

# **Alveolar Ridge Splitting technique in anterior mandibula for removable mandibular implant supported prosthesis. Analysis of a Case Series.**

**Houssam Abou Hamdan.**

Department of Periodontology, Faculty of Dental Medicine, Lebanese University, Lebanon.

**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 mandibula for two-implant 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 defects present 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 immediately installed. A total of 24 implants were installed. In the second surgery no implants were lost. It can be concluded that the bone splitting/expansion seem to be a reliable, predictable, relatively noninvasive technique and presenting limited intraoperative complications to correct narrow edentulous ridges.

**KEY WORDS:** alveolar ridge splitting, bone atrophy, bone graft.

## **1. Introduction**

Bone resorption is physiological in different cases of dental loss. The presence of teeth ensures the stability of the maxillary and mandibular alveolar bone, so their loss also leads to bone loss in the medium and long term [1].

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 [2].

Bone thickness to allow implant placement should be at least greater than 1.5mm, both on the vestibular and on the lingual/palatal side. If the alveolar width is less than 6 mm, transversal bone augmentation is generally required to allow implant placement [3]. In highly resorbed mandible, the alveolar width in anterior zone could be less than 6 mm. Ridge augmentation in deficient alveolar ridge areas are achieved by block graft (autogenous or allograft), guided bone regeneration (GBR), distraction

osteogenesis and alveolar ridge splitting or expansion. The alveolar ridge split technique (ARST) could increase the width of deficient ridge with simultaneous implant placement [4].

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 2002[5]. 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 [6]. 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 [7].

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

## 2. MATERIAL AND METHOD

Twelve patients consecutively treated between June 1, 2014, and July 1, 2017. Patients with total mandibular overdenture for at least 5 years, good systemic health or controlled systemic disease and who required horizontal bone regeneration were selected. Smokers and patients engaged in excessive alcohol consumption were excluded.

All participants were informed about the objectives and procedures involved in the study and each patient gave informed consent in writing.

All the patients underwent radiological examinations prior to surgery. A panoramic X-ray and a cone beam CT scan (CBCT) were performed. The width of the alveolar ridge was measured on CBCT twice at the crestal level. The first before surgery and the second, one year after surgery.

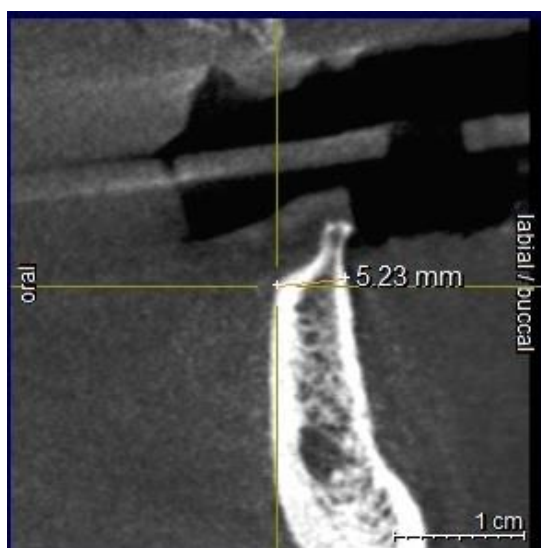


Fig 1: a coronal view showing a crestal width about 5 mm.

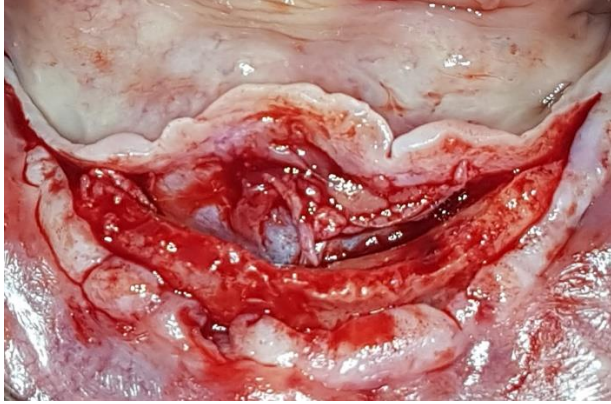


Fig 2: A vue of alveolar crest after elevation of full thickness vestibular and ligual flaps.

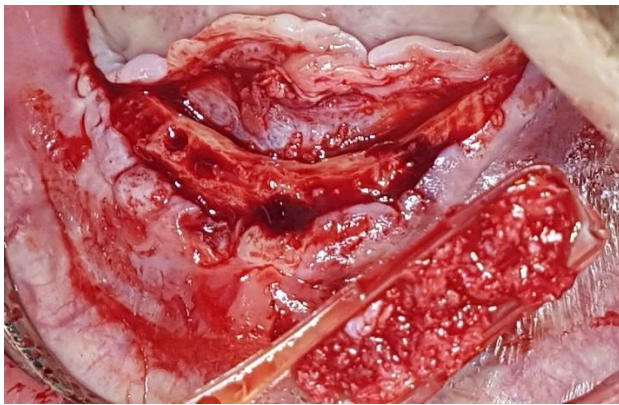


Fig 3: Bone harvested from the bone crest in scraper.

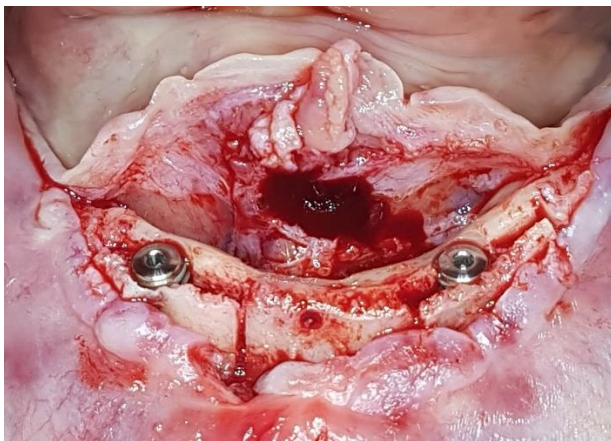


Fig 4: After bone splitt, implants in place.



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 was 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 the piezosurgery unit (Mectron), three cuts, for each implant, were conducted during the proceedings of the ridge splitting: one mid crestal cut on the alveolar ridge, with a depth of 8 mm and two vertical cuts on the buccal bone plate. In the first phase of the implant bed preparation, the pilot drill was utilized; then, the ridge was split employing a ridge expanding kit (Ace), The elastic nature of the bone was utilized so as to prevent fracture, thus after every sequential expander was introduced it was kept in place and removed delicately, maintaining the bone resiliency. In the last stage, the final drill was used to prepare the implant bed, and twelve implants (CowellMedi) and twelve implants (Straumann) were placed. The guided bone regeneration (GBR) was performed using autogenous bone harvested with bone scraper from the anterior mandibular crest and a pericardium collagen membrane (Jason). Periosteal releasing incision was performed to extend the flap coronally over the implant so as to achieve tension free interrupted sutures for a close approximation. The wound was sutured using a 4-0 PGA suture. A combination of horizontal mattress and O sutures was performed to insure the best wound closure. Postoperative instructions were advised to the patient. 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.

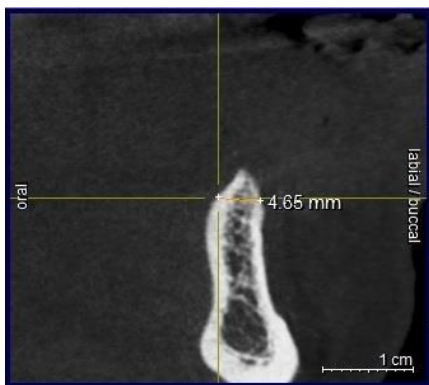


Fig 6: A CBCT coronal view showing a crestal width of 4.65 mm.

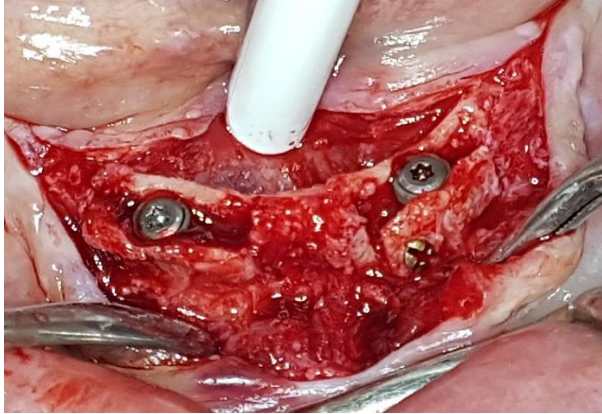


Fig 7: After bone split, the implants in place. Vestibular left plate fractured and fixed with osteosynthesis screws.

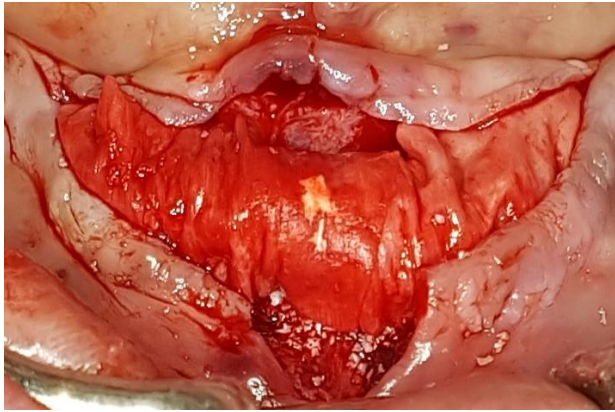


Fig 8: A collagen membrane covering all the surgical site.



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.

Clinical follow-ups were performed at two weeks, three months, and nine months after surgery. A radiological follow-up was performed one year after the operation with a cone beam CT scan.

Three months post implant placement, the implants were uncovered with use of a scalpel and locator abutments were placed. Two weeks later, by direct relining, the overdenture placed.



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

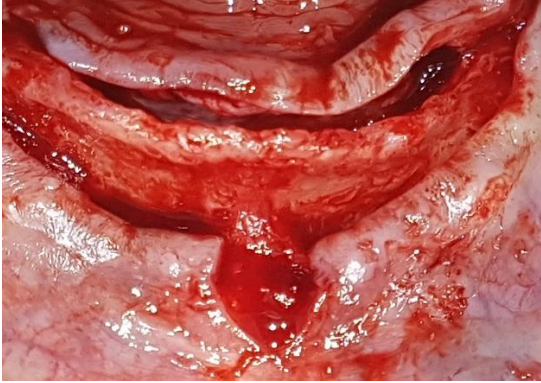


Fig 13: After elevation of full thickness flap and a central vestibular releasing incision.



Fig 14: After ARST, The fractured vestibular plates fixed, the gap filled with autogenous bone.



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

Seven patients were women and five were men. Their ages ranged between 55 and 62 years. Bone regeneration was evaluated on CBCT before the surgery and one year after. In general, all treated defect sites exhibited excellent bone formation. The mean width augmentation was  $3.5 \pm 0.5$  mm.

There were no cases of infection and no complications were recorded. The intraoperative complication was three cases of vestibular cortex fracture. All the complications were easily resolved by stabilizing the fractured vestibular plates by osteosynthesis screws. Soft tissue healing was uneventful and pain and swelling were comparable to usual. All the expanded areas were successful in providing an adequate volume to insert implants according to the prosthetic plan.

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



#### **4. Discussion**

Alveolar ridge split technique was introduced by Tatum Jr. in 1986 with the aim of increasing the amount of bone in the maxilla [8]. This was adapted by Summers in 1994 [9]. Many variations of the ridge split technique have been described by various authors and the ARST became popular in the 1990s through some promising research that demonstrated its efficiency (Simion et al., 1992; Scipioni et al., 1994; Summers et al., 1994) [9,11]. In 2000, Vercellotti et al. introduced piezosurgery in the treatment of the atrophic jaw. Piezosurgery made split technique easier, safer, and also reduced the risk of complications in the treatment of extreme atrophic crests [12].

Survival and success rates of implants placed in the expanded ridges are consistent with those of implants placed in native, nonreconstructed bone. The gap created by sagittal osteotomy/expansion undergoes spontaneous ossification, following a mechanism similar to that occurring in fractures. New bone formation permits a consolidation between the oral and buccal bone plates of the alveolus, and implants placed in expanded ridges seem to withstand the biomechanical demands of loading. By reducing the healing period, the ARST offer an important time and financial economy [13].

Sohn et al. (2010) reported a study of 32 patients using the ARST [4]; they used an osteotomy in the alveolar crest and then a vertical osteotomy to enable displacement of the vestibular bone plate, initially proceeding with an ultrasonic system and later separating with a smaller chisel. In the ARST sequence with immediate implant, 5 out of 21 cases presented a bone plate fracture. Our results confirm the possibility of cortical bone fracture.

Basa et al. (2004) and Piccinini (2009), showed that the ARST with subsequent removal and reinstallation of the lateral bone plate, no implant loss was reported, indicating stability of the technique [14,15].

This technique can be carried out by inserting implants simultaneously or it can be done in two steps. The alveolar ridge split technique with simultaneous implant placement is usually performed to shorten the total treatment time and to eliminate second surgical procedure morbidity [4]

#### **5. Conclusion**

Finally, we can conclude that the ARST together with adequately designed implants are useful for solving cases with bone that is atrophic in width, decreasing the number of indications from previous reconstructive techniques.

#### **Competing Interests**

The authors declare that they have no competing interests.

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