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Case Report

Maxillary Reconstruction using Autologous Bone Graft: A Case Report

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Abstract

The use of autologous ulna bone for the reconstruction of atrophic bone crest could be a viable resource to obtain cortico-cancellous bone graft blocks, since the extraction of this donor site is associated with low morbidity. The objective of this case report was to describe the technique used to achieve three-dimensional regeneration of the atrophic maxillary alveolar process with significant bone defects using an ulna autograft. A 70-year-old male patient, diagnosed with hypertension and controlled diabetes, presented with complete edentulism and a Cawood and Howell Class IV atrophic maxilla. It was decided to reconstruct the upper jaw using an anterior ulna autologous onlay bone graft, in order to place implants for their rehabilitation with implant-supported prosthesis. A linear incision was first made in the forearm to harvest two cortico-cancellous bone blocks. These blocks were anatomically shaped and adapted to the recipient site in the oral cavity. A collagen membrane was placed to stabilize the cancellous portion of the graft, which had not yet fully osseointegrated. To enhance volume and support, a bone xenograft was used to complement the grafted area. Finally, four dental implants were placed-two in each quadrant.

Keywords: Autograft; ulna; atrophic bone crest; elderly; implant-supported prosthesis; systemically compromised

Introduction

Bone volume deficit in completely edentulous patients creates both surgical and prosthetic challenges in implantology. Its pathophysiology involves a combination of metabolic factors—such as nutritional deficiencies, endocrine disorders, and associated osteopenias—and local factors, the most common being the absence of dental organs [1]. This absence causes bone resorption in the maxillary bone due to lack of intraosseous stimulation, affecting the proportions of medullary and cortical bone, with the latter showing less loss. Given this physiological process, identifying the resorption pattern affecting the maxillary and mandibular bones is crucial for adequate reconstruction. In the maxilla, resorption is centripetal, resulting in collapse, whereas in the mandible it is centrifugal [2].

Autologous bone graft surgery requires consideration of both donor site selection and the potential morbidity involved, as well as patient-specific comorbidities that may influence the procedure of alveolar atrophy, a wide range of preprosthetic surgical techniques have been developed [3], including the use of autografts, allografts, and xenografts. These approaches have evolved into hybrid techniques such as onlay grafts, interposition with Le Fort I osteotomy, maxillary sinus augmentation, nasal floor grafting, application of morphogenetic proteins, microvascular grafts, dental implants, zygomatic implants, and osteogenic distraction [4]. In cases of unitary tooth loss or up to three to four teeth, it is possible to perform grafting techniques with intraoral donor sites such as chin, mandibular ramus, and maxillary tuberosity. Alternatively, in cases of total edentulous atrophic maxillary processes, the bone volume offered by these sites is insufficient for reconstruction. Thus, an extra-oral donor site that offers the option of complete maxillary reconstructions with enough bone to obtain the desired volume is required [5].

Both intraoral and extraoral bone grafting techniques present certain limitations and advantages worth considering. Harvesting grafts can lead to various complications, including postoperative pain, nerve injury, and scarring [5]. However, these risks are significantly reduced when the clinician possesses extensive surgical experience and anatomical knowledge. Autologous bone grafts offer the benefit of being rich in viable cellular components, delivering a sufficient volume of cortico-cancellous bone—an essential requirement for successful preprosthetic reconstruction [6]. When planning the construction of atrophic ridges for implant placement, it is critical to evaluate the extent and origin of bone loss. This ensures the formulation of an appropriate treatment plan to be able to increase both the height and the thickness of the alveolar process in the long-term [7].

Despite the numerous reported advantages of autografts, there is still limited evidence on the use of ulna bone as a donor site for intraoral ridge augmentation procedures [8,9]. Therefore, the main objective of this report is to describe a technique for regenerating the alveolar process in atrophic maxillae using ulna autograft in an outpatient setting for patients with systemic compromise, aiming for a successful prosthetic rehabilitation. Additionally, a review of the available evidence on the use of ulna grafts for reconstructing alveolar ridges is needed.

Case report

Type 2 diabetes, presented with the desire to regain the ability to eat through dental rehabilitation. Intraoral examination revealed total edentulism and a severely atrophic alveolar ridge, classified as Class IV according to Cawood and Howell [10] (Figure 1), with a clinically measured ridge thickness of approximately 3 mm. It was decided to perform the reconstruction of the alveolar process with an autologous anterior ulna bone graft type onlay, in order to place implants for their rehabilitation in a second surgical stage. All steps of the procedure and possible associated risks were explained to the patient, and an informed written consent was granted.

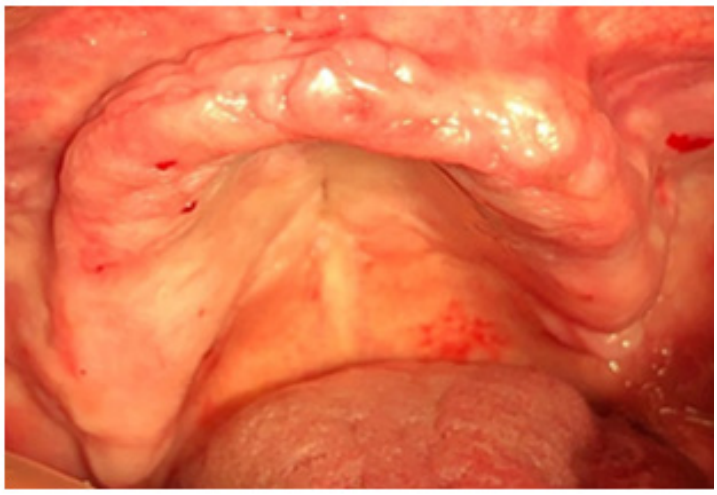

Figure 1: Intraoral clinical review, showing total anodontia of the upper maxillary.

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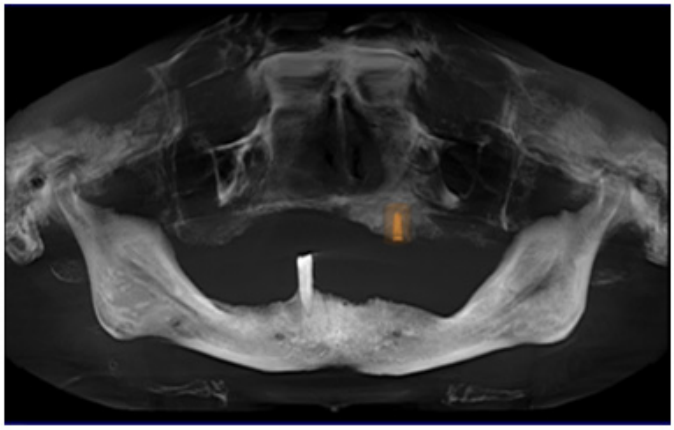


Figure 2: Tomographic diagnosis, showing atrophic alveolar process, where implant planning is shown in the only area where it is feasible to place it.

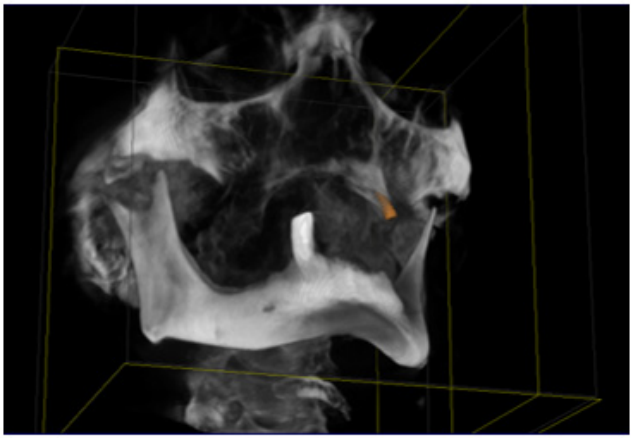


Figure 3: Skull tomography showing the direction of the implant in the densest bone area.

Surgical Technique of Ulnar Autograft in the maxilla

This reconstructive surgery was performed by a multidisciplinary team in an outpatient setting under local anesthesia. Four cartridges of 4% articaine (turbocaine, 4% articaine HCl, 1 : 100,000 epinephrine Aleaciones Dentales Zeyco, SA de C.) were administred throughout the maxilla and five cartridges of the same in the forearm region. A linear mucoperiosteal incision was made with a # 3 scalpel handle and a # 15 blade (B | BRAUN, Germany by Aesculap AG). Once the alveolar process was exposed, decortication of the vestibular cortex was performed, and hemostasis was achieved using gauze and bone wax (Ind and Com Brand, Ethicon). Subsequently, a linear approach to the forearm was made using a #3 scalpel handle with a #22 blade (BBRAUN AG, Germany) (Figure 4). Two blocks of cortico-spongy bone were harvested using a lowering piece and a long-stem carbide fissure bur under irrigation with physiological solution (Figure 5). A chisel and hammer were also employed during the process, yielding approximately 7 cc of graft material. The exposed forearm was sutured using simple continuous stitches with Vicryl #000 (Ind and Com Brand, Ethicon) (Figure 6). Cortical perforations were made to promote graft revascularization, and sharp edges of the bone blocks were smoothed under copious irrigation with sterile saline solution. In the surgical bed of the left maxillary quadrant, 0.5 cc of Bond Bone (SEVEN, Mis México) was applied due to extensive bone loss (Figure 7). Following this, the graft blocks were carefully positioned.

In both quadrants of the upper jaw, the graft blocks were secured using screws (SEVEN, Mis México) measuring 1.5 mm in diameter and 10 mm in length, oriented buccally along the alveolar process. Once the blocks were fixed, a cancellous graft was placed to achieve anatomical conformation of the alveolar ridge. A 0.3 mm collagen membrane (SEVEN, Mis México) was then positioned as both a shaper and stabilizer for the cancellous bone. To minimize graft exposure, the buccal mucosa was elevated and periosteal tension reduced. The area was subsequently sutured using simple stitches with Vicryl #000 (Ind and Com Brand, Ethicon) (Figures 8 & 9).

Figure 4: Exposure of the ulna bone of the left forearm.

Figure 5: Corticospongiosus bone block.

Figure 6: Sutured bone donor forearm.

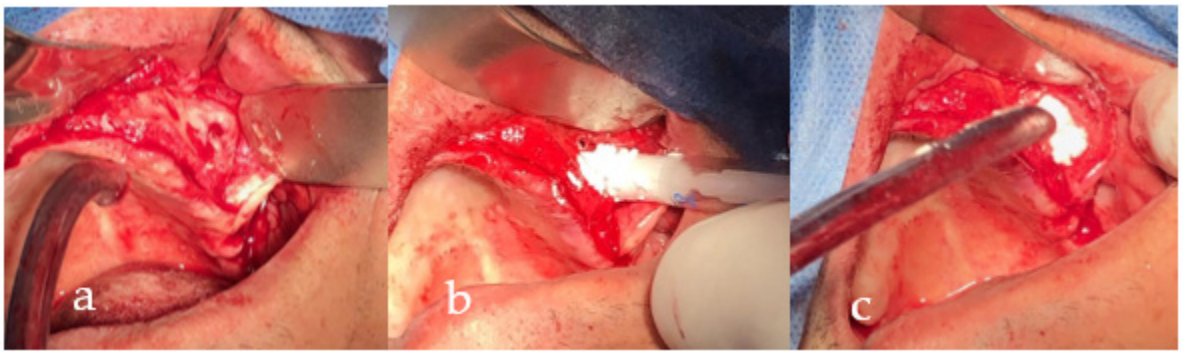


Figure 7: Exposure of the left alveolar ridge, direct placement of the Bond Bone and packing of the regenerative material.

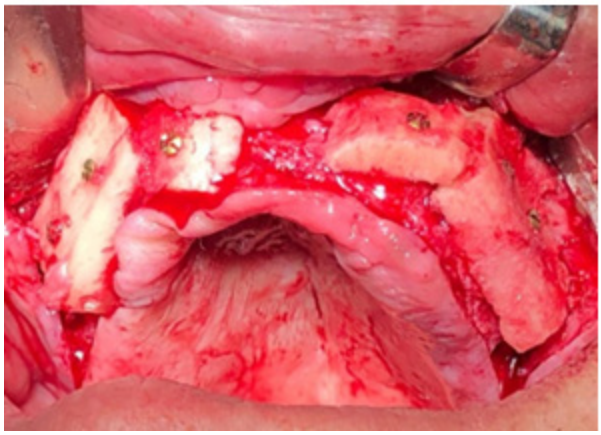


Figure 8: Bone graft fixed throughout the maxillary.

Figure 9: Fully sutured maxillary.

The surgery was completed successfully without postoperative complications. The patient was provided with comprehensive postoperative instructions, including avoidance of sun exposure and refraining from tooth brushing during the first 24 hours following surgery. Additional recommendations included avoiding bending, physical exertion, greasy, spicy, or hot foods, as well as alcoholic beverages and tobacco use. Antibiotic therapy was initiated with amoxicillin 300 mg. For pain management, sulindac was prescribed every eight hours for three days, or as needed. A follow-up appointment was scheduled one week after the procedure.

Implant Surgical Procedure

Four and a half months after graft placement (Figure 10), the patient was scheduled to place his implants. For this procedure, the entire maxillary region was anesthetized with seven cartridges of 4% articaine. A linear incision was made using a #3 scalpel handle

and a #15 blade (BBRAUN, Germany by Aesculap AG), exposing the grafted bone blocks and allowing removal of the fixation screws. During this procedure, partial detachment of one graft was observed due to failed osseointegration, necessitating its removal. To address this, fixation screws were repositioned into areas with successfully integrated bone (Figure 11). The surgical bed was irrigated with 12% chlorhexidine (Lacer, Spain) using a micromotor. Four implants were placed in the maxilla and six in the mandible. Healing screws were fixed using a submerged approach (Figure 12). Due to residual bone loss, a bone xenograft and a collagen membrane (SEVEN, Mis México), measuring 0.20 mm × 0.30 mm, were placed. The surgical site was closed using simple continuous sutures with Vicryl #000 (Ind and Com Brand, Ethicon) (Figure 12). Postoperative instructions were provided, and a computed tomography scan was scheduled to confirm implant positioning (Figure 13). The patient was prescribed amoxicillin 300 mg every 8 hours for 7 days and sulindac every 8 hours for 3 days as needed for pain control. An appointment was scheduled for impression taking and placement of the implant-supported prosthesis.

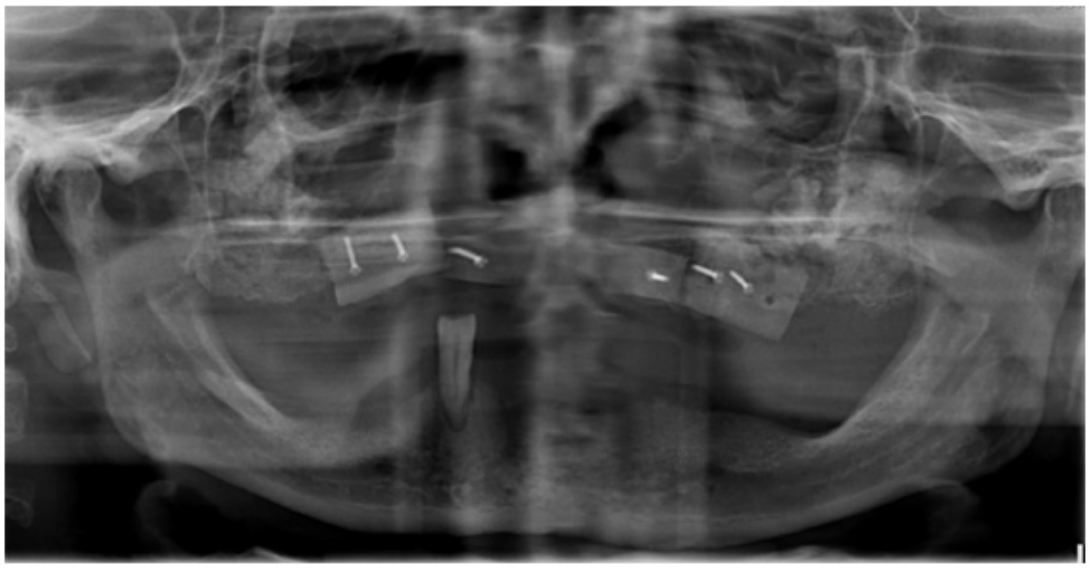
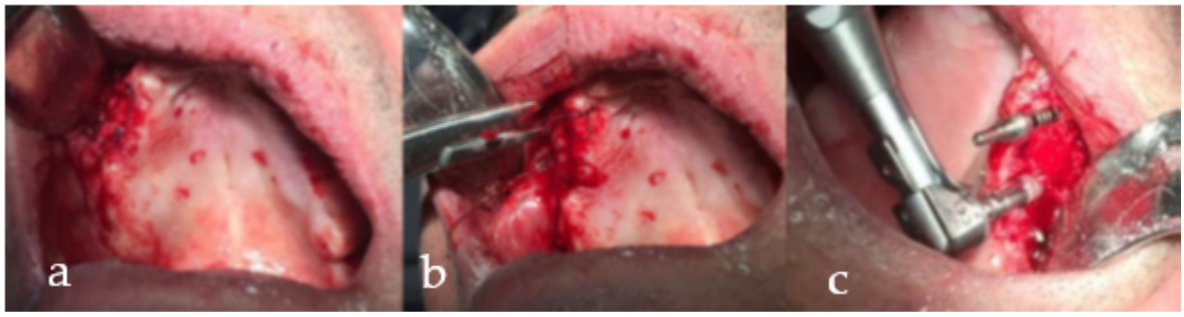


Figure 10: Panoramic radiograph showing anterior ulna bone graft blocks with fixation screws in the upper maxillary.



Figures 11: Detachment zone of non-Osseo integrated block, implants with healing screw in the right maxillary quadrant and implant placement in the left upper quadrant.

Figures 12: Placement of a healing screw in the left quadrant and bone graft, placement of a collagen membrane and closure of the surgical area in the edentulous upper maxillary.

Figure 13: Panoramic radiograph showing the four implants in the upper maxillary placed, as well as six in the lower jaw.

Discussion

In geriatric implantology, treatment planning must be highly individualized, as anatomical and physiological differences become more pronounced with age [11]. Three-dimensional cone beam computed tomography is a highly effective diagnostic and planning tool in minimally invasive implant surgery. From a surgical perspective, two critical factors must be considered when operating on elderly patients: the ongoing effort to minimize morbidity, and the increased prevalence of coexisting medical risk factors in this population [12]. Current literature identifies bone autografts as one of the most reliable and successful techniques for maxillary ridge reconstruction [13]. However, donor site morbidity has prompted many surgeons to seek the most efficient and least traumatic options, including the calvaria, tibia, rib, olecranon, anterior iliac crest, mandibular ramus, and symphysis [4,14,15]. Sjöström et al. highlighted that an onlay-type ulna bone graft allows for harvesting a substantial volume of cortical and cancellous bone, making it suitable for reconstructing the atrophic edentulous maxilla and providing sufficient volume for predictable implant placement [4].

In this clinical case report, an autologous bone graft was utilized-recognized as the gold standard for alveolar ridge augmentation due to its intrinsic osteogenic potential [16] and consistently high survival rate, regardless of donor site [17]. Ulna bone from the forearm was selected as the graft source, given its viability in providing cortico-cancellous bone conducive to optimal regeneration and early implant placement. This approach was particularly suitable considering the patient's advanced age and systemic conditions.

In systemically compromised individuals, complications can be more severe; therefore, a thoroughly updated clinical history is essential to formulate an appropriate treatment plan for outpatient management [18]. In this case, a lack of integration was observed in a portion of the graft placed in the right maxillary quadrant, which necessitated removal during implant placement to proceed with the surgical protocol.

Several factors may have contributed to the partial failure of graft osseointegration, including the patient's systemic condition and associated medications. Intraoperative management may also play a role, particularly the molding of the graft at the recipient site, which can prolong surgical time and require greater manipulation to ensure full coverage and attachment. Moreover, age-related vascular decline and a reduced population of osteoprogenitor cells at the donor site may limit cortical bone revascularization, increasing the risk of delayed healing or graft failure [19].

The implants were initially allowed to heal with a submerged approach for six weeks, followed by an additional six weeks of osseointegration prior to loading. This protocol was essential for achieving aesthetic and functional success, as bone contour, continuity, and volume restoration are key determinants of favorable implant outcomes [19].

The postoperative period was uneventful—no impairment of forearm muscle motility or nerve function was observed. The scar did not affect the patient's aesthetics and was outweighed by the substantial improvement in quality of life, especially dietary rehabilitation, which holds direct relevance for managing systemic conditions.

However, further clinical research is needed to evaluate the performance of various donor sites for ridge augmentation. In reviewing the literature specific to ulna graft use for maxillary defects, only three clinical reports were identified [20-22], underscoring the need for more robust evidence.

In cases where oral aesthetics carry greater significance, such as anterior sector implants following substantial bone loss, the ulna graft offers promising advantages. These include minimizing soft tissue resections and avoiding sensory disturbances to adjacent teeth, which are more common with intraoral harvesting. Although scarring and potential delays in forearm muscle motility may occur, the use of an extraoral donor site reduces complications such as facial neurosensory alterations.

Implant failure may also be closely linked to surgical technique, anatomical placement, and patient factors such as age, nutritional status, smoking, and alcohol consumption. These variables should be carefully considered in treatment planning to mitigate procedural risks.

Conclusion

Autografts offer significant advantages for the reconstruction of maxillary bone defects. These procedures can often be performed on an outpatient basis under local anesthesia in the dental chair, allowing the surgeon to carry them out successfully and efficiently. Therefore, the choice of donor site is typically left to the surgeon's discretion. Based on the clinical outcomes presented in this case report, it can be concluded that the anterior ulna autograft is a viable option for harvesting autogenous bone to reconstruct medium- to large-sized alveolar bone defects.

Data Availability Statement

The data presented in this study are available upon reasonable request from the author (C.E.C.-S.).

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

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