Full mouth rehabilitation using alveolar ridge splitting technique with immediate implant placement on maxilla and delayed implant placement on mandibula: a case report.

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Abstract

The bone split procedure is a technique that is used to increase the width of narrow ridge with possible simultaneous implant placement with high success rates (98 - 100%). In that report, a 52-year-old patient with bilateral edentulous posterior mandibular ridges and edentulous maxilla was referred to our office for implant treatment. A two-step technique on mandible and immediate implant placement on maxilla was adopted. A successful prosthetic rehabilitation was done following the healing phase. This approach leads to restoration of function with a predictable outcome.

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

1. Introduction

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. Dr. Hilt Tatum 1970s introduced the alveolar ridge splitting technique (ARST) or bone spreading [1]. 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) [2,4]. 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 [5].

Dental implant is considered as the most reliable and convenient treatment for partial and full edentulism. As the implant surgery become more and more popular and as the labial alveolar bone often undergoes rapid resorption after natural tooth loss, implant surgeons should be prepared for bone graft during implant surgery, especially that about 80 % of anterior maxillary sextant need bone graft [6]. Thus, to satisfy the ideal goals of implant dentistry, the hard and soft tissues need to present an ideal volume and quality. 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 [7].

In this case report, we describe a case of horizontal ridge augmentation using ridge split and simultaneous implant placement in maxilla and delayed implant placement on mandibula.

2. Case Presentation

2.1. *Patient History and Chief Complaint.* A 52-year-old female reported to our office with bilateral edentulous posterior mandibular ridges and edentulous maxilla. She was not able to chew and her esthetics was compromised.

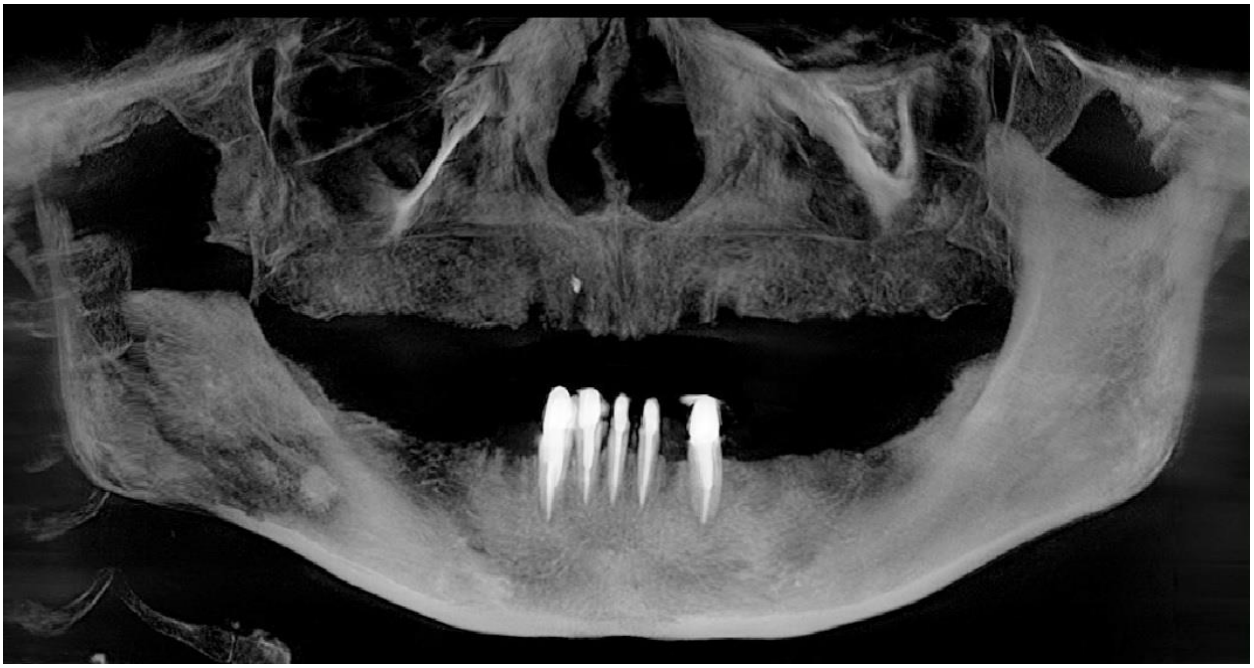

Figure 1: Preoperative panoramic X-ray showing maxillary and posterior bilateral edentulism.

2.2. *Initial Assessment.* Diagnostics included radiographic examination (Figures 1), a Cone Beam Computer tomography scan (CBCT scan) (Figure 2, 3, 4, 5, 6) and a thorough clinical examination. The CBCT scan demonstrated adequate ridge height, but showed a thickness from 7 to 8 mm on 16 and from 4 to 5 mm in the coronal segment of the ridge with progressive apical expansion on 14, 12, 22, 24, 26, 34, 36, 44 and 46, (Figure 2, 3,4,5,6). The bone quality was type 3 on maxilla and type 2 on mandibula, with the medullary bone separating the vertical cortical palatal/ lingual and vestibular bone.

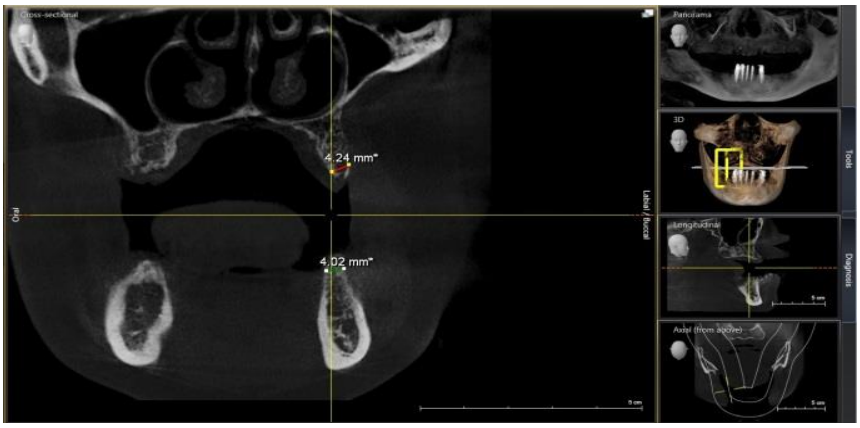

Figure 2: preoperative Cone Beam CT Scan showing the bone thickness on 14 and 44.

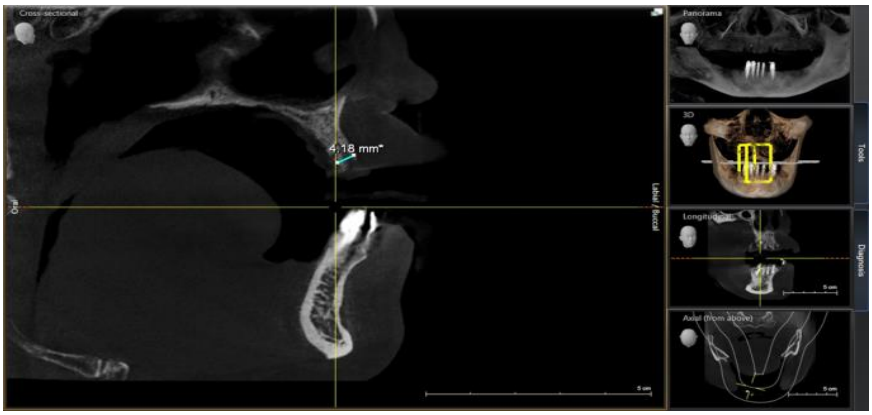

Figure 3: preoperative Cone Beam CT Scan showing the bone thickness on 12.

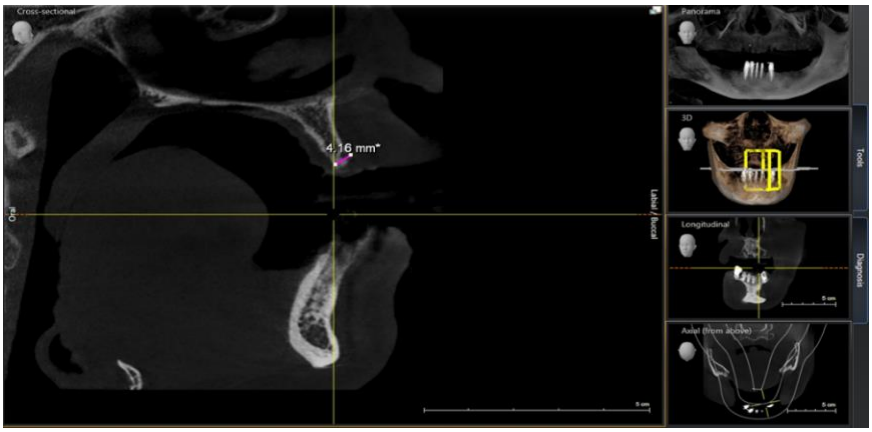

Figure 4: preoperative Cone Beam CT Scan showing the bone thickness on 22.

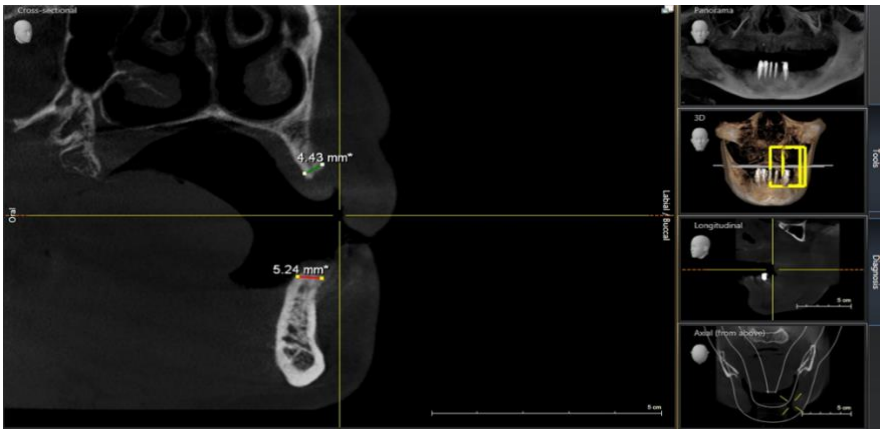

Figure 5: preoperative Cone Beam CT Scan showing the bone thickness on 14 and 44.

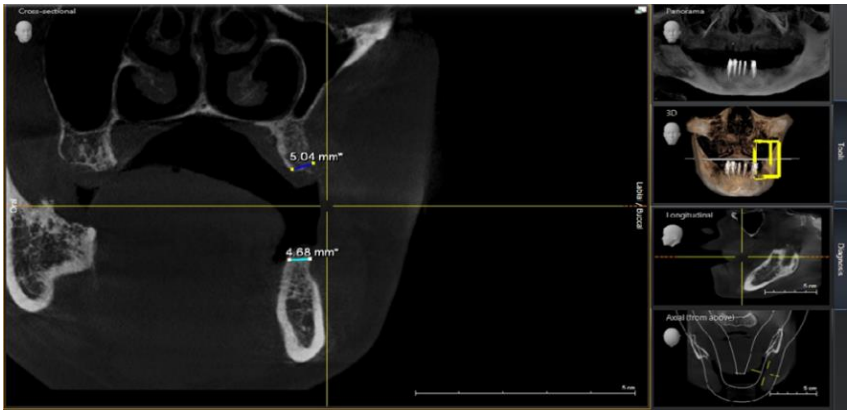

Figure 6: preoperative Cone Beam CT Scan showing the bone thickness on 26 and 36.

We decided to make an ARST with immediate implant placement on maxilla and mandibula.

2.3. *Surgical procedure on maxilla*. The site was anesthetized using 2% lignocaine, 1:100,000 epinephrine. A midcrestal incision was given followed by raising a full thickness flap using a soft tissue elevator, so as to expose the ridge crest, which was approximately 4 to 5 mm bucco-palatally. Using the piezosurgery unit (Mectron), three cuts, for each implant, where 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, a pilot drill with a diameter of 2.2 mm 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 with a diameter of 3.6 mm was used to prepare the implant bed, and six INNO implants (CowellMedi) with a width of 4 mm and a length of 10 mm were placed in 16, 14, 12, 22, 24 and 26 sites respectively.

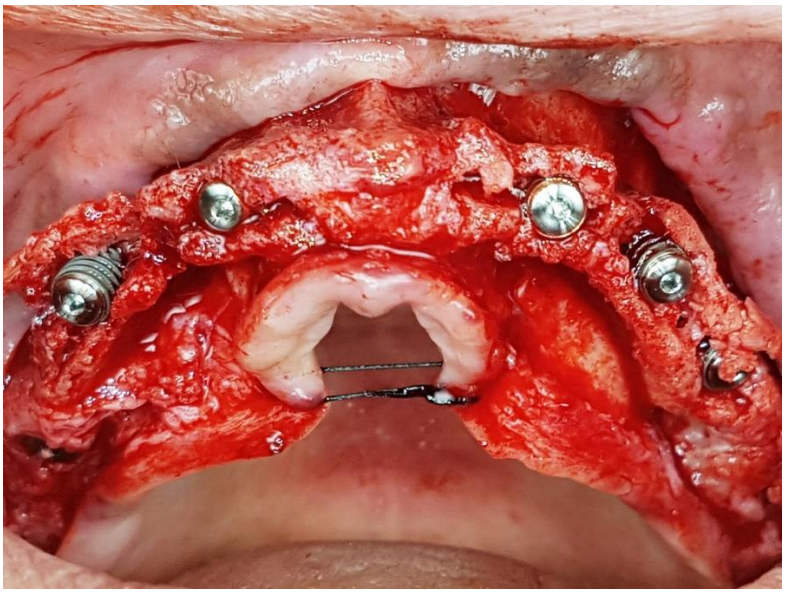

Figure 7: Implants in place after bone splitting.

The GBR was performed using autogenous bone harvested with bone scraper from the tuberosity 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 5-0 PGA suture. 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.

2.3. *Surgical procedure on mandibula*. Two weeks after the maxillary surgery. The site was anesthetized using 2% lignocaine, 1:100,000 epinephrine. A mid-crestal with two vertical, vestibular releasing incisions was given and a full-thickness vestibular flap was elevated and, after isolating the mental nerve, released with a longitudinal periosteal incision avoiding the mental foramen area, from the distal to the mesial, covering the entire length of the flap. On the lingual side, a full-thickness muco-periosteal flap was elevated until reaching the mylohyoid line. Then, detachment of the mylohyoid muscle insertion, usually located in the first molar area, from the lingual flap was accomplished by applying gentle traction with a blunt instrument in a coronal direction. This allows stable primary wound closure without tension, which can result in premature exposure of the augmentation area, jeopardizing the final outcome.

Using the piezosurgery unit (Mectron), a mid-crestal and two vertical cuts, each side, where conducted. Using the bone expander kit (Ace), the bone split was performed. Due to its low elasticity, the buccal plate lost its stability and has to be fixed with two screws using a bone block fixation kit (Straumann). The implant placement reported three months later.

On both surgical sides, the GBR was performed using a mixture of 50% autogenous bone harvested with bone scraper from the retro molar area and 50% xenograft () and a pericardium collagen membrane (Jason)

The wound was sutured using a 5-0 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) and analgesics were prescribed for 5 days and chlorhexidine mouth wash 0.2% for 14 days. Sutures were removed after 14 days.

Three months later four INNO implants (CowellMedi) with a width of 4 mm and a length of 10 mm were placed in 46, 45, 34, 36 sites respectively.

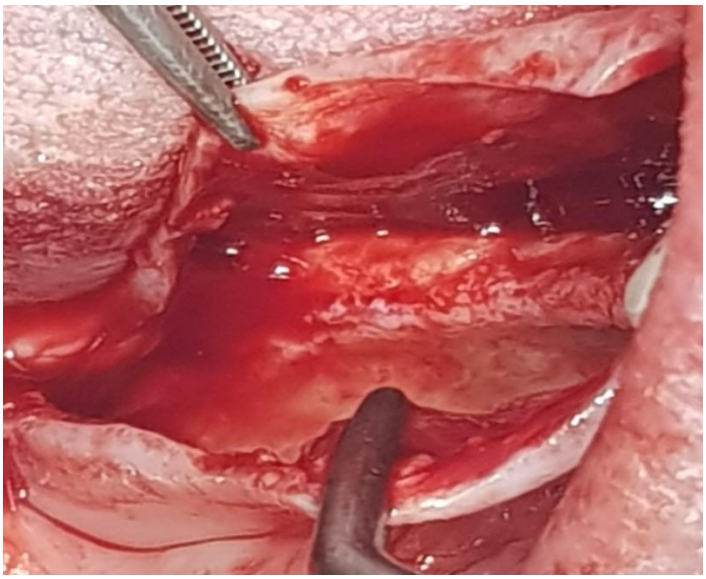

Figure 8: Lingual and vestibular flap after releasing incisions. Note the high mobility of the lingual flap after detachment of the mylohyoid muscle insertion from the lingual flap.

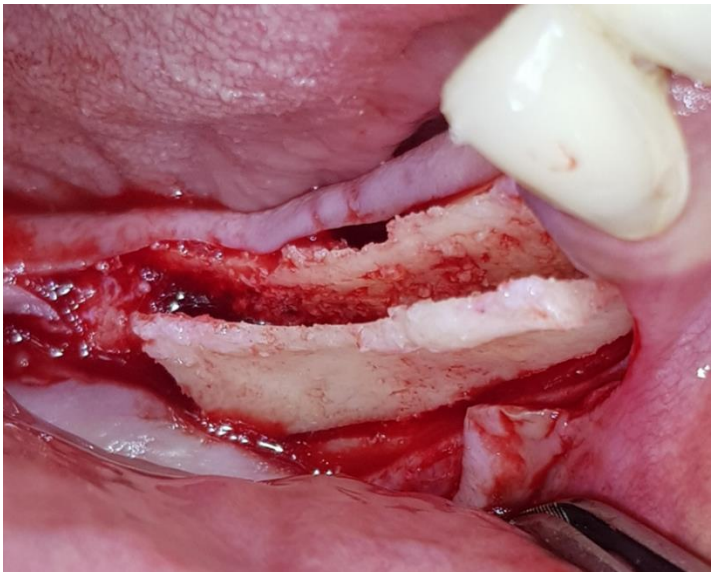

Figure 9: The alveolar ridge after splitting with piezosurgery.

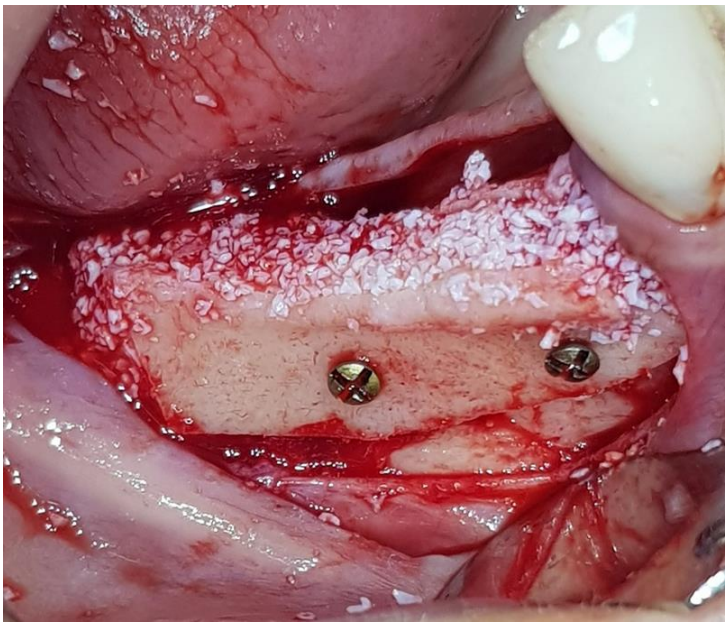

Figure 10: After fixating the buccal plate and filling the gap by a mixture of autogenous bone and xenograft.

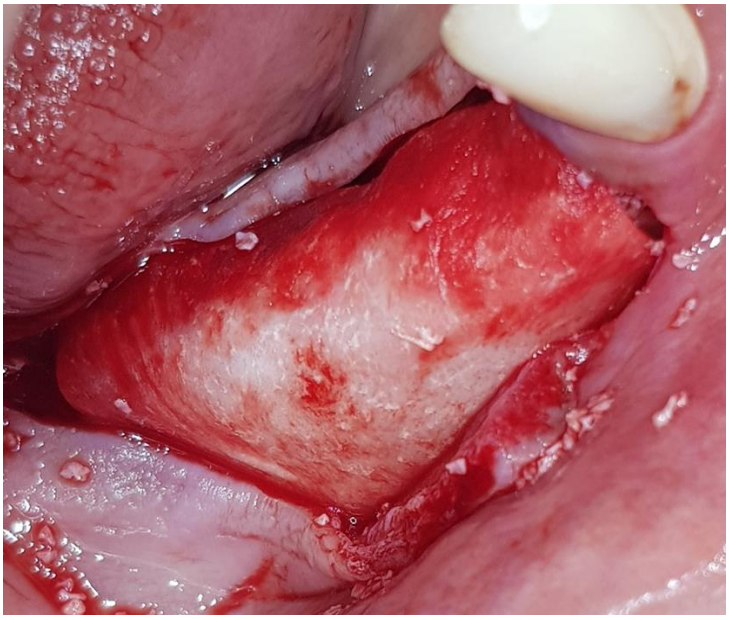

Figure 11: A collagen membrane covering the entire defect.

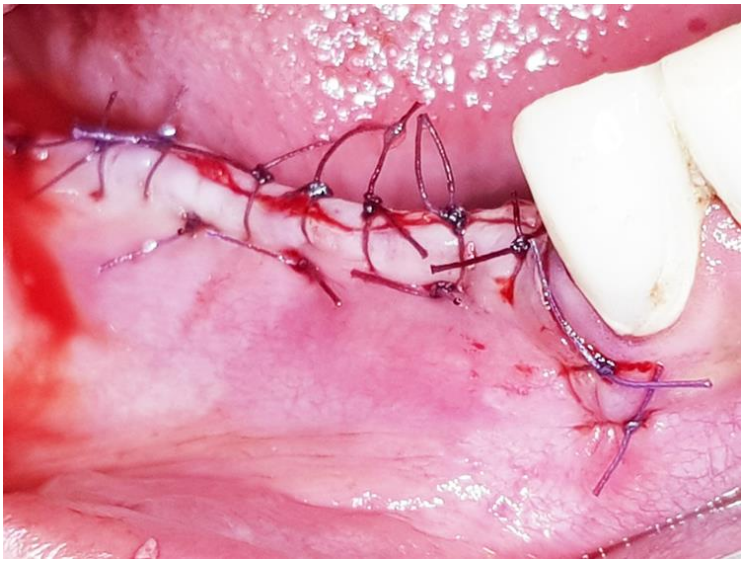

Figure 12: A combination of horizontal mattress and O sutures to insure the best wound closure.

2.4. Prosthetic rehabilitation. Two months post implant placement, the implants were uncovered with use of a scalpel and healing screws were placed for four weeks. The final monolithic zirconia prosthesis were made by a dental laboratory and cemented onto the implants.

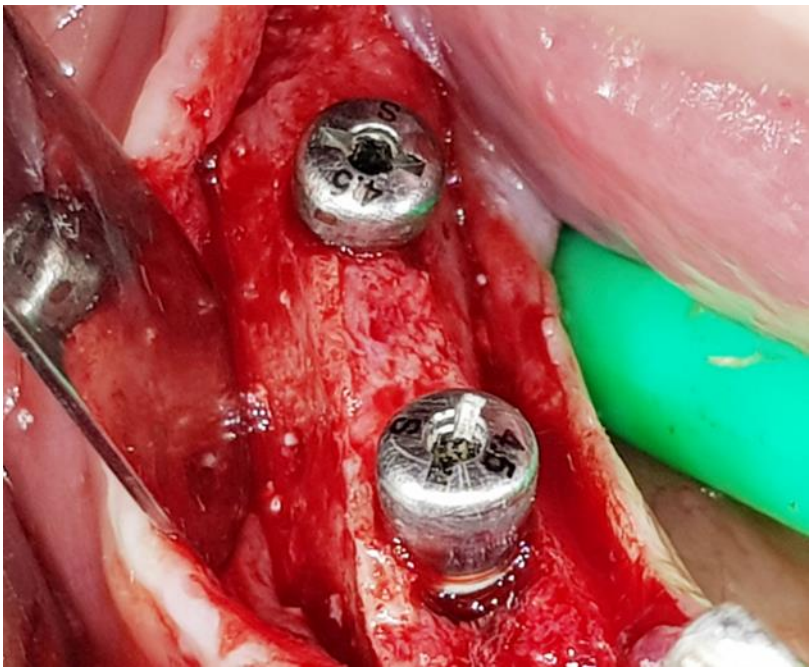

Figure 19: 2 months post implant placement, healing abutments in place on 45 and 46.

Figure 20: 2 months post implant placement, healing abutments in place on 34 and 36.

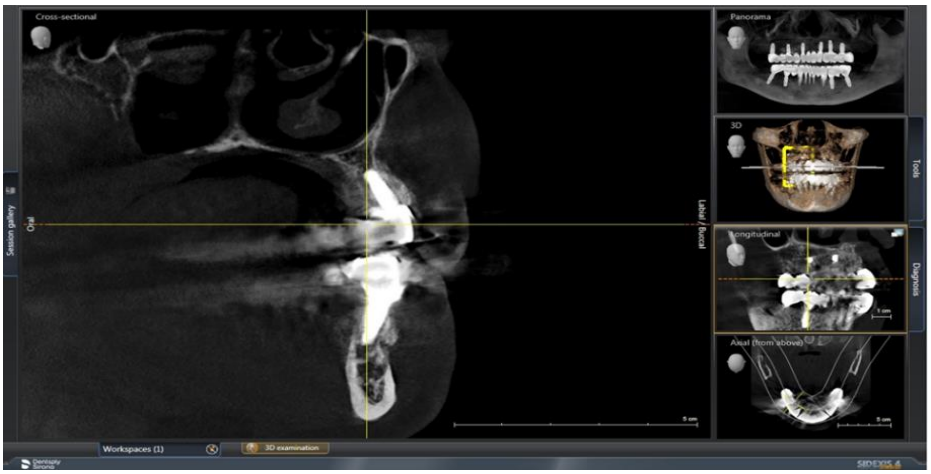

Figure 13: Final Cone Beam CT Scan showing the bone thickness on 15 and 46.

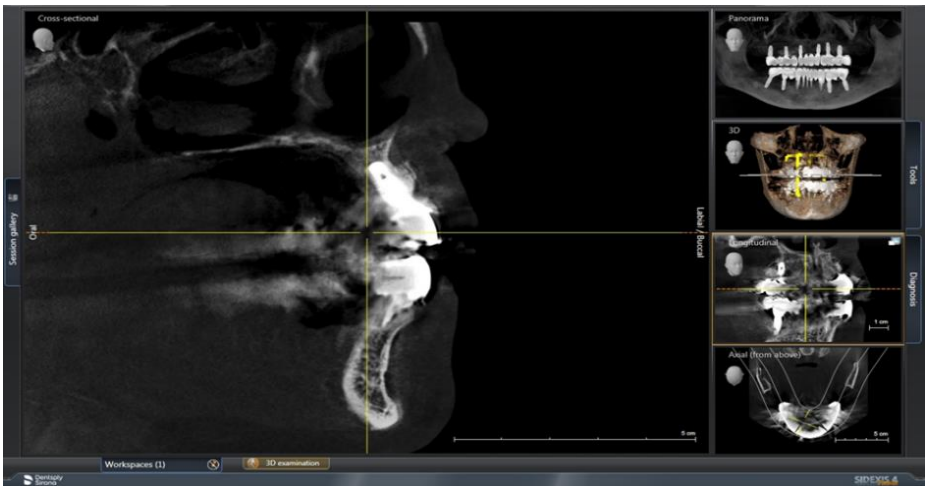

Figure 14: Final CBCT Scan showing the bone thickness on 12

Figure 15: Final CBCT Scan showing the bone thickness on 22

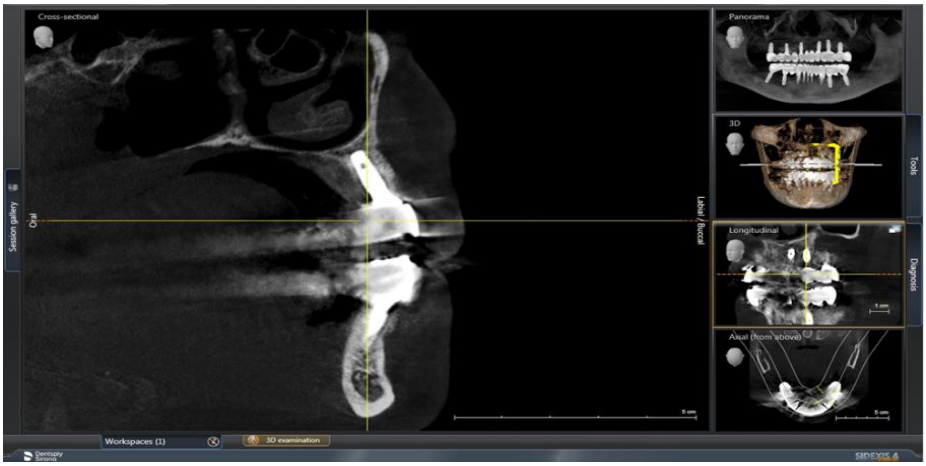

Figure 16: Final CBCT Scan showing the bone thickness on 14 and 34.

Figure 17: Final CBCT Scan showing the bone thickness on 26.

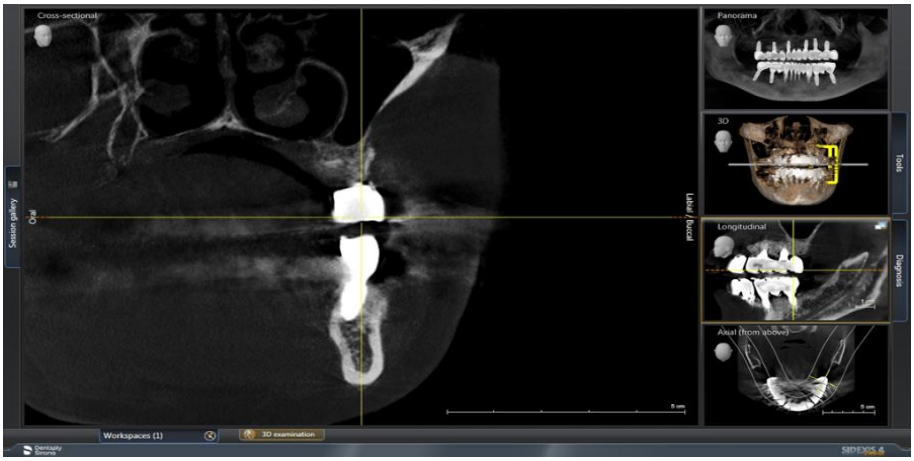

Figure 18: Final CBCT Scan showing the bone thickness on 46

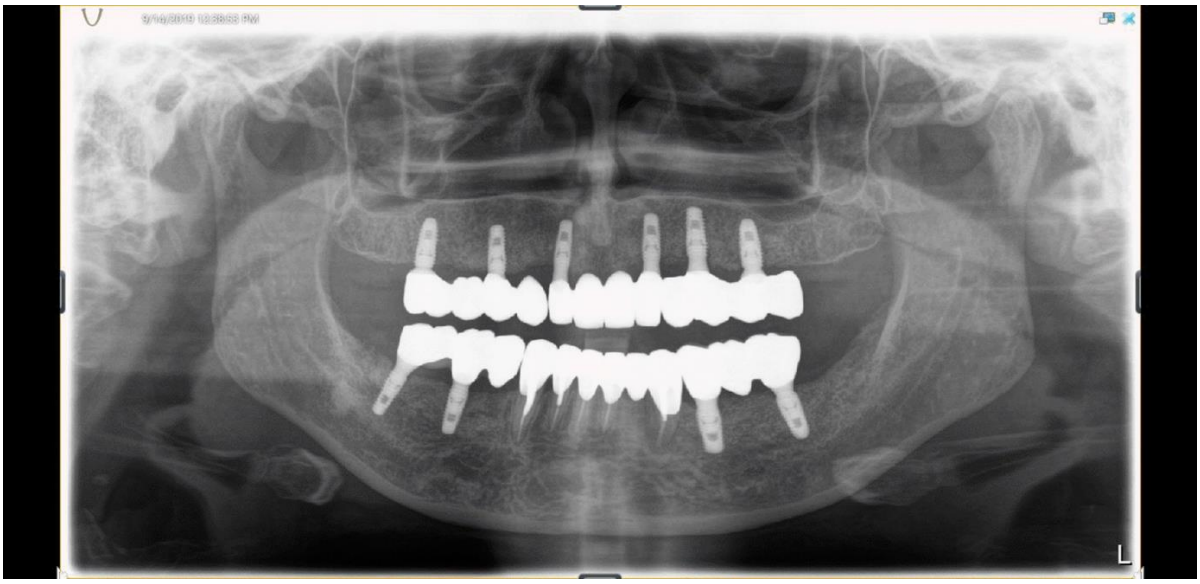

Figure 21: Panoramic X-ray after prosthetic rehabilitation, showing well osseointegrated loaded implants.

Figure 22: Final prosthesis.

3. Discussion: The 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 [8]. Thus the bone splitting/expansion seem to be a reliable and relatively noninvasive technique to correct narrow edentulous ridges.

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 [9].

However, due to the lower bone density and thinner cortical buccal plate, the maxillary ridges are more easily treated than mandibular ridges. Mandibular sagittal osteotomy, although possible, is more difficult due to the denser bone of the buccal plate. Drawbacks of this anatomical condition include greater difficulty in expanding, the risk of a more invasive and more traumatic surgical procedure, and the risk of buccal plate fracture.

Another limitation is represented by unfavorable inclination of implants placed in expanded areas. This procedure may lead to excessive buccal inclination of implants, which may create problems from a

functional and esthetic viewpoint. In the case of unfavorable bone angularity, guided bone regeneration or bone grafting techniques seem to represent more adequate surgical procedures.

Bone splitting/expansion can be applied only when the buccal and palatal/lingual plates are separated by spongy bone. Therefore, the indications are more limited as compared to onlay grafts and GBR, which can be also applied in cases presenting with severe horizontal atrophy [9].

A combination of guided bone regeneration with the alveolar ridge split technique may prevent post-surgical resorption in very narrow ridges. A lack of bone substitute resulted in significant resorption of 3- to 4-mm-wide crests (5%). A bone substitute should be placed to maintain the alveolar bone walls after expansion [10].

The delayed lateral ridge expansion technique can be used more safely and predictably in patients with high bone quality and thick cortex and a narrower ridge in the mandible [11].

The guided bone regeneration and the Lateral ridge split technique have demonstrated predictable techniques with a high success rate, split-crest being a technique that allows the placement of implants in the same surgical act and allows maintaining the patient's bone cortical [12].

4. Conclusion

This case demonstrates the effectiveness and predictability of split ridge to increase the width of deficient ridge with simultaneous implant placement. The ARST proved to be one of the most predictable, simple, fast, and most selective bone augmentation techniques in which the atrophic alveolar process can be expanded.

5. Competing Interests

The authors declare that they have no competing interests.

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