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Alveolar Ridge Splitting Technique with Simultaneous Implant Placement in Anterior Mandible for Removable Mandibular Implant Supported Prosthesis

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

The aim of this study was to evaluate the behavior of the alveolar ridge split technique in a series of surgical cases in anterior mandible for two-implant retained overdenture. Twelve patients were included in this study. The surgeries took place under local anesthesia and consisted of a mid-crestal incision and subsequent bone management with a piezoelectric system. Once the approximately 3 mm expansion had been achieved, the implants were installed and present defects were filled with autogenous bone harvested from the bone crest with a bone scraper. There was a fracture of the bone plate in 3 cases, the fractured plates stabilized with osteosynthesis screws. In each case the implants were simultaneously placed. A total of 24 implants were placed. In the second surgery no implants were lost. It can be concluded that the bone splitting/expansion seem to be a reliable, predictable, relatively non-invasive technique and presenting limited intraoperative complications to correct narrow edentulous ridges.

Keywords: Alveolar ridge split technique; bone atrophy; bone graft.

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1. INTRODUCTION

The concept of "mandibular two-implant Overdentures as first choice standard of care for edentulous patients" is still valid as it is stated in "The McGill Consensus Statement on Overdentures" in [1]. The implant-retained or supported overdenture for the mandible has been shown to be a highly successful prosthetic treatment similar to the fixed implant denture [2]. Typically, in a highly resorbed mandible, two implants would be needed in the canine areas to create a stable base for an overdenture. The use of just two implants can keep the surgical act and the initial cost to a minimum [3].

Bone resorption after dental loss is physiological. The stability of alveolar bone is ensured by the presence of teeth. Bone loss will follow teeth extraction in the medium and long term [4].

The alveolar ridge splitting technique (ARST) fulfill all requirements for best bone healing/regeneration of bony defects, a minimal extent of bone loss, the presence of bony walls, closed healing environment, space provision and mechanical wound stability [5].

For an adequate bone support and stability, the bone thickness, on the vestibular and on the lingual/palatal side, should be greater than 1.5mm. In other case, a horizontal bone augmentation is required [6]. In highly resorbed mandible, the alveolar width in anterior zone could be less than 6 mm. Ridge augmentations could be achieved by block graft, guided bone regeneration (GBR), distraction osteogenesis and alveolar ridge splitting or expansion. The ARST could increase the width of deficient ridge with simultaneous implant placement [7].

The aim of this study was to evaluate a series of cases using the ARST and simultaneous implant placement for two implant supported mandibular overdenture.

2. MATERIALS AND METHODS

Twelve patients consecutively treated between June 1, 2014, and July 1, 2017. Patients with total mandibular dentures for at least 5 years, good systemic health or controlled systemic disease and who required horizontal bone augmentation were selected. Smokers and patients engaged in excessive alcohol consumption were excluded. Patients presenting less than 3 mm crest width and 10 mm crest height were also excluded.

Radiological examinations prior to surgery consisting on panoramic X-ray and a cone beam CT scan (CBCT) were performed for all participants. Measurements at the crestal level were performed before the surgery and one year after.

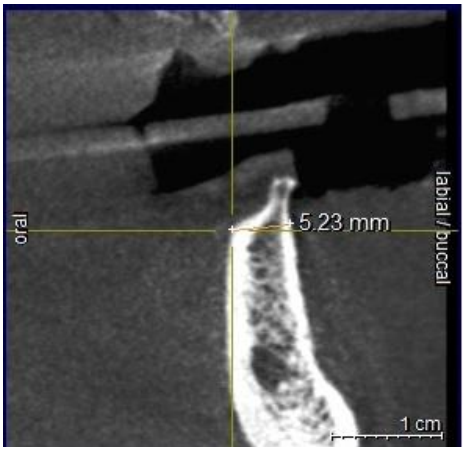

Fig. 1. A coronal view showing a crestal width about 5 mm

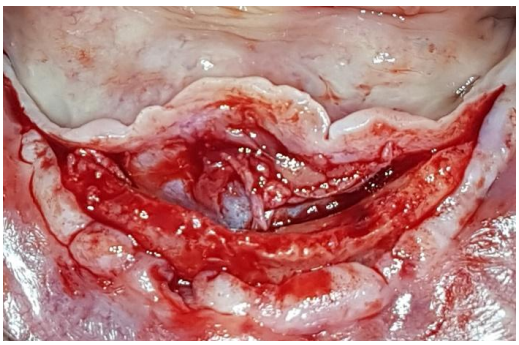

Fig. 2. Vue of alveolar crest after elevation of full thickness vestibular and lingual flaps

Fig. 3. Bone harvested from the bone crest in scraper

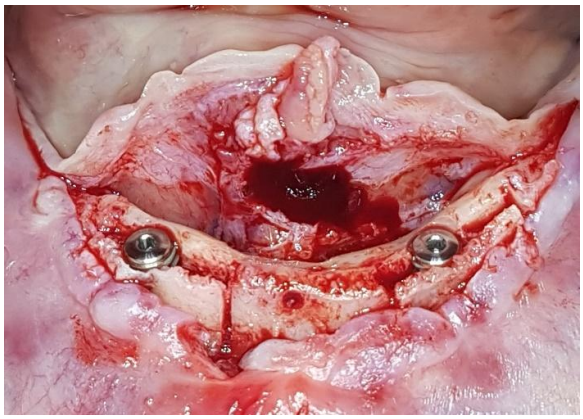

Fig. 4. After bone split, implants in place

Fig. 5. Locator abutments in place, and good healing of tissues

The procedure was performed under local anesthesia. A mid-crestal incision and a full-thickness vestibular flap were elevated carefully on lateral sides to isolate the foramen nerve. One middle vertical releasing incision is given. On the lingual side, a full-thickness muco-periosteal flap was elevated. Using a bone scraper, bone was harvested from the alveolar crest and later used to fill the bone gap after bone splitting. By reducing the bone crest, a benefit of bone width was expected. Using the piezosurgery unit (Mectron), three cuts, for each implant, where performed: one mid crestal, with a depth of 8 mm and two vertical cuts on the vestibular bone plate. The ridge was split employing a ridge expanding kit (Ace), taking advantage of the elastic nature of the bone. After removing the final expander, the final drill was used to prepare the implant bed, and twelve implants (CowellMedi) and twelve implants (Straumann) were placed. Implants with 4 mm width and 10 mm length were used. The guided bone regeneration (GBR) was performed using autogenous bone harvested with a bone scraper from the anterior mandibular crest and a pericardium collagen membrane (Jason). To extend the flap coronally over the implant and to achieve tension free sutures, a periosteal releasing incision was performed. A combination of horizontal mattress and O sutures were achieved to insure the best wound closure. Antibiotics (Augmentin 1 g) twice a day and analgesics were prescribed for 5 days and chlorhexidine mouth wash 0.2% for 14 days. Sutures were removed after 14 days.

Clinical follow-ups were performed at two weeks, three months, and one year after surgery.

Bone regeneration was evaluated on CBCT before the surgery and one year after.

Three months post implant placement, the implants were uncovered and locator abutments were placed. The overdenture placed by direct relining, two weeks later.

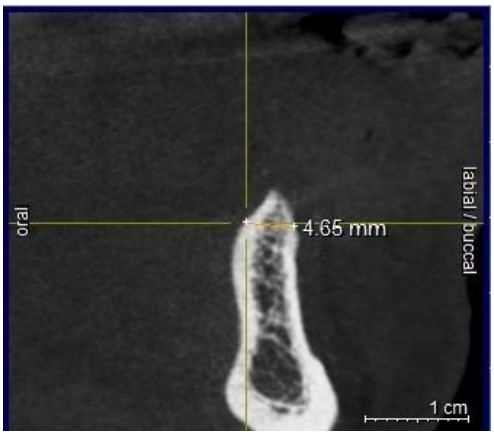

Fig. 6. A CBCT coronal view showing a crestal width of 4.65 mm

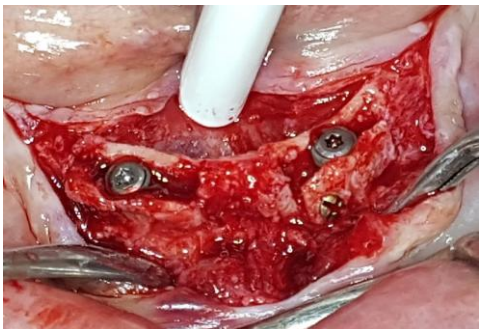

Fig. 7. After bone split, the implants in place. Vestibular left plate fractured and fixed with osteosynthesis screws

Fig. 8. A collagen membrane covering all the surgical site

Fig. 9. A combination of O and horizontal mattress sutures

Fig. 10. At second surgery, vestibular repositioning of keratinized gingiva

Fig. 11. Locator abutments and a good soft tissue environment

Fig. 12. A CBCT coronal view showing a crestal width of 3.18 mm

Fig. 13. After elevation of full thickness flap and a central vestibular releasing incision

Fig. 14. After ARST, the fractured vestibular plates fixed, the gap filled with autogenous bone and covered with collagen membrane

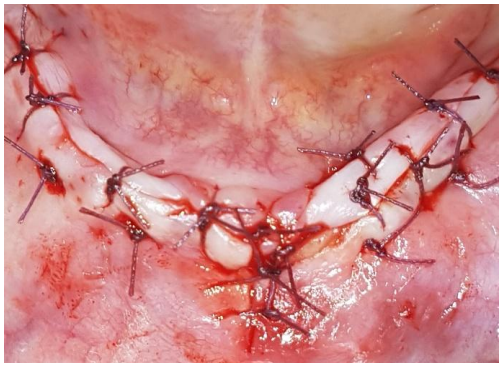

Fig. 15. A perfect wound closure with combination of O and horizontal mattress sutures

Fig. 16. At second stage surgery, removal of osteosynthesis screws. We note the bone thickness around the implants

Fig. 17. After healing, locator abutments in place

3. RESULTS

The mean width augmentation in treated sites was 3.5 ± 0.5 mm. There were no post-surgical complications recorded. Three cases of vestibular cortex fracture were resolved by stabilizing the fractured vestibular plates by osteosynthesis screws.

A total of 24 implants were placed. The primary stability was achieved, greater than 20 N in all implants. The osseointegration of implants was successfully reached in all cases after prosthetic loading.

4. DISCUSSION

The healing mechanism of the expanded ridge is similar to that occurring in fractures. A spontaneous ossification occurs and the regenerated bone is like native, nonreconstructed bone [8]. The implants placed in expanded ridges seem to withstand the biomechanical demands of loading [8]. This technique can offer the opportunity to insert the implants simultaneously. The ARST with simultaneous implant placement is performed to reduce the total treatment time and to avoid the second surgical procedure [7]. By reducing the healing period, the ARST offers an important time and financial economy [9], especially regarding the advanced bone resorption in edentulous patients wearing total removable prosthesis for more than 5 years. The ARST seems to be a sure and reliable procedure, the implant success rate was found to be 97.5% [10].

Due to the thicker less flexible cortical plate, the ARST in the mandibular bone may confront with difficulties. The risk of fracture of the buccal plate is always present. Sohn et al. (2010) reported 5 bone plate fractures out of 21 cases presented [7,11,12] showed that no implant loss was reported with subsequent removal and reinstallation of the lateral bone plate. Our results confirm the possibility of reproductive and sure management of cortical bone fracture.

The GBR procedure in combination to the ARST could prevent the post-surgical resorption of the crestal bone in very narrow ridges [13].

The presence of spongy bone separating the buccal and palatal/lingual plates, is another limitation of the ARST. In cases of anterior mandible for two-implant retained overdenture, the crest is reduced using a bone scraper, and later used to fill the bone gap after bone splitting. By reducing the bone crest, a benefit of bone width was always expected.

5. CONCLUSION

Within the limitations of the present study, the ARST could be one of the fast and predictable bone augmentation techniques. In comparison to other bone augmentation techniques, the ARST allows the possibility of simultaneous implant placement and eradicates the possible morbidity from a second surgical site. In addition, the use of just two implants, for implant supported overdenture, can keep the surgical act and the initial cost to a minimum. Nevertheless, the ARST require a minimum of surgical training, and has limitation concerning alveolar crest width and bone quality.

CONSENT

All patients were informed about the procedure and each patient gave informed consent in writing.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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