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Sticky Bone added to the Split Crest technique for implant placement in an atrophic mandible. Clinical Case

Hueso pegajoso añadido a la técnica Split Crest para la colocación de implantes en una mandíbula atrófica. Caso clínico

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ABSTRACT

Placing an implant in an atrophic alveolar ridge is a challenge regarding the reconstruction of bone defects of one or two walls. A solidified bone graft trapped in a fibrin network prevents its dispersion even when subjected to movement or shaking. The Split Crest technique offers a practical way to expand the atrophic alveolar ridge. This allows the use of bone grafts without needing a second surgical site, which reduces the risk of edema, nerve injuries, and pain. A 50-year-old patient, systematically healthy, reported difficulty chewing, swallowing, and speech due to a poorly adapted prosthesis in the jaw, which caused dissatisfaction with the prosthetic treatment already performed. This case report aimed to describe the Sticky Bone procedure by adding an autologous atrophic jaw graft using the Split Crest technique, obtaining an average bone gain of 2.5mm, having good results after eight months postoperatively, there was no peri-implant marginal bone resorption.

Keywords: Oral Surgery, Maxillomandibular Joint Surgery, Bone Substitutes, Dental Implants.

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RESUMEN

La colocación de un implante en una cresta alveolar atrófica supone un desafío al abordar la reconstrucción de defectos óseos de una o dos paredes. Un injerto óseo solidificado atrapado en una red de fibrina impide su dispersión incluso cuando se somete a movimientos. La técnica Split Crest ofrece una soluciòn práctica para expandir la cresta alveolar atrófica utilizando injertos óseos, sin necesidad de un segundo lecho quirúrgico, reduciendo el riesgo de edema, lesiones nerviosas y dolor. Un paciente de 50 años de edad, sistemáticamente sano, refirió dificultades para masticar, tragar y hablar debido a un tratamiento protésico ya realizado. Este caso clínico buscò describir el procedimiento Sticky Bone mediante la adición de un injerto maxilar autólogo atrófico utilizando la técnica Split Crest, obteniendo una ganancia ósea media de 2,5 mm, observándose buenos resultados después de ocho meses postoperatorios, sin reabsorción ósea marginal periimplantaria.

Palabras clave: cirugía bucal, facturas maxilomandibulares, sustitutos de huesos, implantes dentales.

INTRODUCTION

Bone loss in the alveolar ridge after tooth extraction or loss is a gradual and irreversible process that occurs over approximately six months. This process leads to bone defects in the edentulous ridges.(1)

Placing an implant in an atrophic alveolar ridge has become a challenge. When approaching the reconstruction of bone defects of one or two walls or achieving a three-dimensional ridge augmentation, bone grafts, collagen membranes, or titanium mesh to contain particulate staples bone during healing are often required.(2) However, these procedures are invasive and technique-sensitive, which implies a longer surgical time.(3)

As an alternative to the titanium mesh or bone block procedure, Sticky Bone was introduced in 2010.

A solidified bone graft trapped in a fibrin network prevents its dispersion even when subjected to movement or shaking.(4)

The Sticky Bone has the advantage of being malleable, which makes it easier to adapt to different types of bone defects. Furthermore, its use prevents both micro and macro displacement of the bone graft, which helps maintain the volume of the bone augmentation during the healing process. (4,5) What is mentioned above implies reducing the need for bone block and titanium mesh. A fibrin network in the Sticky Bone traps platelets and leukocytes, releasing growth factors.(6)

This feature accelerates bone regeneration and facilitates soft tissue regeneration.(7) Importantly, no additional biochemical additives are required to obtain Sticky Bone, simplifying the procedure and eliminating the need to use additional substances.(7,8,9)

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The Split Crest technique offers a simple, rapid, and predictable way to expand the atrophic alveolar ridge. This allows bone grafts to be used without needing a second surgical site, reducing the risk of edema, nerve injury, and pain.[5,9,10]

It is crucial to have an alveolar ridge of adequate height and width to obtain proper function and desired aesthetics in dental implant restorations.[11] It has been proposed that having a facial and lingual alveolar bone thickness of at least 1 to 1.5 mm around the inserted implant is necessary to achieve proper union with the Bone and obtain predictable long-term results in implant treatment.[12]

The Split Crest and immediate implant placement involve the longitudinal separation of the ridge into two parts through chisels, piezoelectric surgery, or oscillating saws.[13] A particulate autogenous bone graft or bone substitute is often placed around the implants between the buccal and palatal cortical layers.[14]

Systematic reviews and meta-analyses have shown that horizontal reconstruction of alveolar deficiencies using this ridge-splitting technique appears to be a reliable and effective surgical approach, with a high implant survival rate, an increase in the horizontal width of the alveolar ridge, and few biological and technical complications.[15,16]

This case report aimed to report the preparation procedure for the Sticky Bone with Split Crest technique, adding an autologous bone graft in a patient with horizontal mandibular atrophy by placing four implants to rehabilitate it orally.

CASE PRESENTATION

A female patient, 50 years old, from the city of Riobamba, who was systemically healthy, arrived at the Lumerdent private clinic. The patient reported difficulty chewing, swallowing, and speaking due to a poorly adapted prosthesis in the jaw, which caused dissatisfaction with the prosthetic treatment.

A radiographic analysis was performed, and variation in bone volume was confirmed, both in the maxilla and the mandible. It was proposed that implants be placed in the upper and lower parts if necessary. However, for economic reasons, the patient agreed to have it performed only on the lower part.

We proposed performing block bone grafting by taking a graft from the iliac crest. However, the patient had negative responses because it was a procedure that required being conducted in the operating room with general anesthesia. So, in this particular case, two techniques were used in combination: the first, called Sticky Bone, is a xenograft, and the second, known as Split Crest, involves expanding the Bone.

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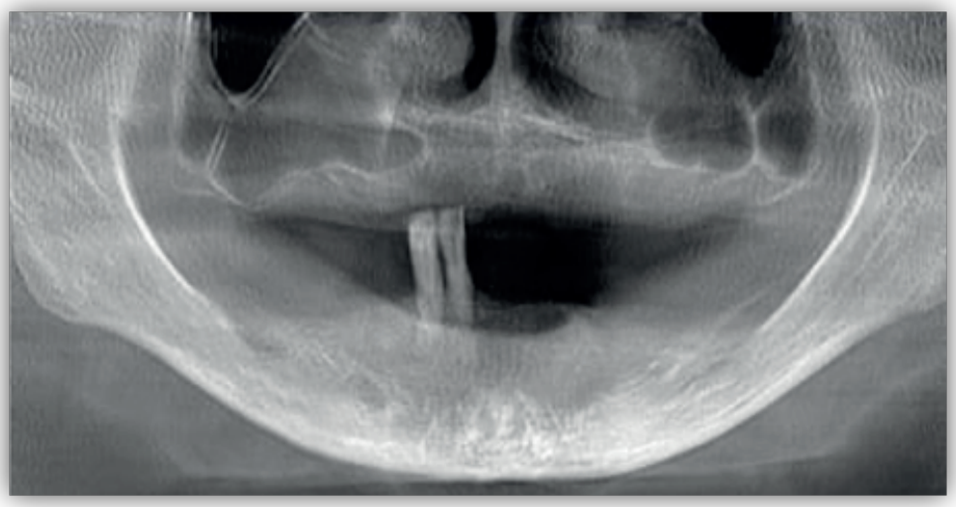

Figure 1. Initial panoramic radiograph analysis of the maxilla and mandible

The initial panoramic radiograph revealed a maxilla with marked vertical atrophy, suggesting significant bone height loss in this region. Likewise, the mandible shows evident horizontal atrophy, indicating a considerable reduction in the width of the mandibular Bone. The radiographic image also clearly shows two remaining teeth: a lower right central incisor and a lower right lateral incisor, both located in the anterior part of the mandible. (Figure 1)

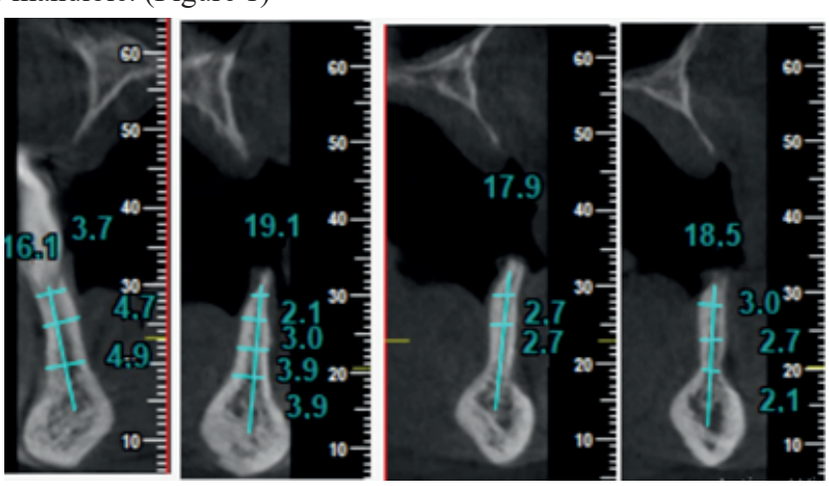

Figure 2. Bone quantity of the third quadrant vertically and horizontally

In quadrant three, the horizontal bone crest does not exceed 2,7 mm. To place a dental implant, at least 1,5 mm of Bone is required on each side.[8] Therefore, the implant cannot be placed since the thinnest implant available has a diameter of 2,9 mm. Thus, the objective is to regularize the ridge under the crest until reaching a diameter buccal-lingual 3 mm. (Figure 2)

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Figure 3. Edge regularization without generating excess heat

Ridge regularization is carried out without using rotary tools or surgical drills since their friction generates excess heat that could cause bone necrosis and unwanted resorption. The objective is to perform the treatment using a high-frequency surgical tool, providing more significant irrigation and precise cutting, thus avoiding bone necrosis. (Figure 3)

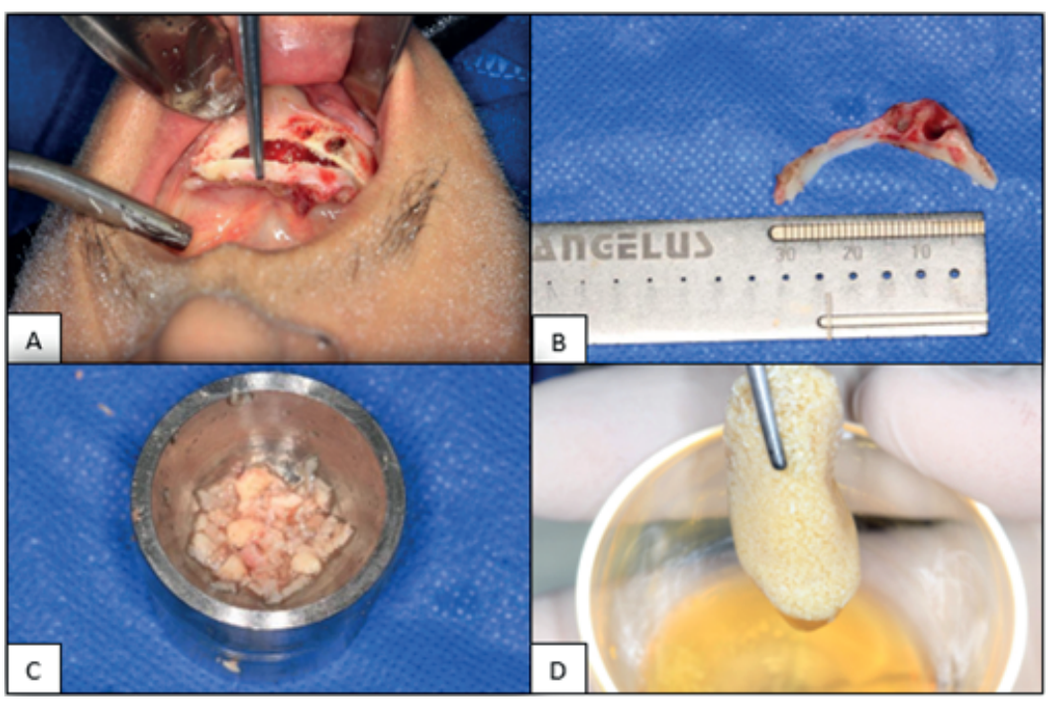

Figure 4. Extraction, measurement, preparation, and conformation of Sticky Bone

A - Extraction of the bone fragment. **B** - The bone fragment is measured, considering that it is a type I Bone, obtained from the parasymphysis and symphysis. **C** - We crush the bone fragment in a trephine and immerse it in a saline solution to maintain hydration. D - PRF (Platelet Rich Fibrin) and HiperRF (Bone Growth Factor) are mixed with synthetic Bone, thus creating the compound known as Sticky

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Bone. In this clinical case, in addition to the synthetic graft, autologous Bone is added to ensure that the graft is not only osteoconductive and osteoinductive but also osteoforming, fulfilling the three biological characteristics of a graft. The main objective is to promote the formation of more Bone. (Figure 4)

Synthetic Bone: From the Straumann brand – with a grain of 2.00mm (Botiss dental Cerabone)

Figure 5. Lanned vertical osteotomy in the vestibular cortex of the mandibular symphysis and parasymphysis

As shown in figure 5, The Split Crest technique increases the bone crest to place implants horizontally. Vertical cuts must be made because when the expansion is carried out, the pressure from the expanders can fracture the bone walls.

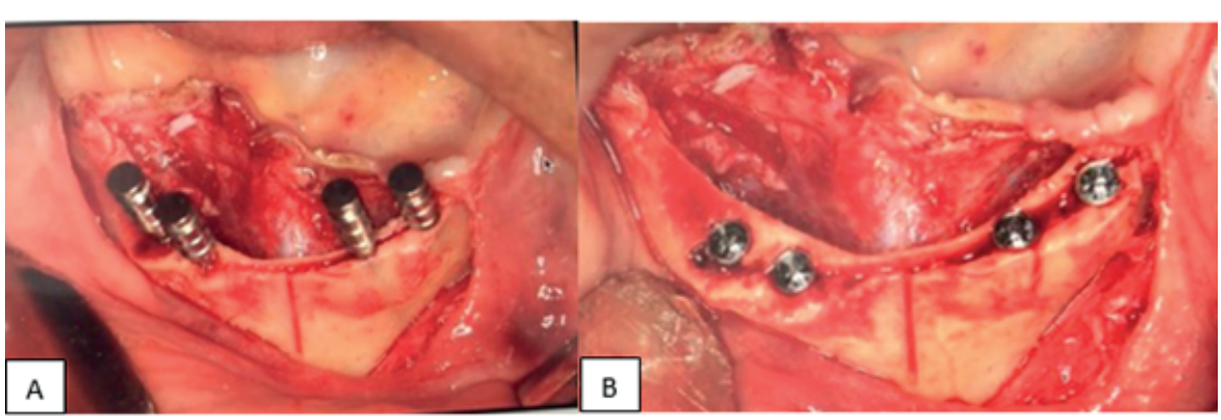

Figure 6. Dilation of the lingual vestibular table with the use of bone expanders

A - The bone expanders are placed after performing the Split crest technique. They enter the Bone little by little and continue expanding. The force must be controlled so that the bone tables do not

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break. Each expander has a size that continues to increase as it enters. **B** - The internal hexagon implants are placed in the space gained by the bone expanders. (Figure 6)

ADIN brand implants (TOUAREG Close Fit UNP – ultra-narrow platform implant with Osseofix surface) were used. Size 2,75 x10mm, the implant was inserted at 20 revolutions per minute with a torque of 35N, using an NSK brand motor. Surgic Pro.

Obtaining PRF: Six 10ml blood test tubes without anticoagulant were extracted to immediately centrifuge at 2700 revolutions per minute for 12 minutes.

Obtaining Sticky Bone: it is composed of HiperPRF, PRF and synthetic Bone
Synthetic Bone: From the Straumann brand – with a grain of 2,00mm (Botiss dental Cerabone)

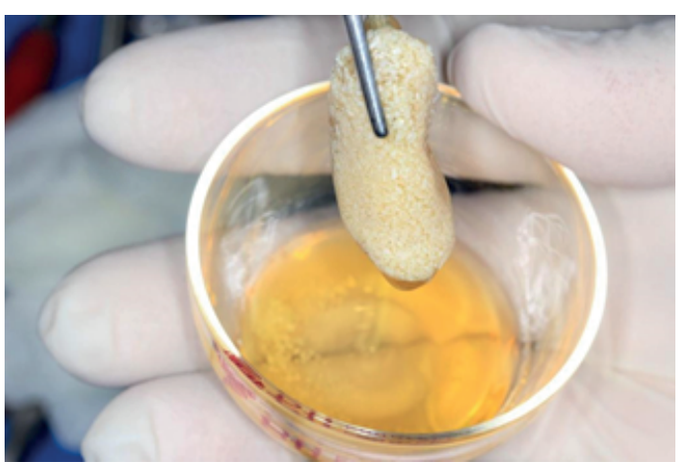

Figure 7. PRF - HiperRF - Synthetic Bone mesh

After grinding the trephine and mixing it with the PRF, we obtain the Sticky Bone mesh. (Figure 7)
Obtaining PRF: Six 10ml blood test tubes without anticoagulant were extracted to centrifuge at 2700 revolutions per minute for 12 minutes immediately.

Obtaining Sticky Bone: it is composed of HiperPRF, PRF, and synthetic bone.

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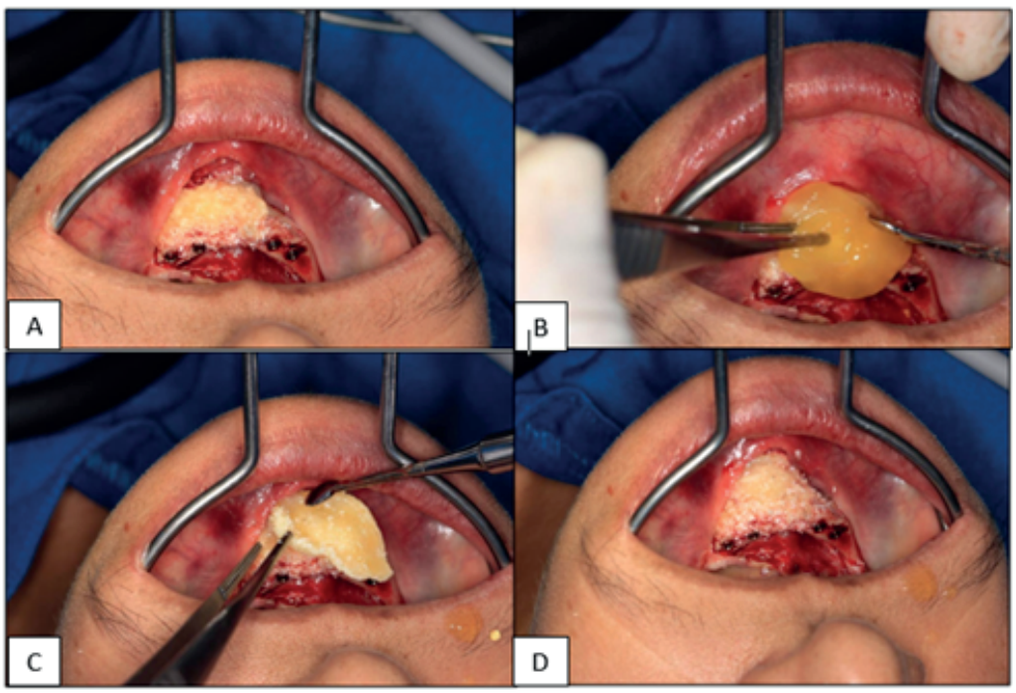

Figure 8. Sticky Placement Bone with synthetic bone variant covered with PRF membranes

A-B-C-D- Sticky Mesh bone is placed, filling all the spaces next to the PRF to accelerate angiogenesis, managing to nourish the synthetic and autologous bone, the objective being not only to have osteoconduction but also osteogenesis, taking into account that the PRF is an angioprogenitor which helps us improve the cicatrization. (Figure 8)

Figure 9. Modified continuous suture with 3/0 Nylon thread

A modified continuous stitch was performed with 3/0 Nylon thread to prevent food accumulation and achieve a cleaner wound. (Figure 9)

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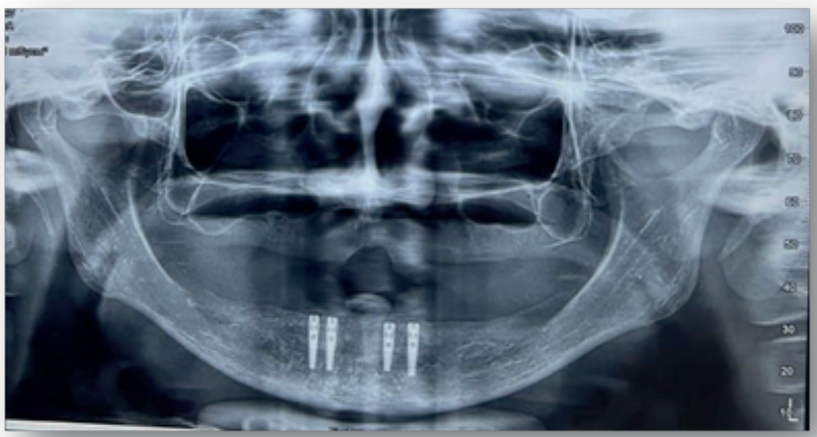

Figure 10. Post-surgical control

The follow-up panoramic radiograph was taken at eight months, clearly showing the stability and preservation of the placed dental implants. Additionally, adequate bone tissue formation around the implants was observed, with no signs of marginal bone resorption in the peri-implant areas. This absence of bone loss around the implants is a positive indicator of the success of the implant treatment, confirming the favorable results achieved in this clinical case. (Figure 10)

DISCUSSION

The case presented serves as a clear illustration of how the treatment of the atrophic jaw is approached.

The Split Crest technique is booming and is a viable alternative for managing alveolar bone defects in the horizontal atrophic jaw.[1,3,4] The Ridge Split maxillary ridge expansion technique can be a predictable alternative with high success rates to improve the conditions of the edentulous ridges for implant placement, either immediately or late.[1,2,18]

Upadhayayaa et al.[2] indicate that PRF, Concentrated Growth Factor (CGF), and Sticky Bone are easy to manufacture and are very effective materials for the reconstruction of edentulous alveolar bone defect, with significant similarity in the present article for using PRF and HiperRF with synthetic bone, thus creating the compound known as Sticky Bone, having good bone regeneration results.

This case report coincides with other investigations[4,15] that have considered evidence that PRF is a biological material with significant regenerative properties for recovering soft and bone tissues. This biomaterial promotes healing without causing inflammation and can be applied independently or in conjunction with bone grafts. Its use facilitates hemostasis, the development of bone tissue, and its maturation.

Jensen et al,[8] and Palacios et al,[9] state that using the bone block technique is very feasible since an average gain in the width of the alveolar ridge varies between 3,25 and 3,5 mm after using the Split

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Crest technique. Unlike the present article, these studies disagree with the clinical case presented in this manuscript, where bone blocks and titanium meshes are avoided because these procedures are invasive and sensitive to the technique, which implies a longer surgical time, which we give a similarity for these results.

Combining these techniques with bone grafts is a common practice, in which grafts are placed in the spaces created by the expansion of the bone tables. According to Starch-Jensen and Becktor[16,13], autogenous grafts have shown a high success rate in implant survival. However, their use may increase morbidity at the extraction site and prolong treatment time. Therefore, it was recommended to immediately place the grafts after expansion, as was done in the case presented, to avoid extending the patient's treatment time.

The implant can be inserted immediately after tooth extraction or wait for the wound to heal, thus allowing early or late/conventional placement. Early implant placement occurs four to eight weeks after extraction when the soft tissue has healed.[9] Immediate implant installation has certain advantages, such as preserving the size of the alveolar bone, reducing the need for surgery, and speeding up the treatment process. Likewise, the flap incision can be avoided by opting for immediate implant placement.[5] That is why the immediate post-extraction placement of the four dental implants was carried out in the clinical case presented.[8,9,11]

The alveolar ridge expansion technique has a high survival rate. Compared to implants placed in bone without ridge expansion, it is a reliable option for implant placement in narrow alveolar ridges.[17,18]

CONCLUSIONS

Mandibular atrophy is a complicated situation that requires the collaboration of a team of specialists to address it. Surgeons face a significant challenge due to potential complications that may arise before, during, or after surgery.

The Split Crest technique, combined with a sticky bone preparation to increase bone availability, allowed the patient to achieve a functional result. The PRF showed that it was easy to manufacture and was prepared with very effective materials for reconstructing the edentulous alveolar bone defect. The average bone gain was 2.5mm, with good results; after one month postoperatively, there was no peri-implant marginal bone resorption.

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Author Contributions:

Conceptualization, V.M.B.G. and M.P.Q.E.; methodology, C.D.G.C.; validation, M.A.C.R., V.M.B.G., M.P.Q.E., C.D.G.C., and M.A.C.R.; investigation, V.M.B.G. and M.P.Q.E.; resources, V.M.B.G.; writing—original draft preparation, M.A.C.R.; writing—review and editing, M.P.Q.E., C.D.G.C., and M.A.C.R.; visualization, V.M.B.G.; supervision, M.P.Q.E.; All authors have read and agreed to the published version of the manuscript.

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