Mandibular bone regeneration after bone slat technique

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Summary

***Background*. The reconstruction of alveolar ridges for implant placement is still a challenging surgical procedure, especially in the case of extensive vertical and horizontal bone atrophy.**
***Objective*. The objective of the present study was to evaluate the quantity and quality of newly regenerated bone; clinically by means of direct clinical measuring, ridges augmented by autogenous cortical bone associated with autogenous particulate bone graft in the posterior lower jaw defect.**
***Methods*. For the preliminary study, a bone defects in partially edentulous in patient aged 52 years were selected to receive horizontal ridge augumentation prior autolougous bone block and particulate graft. The donor site was the ramus of the same side. Prior the clinical evaluation, periapical X-ray and the cone beam computerized tomography (CBCT) was observed the quality, quantity and the stability the soft and hard tissue healing process, final result and the outcome.**
***Result*. The bone augmentation achieved with this technique created the ideal bone volume of hard and soft tissue, in quantity and quality, for placement of implants.**
***Conclusion*. The surgical technique was found to be easy in terms of technique and surgical trauma.**

Key words: bone slat technique, mandible reconstruction, implant dentistry, autologous bone block graft.

Introduction

The reconstruction of alveolar ridges for implant placement is still a challenging surgical procedure, especially in the case of extensive vertical and horizontal bone atrophy. A number of surgical procedures have been utilized to reconstruct the alveolar crest. These procedures include "split-ridge" (osteotomy for lateral expansion), osteodistraction, bone grafting with various grafting materials (autogenous bone, allograft, xenograft and alloplastic materials), guided bone regeneration (GBR) alone or in combination with grafting materials and other techniques (1-18).
Therefore, the purpose of the present study was to clinically and cone beam computerized tomography (CBCT) evaluate the quantity and quality of newly regenerated bone for mandibular posterior lateral defect utilizing autogenous cortical as a membrane with autogenous particulate bone to facilitate placement of implants.

Case report

A 52-year-old female non-smoker, good general conditions, edentulous in the posterior mandible, presented for implant rehabilitation. Clinical and radiographic examinations (cone beam computerized tomography: panorex and cross section view) showed severe vertical mandibular atrophy [7 mm of bone height from the ridge to the mandibular canal and 3 mm of bone width Occlusal Vertical Dimension (OVD) was increased because of bone atrophy] (Figs. 1, 2). Posterior mandibular vertical ridge augmentation was planned to allow for future placement of implants.
The exclusion criteria were:

- local infection
- smoking(more than 10 cigarettes/day)
- uncontrolled diabetes (HbA1c >53 mmol/mol)
- previous radiotherapy in head and neck region
- chemotherapy in progress
- liver, kidney or hematological diseases

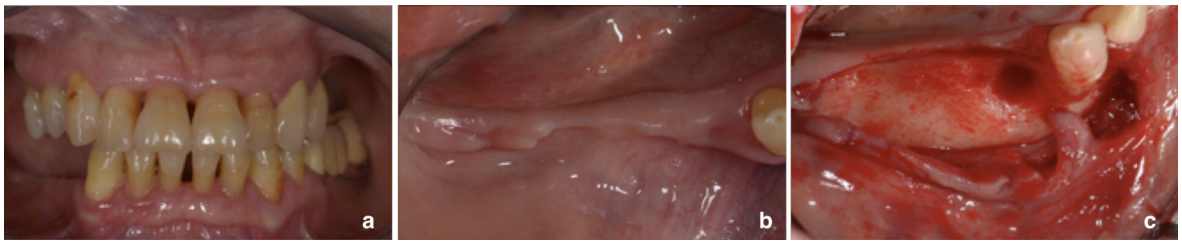

Figure 1. a, b Clinical view: horizontal defect; clinical evaluation of the soft tissue and intermaxillary relationship; c. clinical view of the bone defect.

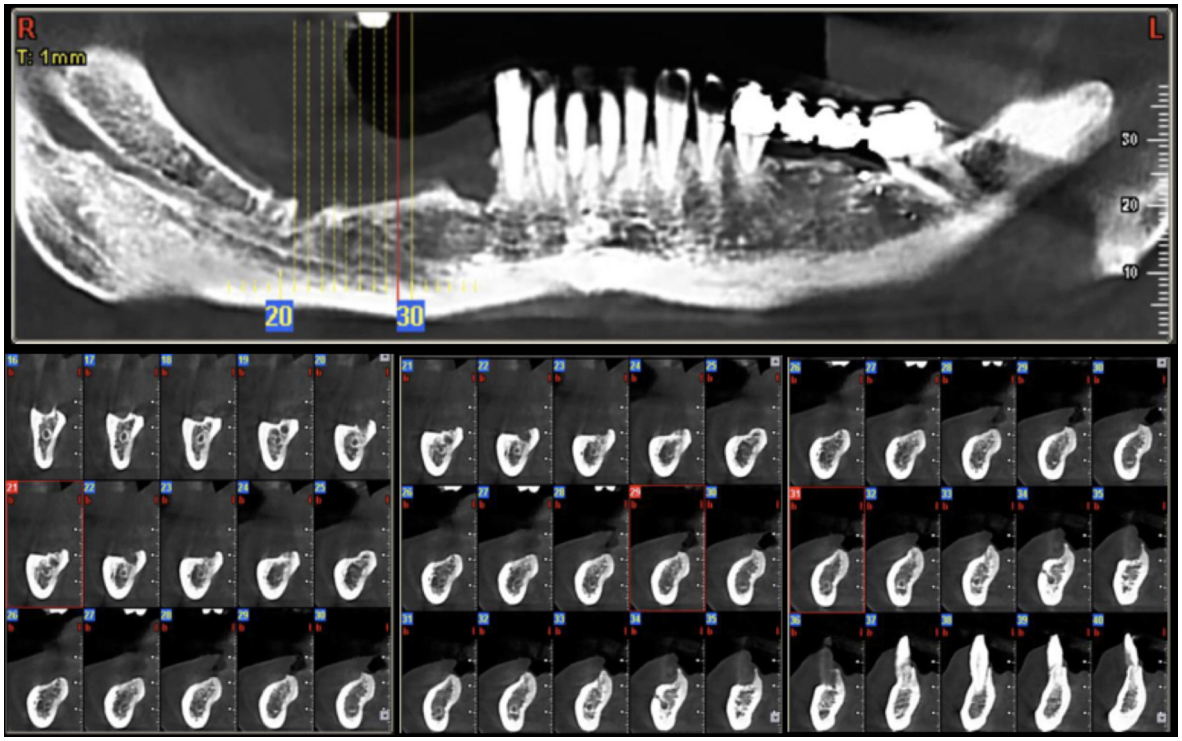

Figure 2. CBCT evaluation the horizontal bone defect and the donor site choosing.

- immunosuppression
- corticosteroid therapy in progress
- pregnancy
- inflammatory or autoimmune diseases of the oral cavity
- poor oral hygiene and lack of motivation.

Surgery was carried out under local anesthesia (2% mepivacaine and adrenalin 1:100 000). A supracrestal incision was made in the edentulous ridges and on the mucogingival line in the anterior region, and a full mucoperiosteal flap was raised. The emergence of right inferior dental nerves at the mentonian foramina was exposed. A bone slat graft from the mandibular ramus of the same side was harvested using piezoelectric equipment (Piezosurgery, Mectron, Garlasco, Italy) (Fig. 3a). The bone slat graft was fixed on the top of the ridge with osteosynthesis screws (Stoma Storz am Mark ® Emmingen-Liptingen GmbH). A particulate autologous bone graft was harvested from the mandibular ramus by cortical bone collector "safescraper twist" (Meta, Reggio Emilia, Italy) of the same side placed inside of the space created between the bone slat and the native lingual bone (Fig. 3b-d); finally, a resorbable collagen membrane (Bioguide, Geistlich AG, Wolhusen, Switzerland) was placed to protect the augmented site (Fig. 3e). The flap was completely release and closed with nonabsorbable monofilament sutures 5/0 (Fig. 3f). Amoxicillin plus clavulanic acid (825/125 mg 2 times a day for 6 days) and ibuprofen (600 mg 3 times a day for 3 days) were administered. Patients were instructed not to brush the surgical site and to continue rinsing with 0.20% chlorexidine twice a day till suture removal, 15 days later.

Clinical measurements

Bone height and width were measured by a periodontal probe (Hu-Friedy Unc/cp 15) and recorded, by the same operator approximating to 0.5 mm, at baseline surgical procedure and at time of implant placement (re-entry). Two horizontal measurements were taken:

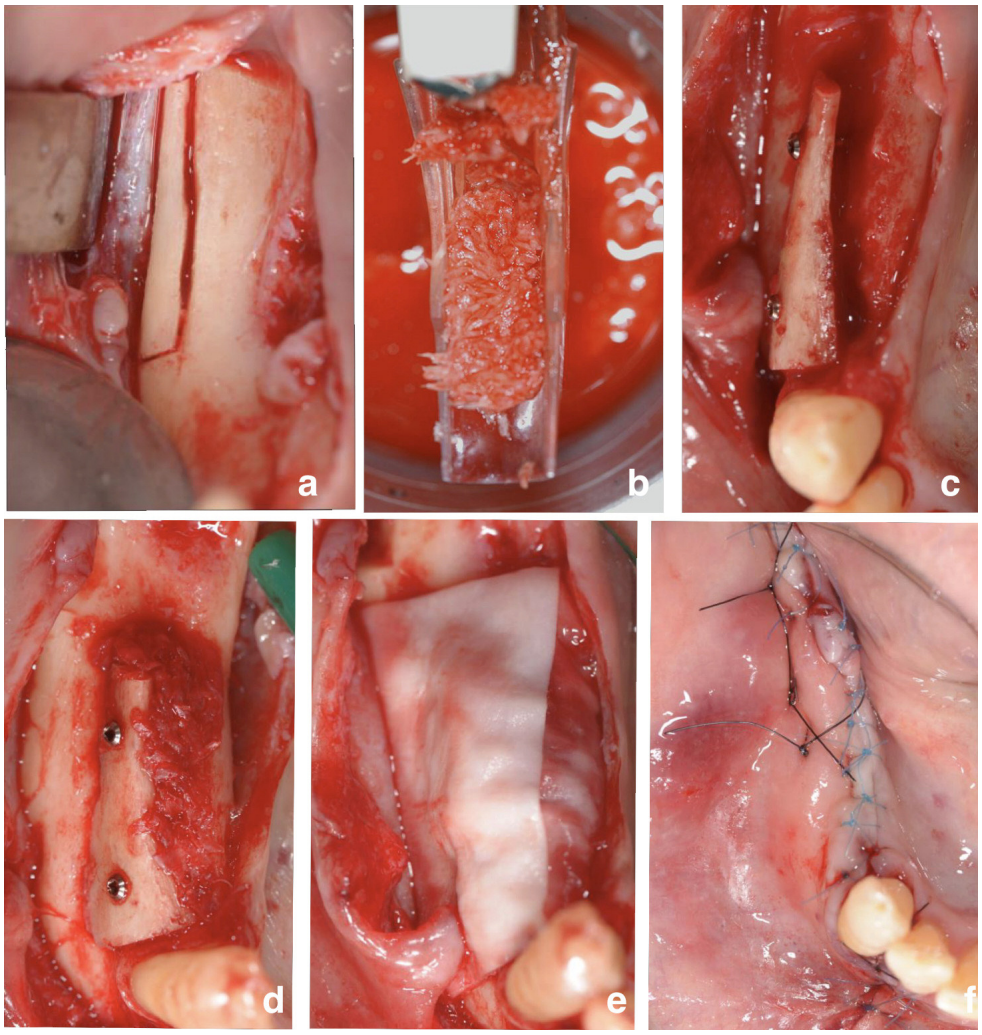

Figure 3. a, b. The ramus as donor site, block and particulate. Clinical view the bone harvested using piezosurgery. Note very slim the osteotomy thickness; c, d. The block was fixed prior two mini screws and the space making was filled with autologous particulate bone; e. The surgical site of the bone augmentation was been covered with a resorbable collagen membrane in a double layer; f. The flap, after periosteum incision, was relaxed to obtain a correct suturing.

one at the point of greatest coronal convexity of the adjacent teeth and one at the greatest concavity of the defects. For this second measurement the distance to the adjacent teeth cement-enamel junction was recorded to standardize the height of measurement. Vertical measurements were taken at the maximum bone deficiency, and compared to adjacent bone peaks.
Two MIS V3 implants (MIS) 5.0 mm diameter and 10 mm length in correspondence of the tooth 46 and 3.9 mm diameter and 11.5 mm length in tooth 44 were inserted as prosthetically planned.

Results

The postoperative clinical and radiographic examination (periapical x ray and CBCT scan) showed an increase in the height and the width of the alveolar ridge (Figs. 4a, b, 5a). Implants were placed 3 months after augmentation (Fig. 5b, c) and were loaded 2 months after placement. No implant failures were recorded 36 months after loading (Figs. 5d-7a, b).

Discussion

In cases of a three-dimensional ridge defect, a non-absorbable membrane with a supporting titanium frame is required (19). The possibility of grafting-material collapse or premature membrane exposure is greatly increased (20). As an alternative to the single block onlay graft, a method using a thinner cortical blocks (laminae) was introduced. These can be fixed into the defect area to create the occlusal bone plate and the vestibular plate or the buccal and lingual walls (21) and Khoury first used thin mandibular cortical bone blocks (laminae) to reconstruct the buccal and palatal (lingual) walls or the occlusal wall of verti-

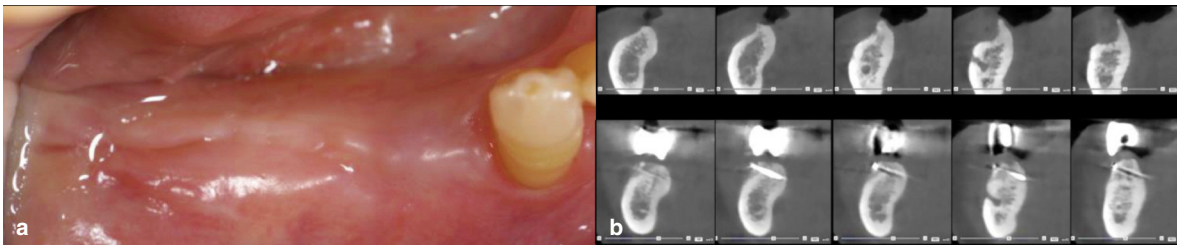

Figure 4. a, b Clinical and radiographic (CBCT Scan) view after 3 months.

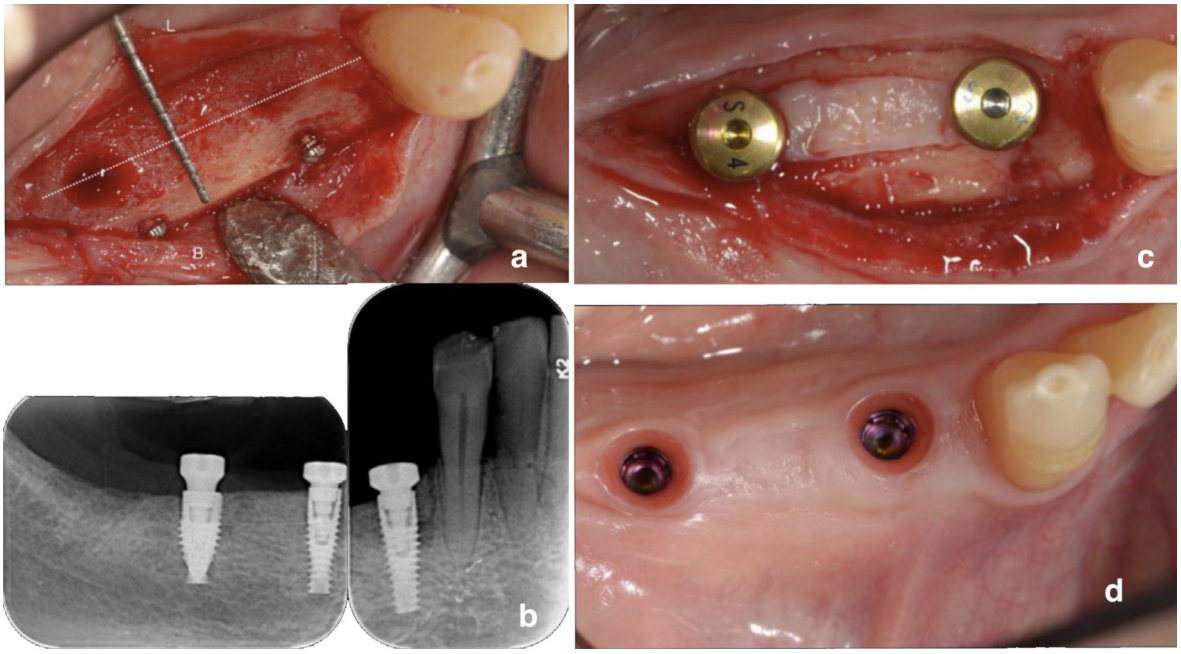

Figure 5. a. Bone healing after 3 months; b. Implants placement; c. Healing abutment and connective tissue graft; d. soft tissue healing around implants after 12 months.

Figure 6. a, b. Clinical view immediate delivery of the prosthesis in 2013; c. Periapical X-Ray.

cal defects, filling the intervening space with autogenous bone (21). We modified this technique because we prefer to harvest the laminae autologous bone directly from the donor site in single slats differently from that described by Khoury (21) that harvests the block and than perform the splitting of the block in several laminae.

According to our study, the bone augmentation techniques generated a sufficient amount of bone to insert an implant properly. At reentry, the autologous bone slat grafting appeared clinically well-incorporated into the native bone, suggesting that good contact and good fit between the graft and the recipient site had been obtained during the first surgery.

In the present study no exposure of the bone slat graft was observed. This phenomenon, which is rather commonly reported (22), was carefully avoided by a complete release of the flaps during the first surgery.

Moreover, several Authors, have described neurological problems due to bone harvesting from the mandibular ramus and symphysis, characterized by paraesthesia, anaesthesia, hyperalgesia of the chin area (23, 24).

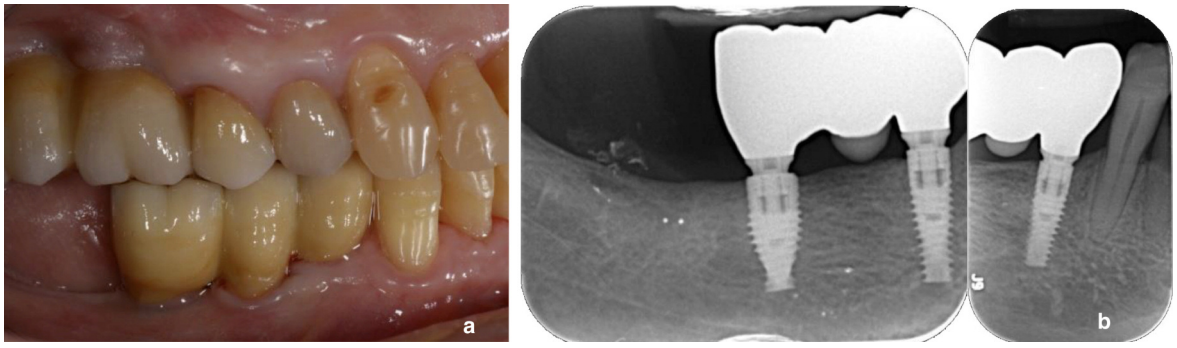

Figure 7. a. Clinical view after 3 years; b. Periapical X-Ray after 3 years.

This technique involves the removal only of the cortical bone by way of slats thus avoiding the possibility of damaging neurovascular underlying structures making it safe and effective.
Further studies are needed to increase the sample size, to verify augmentation stability over time, success of implant therapy in the medium and long term and eventual differences in the incidence of biological or aesthetic complications using this technique. The bone slat technique was found to be easy, effective and surgically atraumatic.

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