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Case Report

Case Report: Customized Subperiosteal Implants: Redefining Implantology and Rehabilitation in Severe Maxillary Atrophies

Freiman Álvarez Hurtado[1*]

[1]Dentist, Oral and Reconstructive Implantologist, Professor, Researcher, Clinician, Colombia

***Correspondence author:** Freiman Álvarez Hurtado, Dentist, Oral and Reconstructive Implantologist, Professor, Researcher, Clinician, Colombia; E-mail: drfreimanalvarez@gmail.com

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Abstract

In this case, the patient presented with severe atrophy of the maxillary ridge, making the use of conventional implants unfeasible. Faced with this challenge, a completely personalized approach was chosen. A high-resolution helical CT scan was performed, accurately capturing the remaining bone architecture.

Based on this analysis, a subperiosteal implant was digitally designed using CAD/CAM technology, with meticulous attention to detail to ensure a custom-made fit. The design was printed using stereolithography and subsequently manufactured in sintered titanium, a material that offers exceptional strength and biocompatibility.

During surgery, the implant was positioned on the cortical bone and secured with screws on the buccal and palatal sides, also taking advantage of the mechanical retention provided by the patient's bone morphology.

Rehabilitation was completed using a Toronto-type bar made of Trilor®, over which composite crowns fabricated extraorally were cemented using resin cement to ensure precision and long-term durability.

The outcome extended beyond technical success. It was possible to maintain the vertical dimension, restore masticatory function and re-establish the patient's aesthetics ultimately improving her confidence. Because, in the end, it is not just about bone and titanium; it is about improving lives.

Keywords: Maxillary Atrophies; Implant; Rehabilitation; Cortical Bone

Introduction

The rehabilitation of patients with severe maxillary atrophy represents one of the most demanding challenges in contemporary dentistry. Traditional implantology often proves insufficient when bone volume is critically compromised, leaving clinicians to explore alternative strategies that combine innovation, precision and patient-centered care. In such scenarios, the integration of advanced imaging, digital design and customized manufacturing technologies has transformed the way treatment plans are conceived and executed. Rather than relying on conventional implants, which may be unfeasible due to anatomical limitations, the use of subperiosteal implants designed through CAD/CAM workflows offers a tailored solution that respects the unique morphology of each patient [1,2].

This approach begins with high-resolution imaging, allowing for an accurate assessment of the residual bone structure. The digital environment then becomes the foundation for creating a personalized implant design, ensuring a precise fit and optimal stability. Once manufactured in biocompatible materials such as sintered titanium, the implant is surgically adapted to the cortical bone, secured with mechanical retention and complemented by prosthetic components that restore both function and aesthetics. Beyond the technical achievement, this methodology underscores a deeper commitment: restoring confidence, dignity and quality of life [3].

Case Presentation

A 68-year-old female patient, medically classified as controlled hypertensive, presented with a long history of edentulism. She had relied on a conventional mucosa-supported prosthesis for more than three decades, but expressed a clear desire to transition to fixed teeth in order to regain stability, comfort and confidence. Given the complexity of her condition, a meticulous diagnostic protocol was initiated. An intrahospital computed tomography scan was performed to achieve superior resolution and precise visualization of the residual maxillary structures. The data were processed in specialized planning software, including 3-matic, which enabled the digital design of a customized subperiosteal implant (Fig. 1-17, Table 1).

The implant was manufactured in Grade 23 ELI titanium, using sintering techniques to ensure mechanical strength. The internal surface underwent SLA treatment combined with acid etching, followed by high-quality sterilization to guarantee biocompatibility. Fixation screws were fabricated and strategically positioned on both palatal and vestibular aspects to maximize stability. For the prosthetic phase, a Toronto-type bar was produced in Trylor, serving as the framework for 3D-designed teeth generated with Exoplan. These crowns were fabricated outside the oral cavity and cemented extraorally to achieve precision. The final prosthesis was then cemented intraorally, occlusion was carefully adjusted and postoperative recommendations were provided to the patient [4,5].

Importantly, the entire procedure was completed in a single surgical intervention, thereby reducing biological cost and minimizing patient morbidity. The outcome not only restored masticatory function and aesthetics but also fulfilled the patient's long-standing wish for fixed dentition, significantly improving her quality of life [6-9].

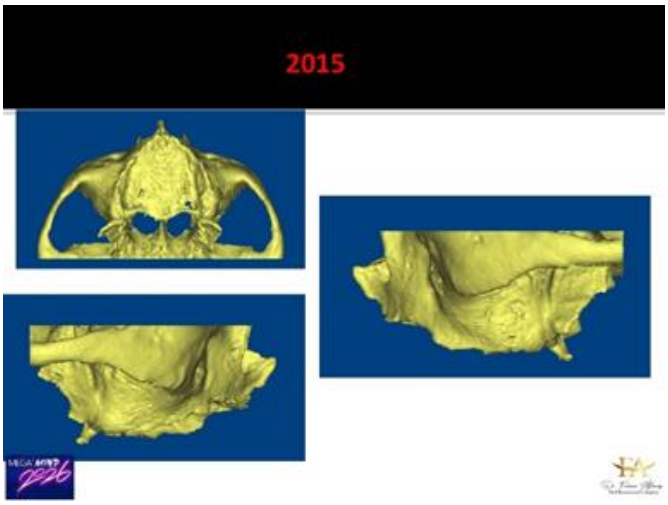

Figure 1: Full-scale printed stereolithographic model, occlusal view.

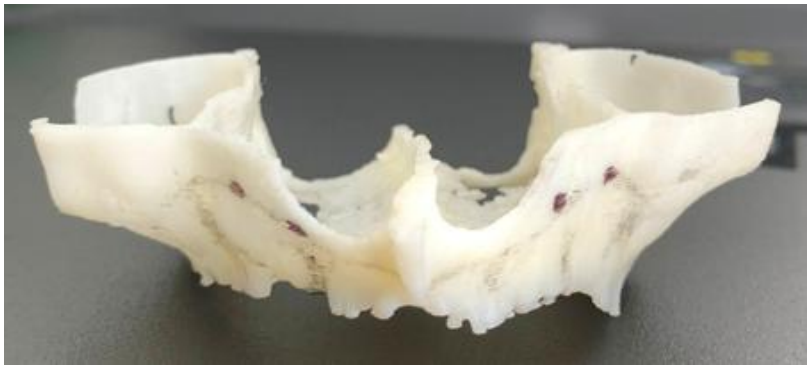

Figure 2: Full-scale printed stereolithographic model, front view.

Figure 3: Full-scale printed stereolithographic model.

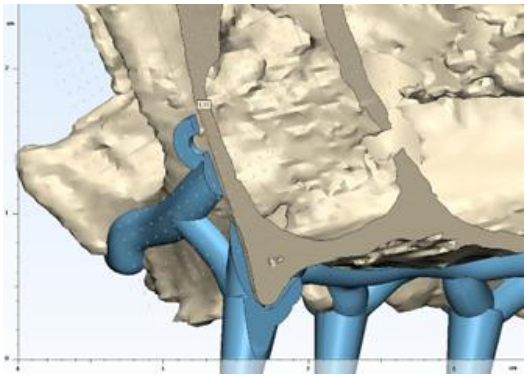

Figure 4: Implant design in the program (blue color?).

Figure 5: Implant printed on you. Sintered, adapted to the model, occlusal view.

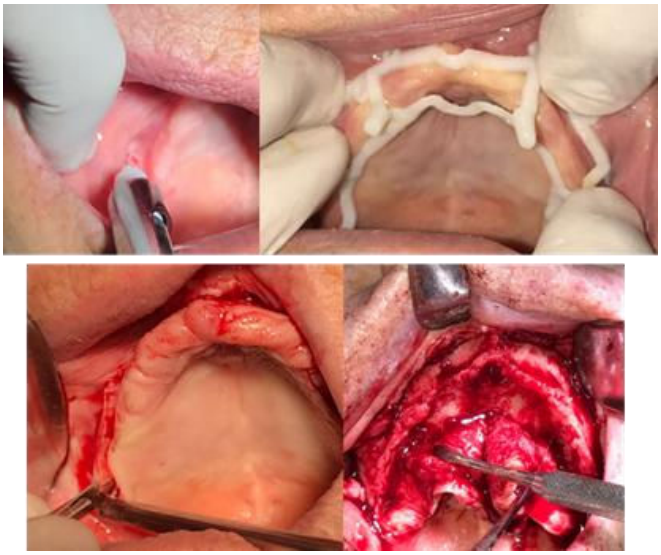

Figure 6: Demarcation in extension using PLA implant replica, bilateral full thickness flap lifting.

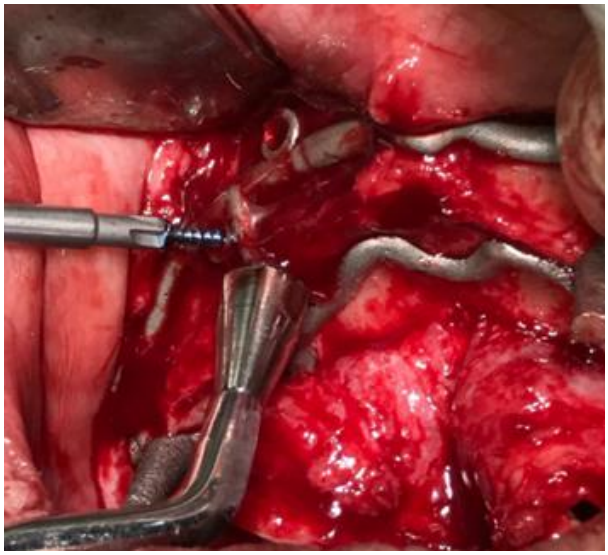

Figure 7: Adaptation of the implant to the bone architecture, lateral fixation with screws.

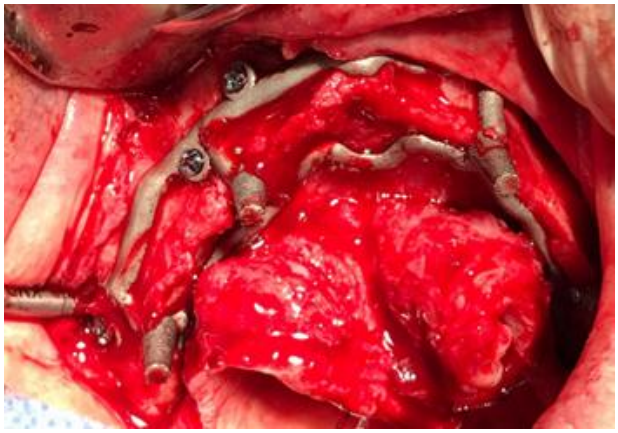

Figure 8: Suture with exposed struts in mouth.

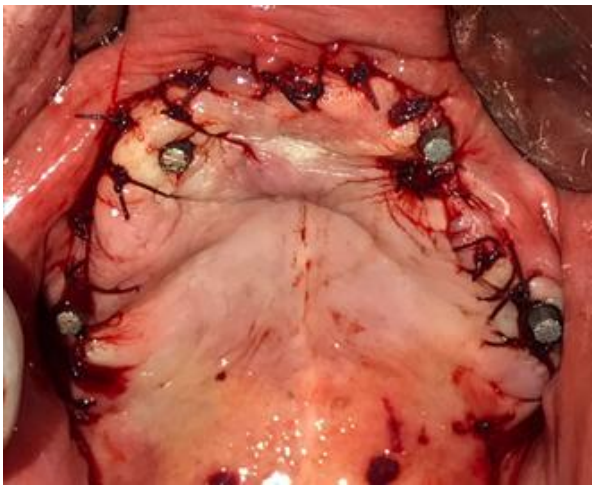

Figure 9: Suture with exposed struts in mouth.

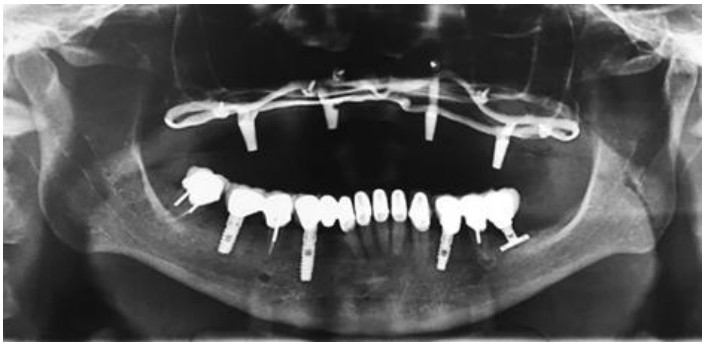

Figure 10: Panoramic X-ray.

Figure 11: Control photograph, 30 days.

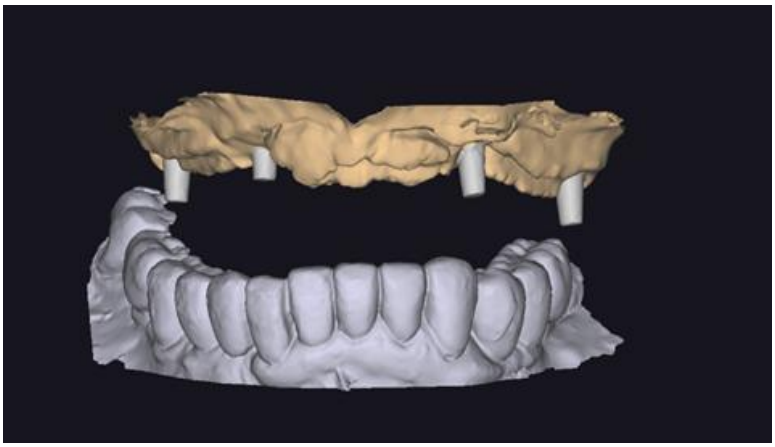

Figure 12: Scanner, upper and lower.

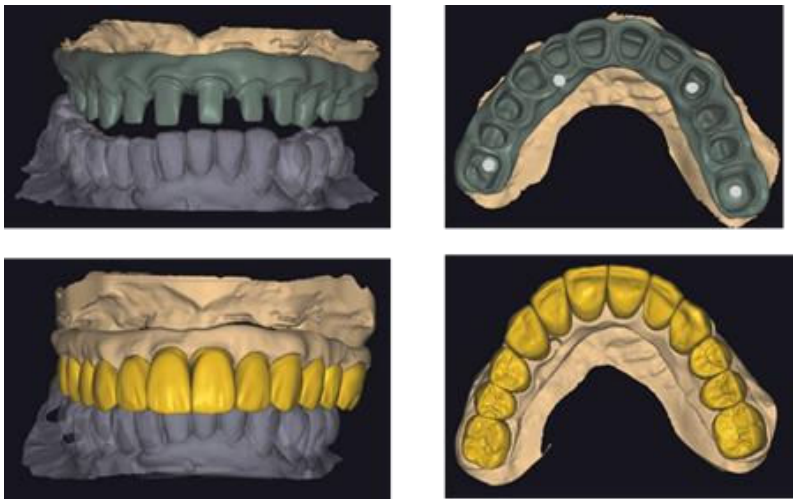

Figure 13: Design of the Toronto type bar in Trylor and teeth to be injected.

Figure 14: Milled bar and cementation of extraoral crowns.

Figure 15: Prosthesis cemented in the mouth, optimal olcussion.

Figure 16: Prosthesis cemented in the mouth, optimal olcussion, occlusal view.

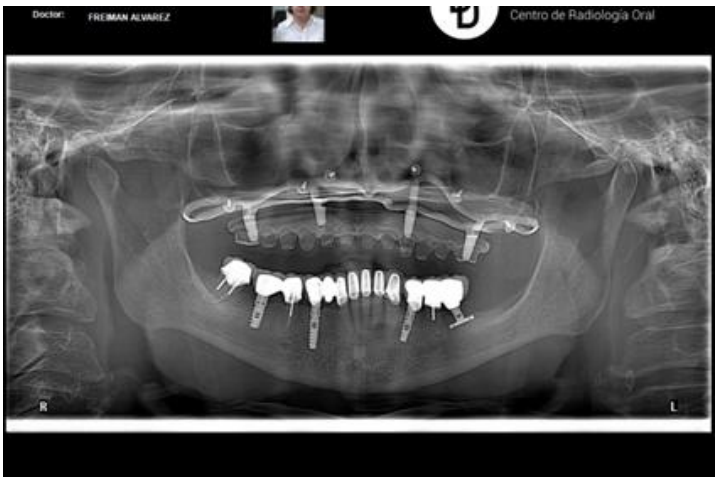

Figure 17: Control x-ray 10 years.

Parameter	Detail	Note
Patient Age	68 years	Controlled Hypertensión
Custom implant maxillary	Ti 23 degree	SLA, acid ectching
Fixing screws	Ti 5 degree	6 - 2mm x 4mm
Trylor Bar	Type Toronto	Cemented
Crown Type	Injected Composite	12 cemented

Table 1: Parameter details.

Discussion

The management of severe maxillary atrophy through customized subperiosteal implants highlights the evolution of dental rehabilitation from conventional approaches to highly individualized solutions. In this case, the decision to move beyond traditional mucosa-supported prostheses was driven not only by anatomical limitations but also by the patient's desire for fixed dentition after decades of functional compromise. The integration of advanced imaging, digital planning and precision manufacturing demonstrates how technology can bridge the gap between clinical challenges and patient expectations. The use of intrahospital CT scanning provided superior resolution, ensuring that the implant design was based on accurate bone morphology. Specialized software such as 3-matic allowed for a digital workflow that translated anatomical data into a tailored implant structure. Manufacturing in Grade 23 ELI titanium, combined with surface treatments like SLA and acid etching, enhanced biocompatibility and long-term stability. These technical refinements, together with optimal sterilization protocols, minimized biological risk while maximizing mechanical retention [7].

From a surgical perspective, completing the procedure in a single intervention reduced biological cost and patient morbidity, an important consideration in elderly individuals with systemic conditions such as controlled hypertension. The prosthetic phase, involving Trylor bars and Toronto-type frameworks, further emphasized precision and durability, while extraoral cementation of 3D-designed crowns ensured accuracy in occlusion and aesthetics.

Beyond technical success, the case illustrates a broader principle: modern implantology must align functional rehabilitation with emotional and psychological outcomes. Restoring fixed teeth provided not only improved mastication and vertical dimension but also renewed confidence and quality of life. This reinforces the idea that advanced digital dentistry is not solely about materials and mechanics, but about delivering human-centered care through innovation [8,9].

Conclusion

This clinical case demonstrates how the convergence of advanced imaging, digital planning and customized manufacturing can redefine treatment possibilities for patients with severe maxillary atrophy. By moving beyond the limitations of conventional prostheses, the team was able to design and deliver a subperiosteal implant that responded precisely to the patient's anatomical and functional needs. The workflow from intrahospital CT scanning to CAD/CAM design, titanium sintering, surface treatment and prosthetic fabrication illustrates a seamless integration of technology and clinical expertise. The single-stage surgical approach minimized biological cost and reduced patient morbidity, while the prosthetic phase restored both function and aesthetics with remarkable accuracy. Importantly, the rehabilitation was not only a technical success but also a human achievement: the patient regained fixed dentition after decades of compromise, experiencing renewed confidence and improved quality of life.

This outcome underscores a broader principle in modern dentistry: innovation must serve the individual, combining precision engineering with compassionate care. The case highlights that true progress lies not merely in the materials or methods employed, but in the capacity to transform lives through solutions that are both scientifically rigorous and deeply human-centered.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Acknowledgement

None.

Data Availability Statement

Not applicable.

Ethical Statement

The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Informed Consent Statement

Informed consent was taken for this study.

Authors' Contributions

All authors contributed equally to this paper.

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