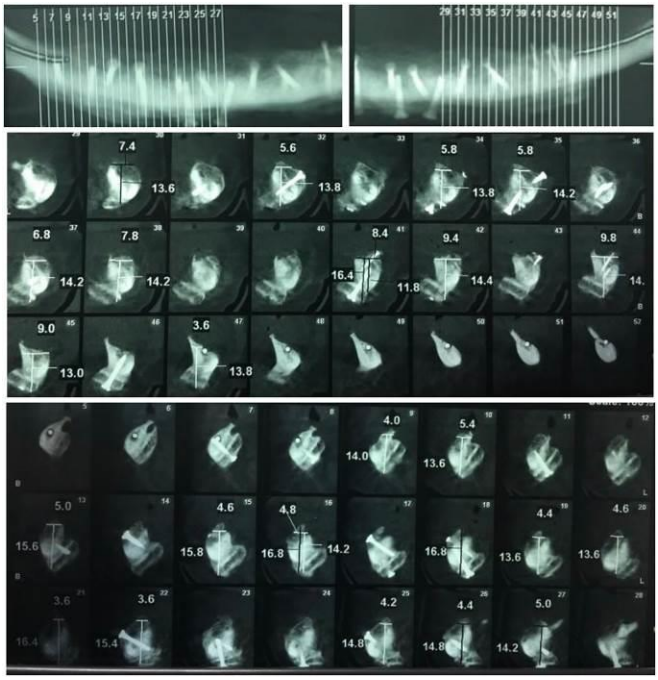

Figure 6. The cone-beam computed tomography of reconstructed mandibular ridge six months post-operatively

was done using normal saline. No biomaterials or membrane were used and the grafted sites were sutured in layers with no soft tissue tension. Patient received clindamycin (600 mg, three times a day) and analgesics post-operatively. Patient was mobilized one day after the surgery and vacuum drainages were removed after three days. The patient was discharged from the hospital 5 days after the surgery. During the healing period, no infection, wound dehiscence or tenderness were observed on the graft recipient or donor sites.

Figure 7. Panoramic radiography after implant fixtures insertion

Figure 8. Buccal and lingual vestibuloplasty, free gingival graft and loaded healing abutments

Figure 9. Mandibular hybrid prosthesis on four implants fixed complete denture with a maxillary removable complete denture delivered to the patient

In the second stage, six months later, a cone-beam computed tomography image was taken to evaluate the mandibular bone height and width in grafted sites (Figure 6). Regarding the amount of new bone formation in mandible, we could use six to eight dental implants, however because of financial limits of patient and use of maxillary complete denture, a hybrid prosthesis on four dental implants with

posterior cantilever design was suggested. The procedure was performed under general anesthesia. Prior to implant insertion, the fibroplastic tissue on mandibular ridge was excised. Lag screws which could interfere with the path of dental implants were removed. Four dental implants (Osstem ® implant system, 4 mm in diameter and 11.5 mm in length) were inserted between mental foramens and the crestal incision was sutured. Post-operative radiography showed reasonable implant position and direction in mandible (Figure 7).

The third stage was three months later. Under general anesthesia, Simultaneous buccal and lingual vestibuloplasty was done according to the procedure described by Trauner (15) and MacIntosh-Obwegeser (16). Cover screws were removed and healing abutments were loaded. Free gingival graft from bilateral palatal donor sites was performed to achieve adequate keratinized tissue around implants (Figure 8). A bolster dressing was adopted deep in buccal vestibule of mandible for two weeks in order to minimize the changes following tissue relapse.

After two months, the prosthetic procedure started for the patient.

Results

Following stage four, a mandibular hybrid prosthesis on four implants with a maxillary removable complete denture were delivered to the patient (Figure 9).

Discussion

In this article, we described a surgical procedure using autogenous iliac and rib bone grafts for onlay bone grafting and simultaneous inferior alveolar nerve transposition through extraoral approach. Following this procedure, a reasonable quantity and quality of bone were provided to insert four dental implants. According to a meta-analysis, the mean amount of vertical ridge augmentation in onlay bone grafts were 3.47 mm (1), however, our procedure achieved a minimum height and width of approximately 13.5 mm and 4.2 mm, respectively.

One of the treatment alternatives for this case was an all-on-four prosthesis. This technique requires adequate amount of bone from mental to mental foramen region. In this case, as it can be seen in figure 1, there were not sufficient height and width for insertion of four implant fixtures. Also, the absence of adequate bone (less than 10mm in height) could predispose the mandible for atrophic fracture. Therefore, we have employed this procedure in order to rehabilitate the atrophic ridge and to avoid atrophic fracture of mandible at the same time. Mandibular inferior border augmentation was done using rib cortical bone blocks. Because of the lower width of these grafts, we need a graft with more width for the augmentation of superior border. Therefore, in the superior border we used corticocancellous iliac bone graft to augment mandibular ridge for implant insertion. Rib grafts has been used previously in the inferior border for reconstruction of an atrophic mandible to avoid atrophic fractures and showed reasonable outcomes (10, 13). Nerve transpositioning was performed extraorally and simultaneously with the procedure of grafting, as we need mandibular inferior border augmentation to avoid atrophic fracture in molars area, as well as anterior segment.

Despite the complicated surgical procedure, our patient did not encounter any complication, including infection, wound dehiscence, motor and sensory dysfunction or significant morbidity of iliac or rib donor sites. However it has been shown in the literature that onlay bone grafting may exhibit more sensory disorders and wound dehiscence than other techniques (1). Inferior alveolar nerve transposition may also show persistent neurosensory disorders. It was reported 12.12% in a systematic review conducted by Palacio Garcia-Ochoa *et al.,* (17). None of these complications were observed during our follow up period.

Further follow-up sessions are required to fully evaluate the outcomes of this complicated procedure (including implant survival) and its effects on patient's quality of life.

Conclusion

Following four stages of surgical and prosthetic procedures, rehabilitation of a severe mandibular atrophic ridge was done with autogenous iliac and rib bone grafts, simultaneous inferior alveolar nerve transposition and a mandibular hybrid prosthesis on four implants. Further follow up of the patient will reveal the outcomes of this procedure. This procedure can be suggested in the case of severe mandibular atrophic ridges which need inferior border augmentation and superior border vertical and horizontal augmentation at the same time.

Conflict of Interest: 'None declared'.

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