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Flapless Approach and Digital Workflow in the Implant-Prosthetic Rehabilitation of the Maxillary Arch Using Electrowelded One-Piece Implants and a Two-Stage Implant in the Tuber Region: 6-Year Clinical Follow-Up

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ABSTRACT

Implant rehabilitation of the maxillary arch represents a clinical challenge due to the poor quality of maxillary bone and its anatomical complexity. This article describes a clinical case of full-arch maxillary rehabilitation performed flaplessly using a combination of grade 3 titanium one-piece implants, bent and stabilized through intraoral electrowelding, along with a posterior two-stage implant placed in the tuberosity region. The 6-year clinical and radiographic follow-up demonstrated implant stability, absence of biological complications, and satisfactory prosthetic function.

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Introduction

Implant rehabilitation of the edentulous maxillary arch (Figure 1), whether immediate or delayed loading, requires accurate planning (Figure 2), especially when a flapless technique is preferred. One-piece implants, combined with intraoral electrowelding using a syncrystallizer, represent a valid option for achieving immediate arch stabilization. The objective of this paper is to present a clinical case treated with this technique, without raising a surgical flap, integrated with a posterior two-stage implant to bypass the maxillary sinus, thereby avoiding invasive surgical procedures such as lateral or crestal sinus lifts. The final prosthesis was supported by a series of chrome-cobalt meso- and suprastructures.

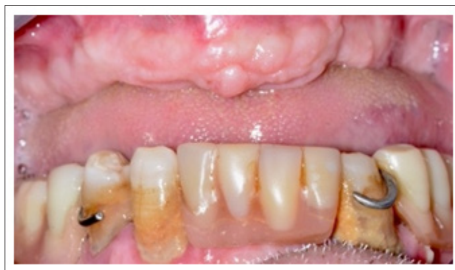

Figure 1: Edentulous Upper Jaw

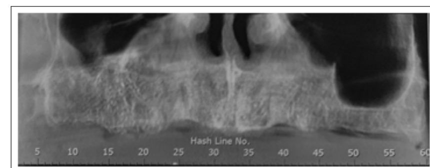

Figure 2: Tc Cone Beam Panorex

Materials and Methods

A male patient with an edentulous maxilla underwent flapless implant surgery with the insertion of grade 3 titanium one-piece implants (Figure 3), without incisions or flap elevation [1-5]. The implants were placed (Figure 4) following Garbaccio's "bicorticalism" principle, essential for ensuring primary (mechanical) and secondary (biological) stability. The implants were then bent using a manual driver, moving the coronal portion in a single bucco-palatal direction to follow the maxillary anatomy and achieve appropriate prosthetic parallelism. A control radiograph was taken (Figure 5).

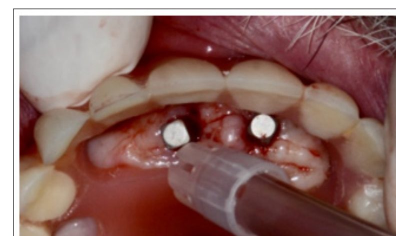

Figure 3: Use of the Surgical Guide

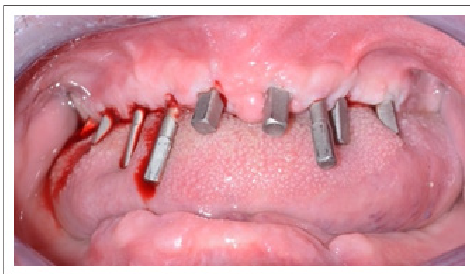

Figure 4: Flapless Implant Placement

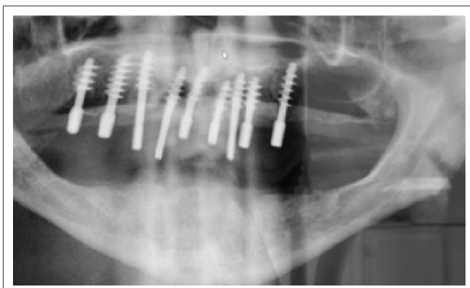

Figure 5: Rx Check Before Welding the Titanium Bar

Intraoral electrowelding (Figure 6) was performed using the Mondani syncrystallizer, connecting a grade 3 titanium bar at the coronal-cervical portion of the implants to maintain stability (Figure 7), particularly during the critical 3-4 week postoperative period when bone remodeling can physiologically reduce implant stability. In the same surgical session, the surgical stent was relined and refined, transformed into a resin provisional prosthesis (Figure 8), and immediately cemented onto the implant abutments and the electrowelded bar [6-11].

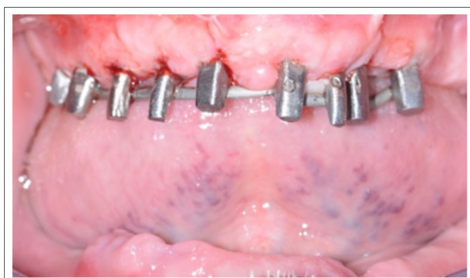

Figure 6: Electro-Welded Titanium Bar

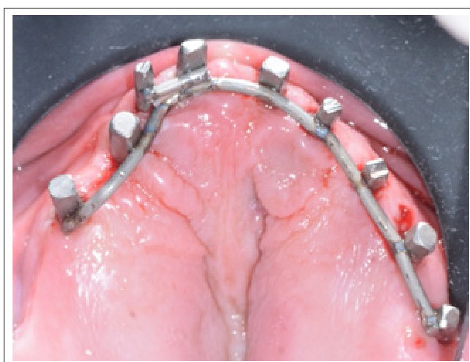

Figure 7: Double Titanium Bar on Elements 1.1 And 1.2

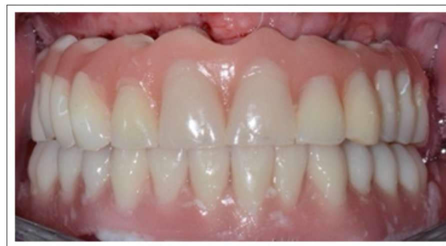

Figure 8: Surgical Template Transformed into a Cemented Temporary Prosthesis in the Same Surgical Session

In the left maxillary tuberosity region, where anatomical conditions did not allow the placement of a one-piece implant, a two-stage implant was placed (Figure 9, 10, 11), left submerged for four months before loading [12-15].

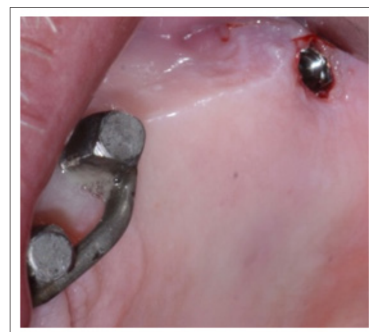

Figure 9: Flapless Insertion of a Biphasic Implant in the Tuberal Implant

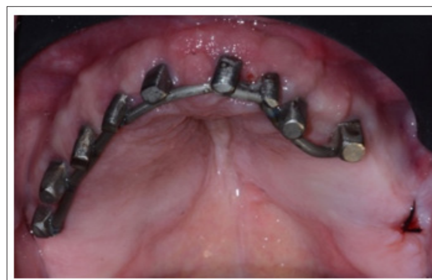

Figure 10: Flapless Insertion of a Biphasic Implant in the Tuber Area

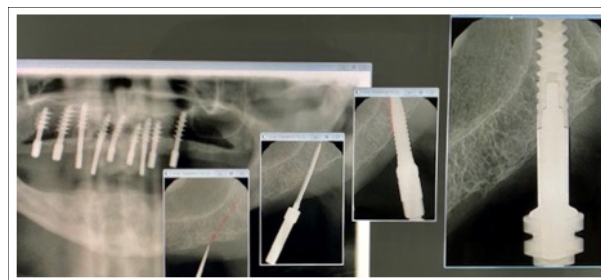

Figure 11: X-ray Monitoring of Implant Insertion in the Tuber Area

After four months, a first digital impression (Figure 12) of the cemented prosthesis was taken and archived. The provisional prosthesis and the electrowelded bar were then removed (Figure 13, 14). Following clinical and radiographic confirmation of complete osseointegration of all implants, the definitive prosthesis was fabricated: an overdenture with a chrome-cobalt mesostructure,

onto which a counter-milled conometric bar was constructed. A prosthesis with composite denture teeth and gingival tissue was built on top [16-18].

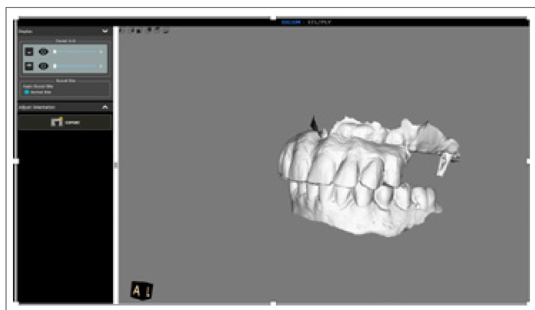

Figure 12: First Impression with Provisional

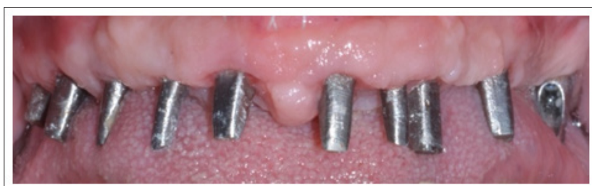

Figure 13: Decommissioning of the Bar, Individual Control of Implant Stability and finishing of the Abutments

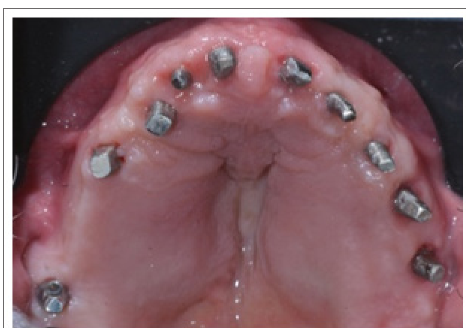

Figure 14: Peri-Implant Soft Tissue Control

The clinician took a digital impression of the implant abutments and jaw relation using a hemi-prosthesis and intraoral scanner, which was imported into the lab's model builder software (Figure 15, 16). Before taking the impression, the peri-implant soft tissues were carefully evaluated (Figure 17, 18, 19).

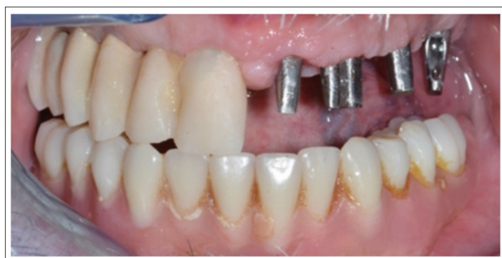

Figure 15: Provisional to Detect Occlusion with Oral Scanner

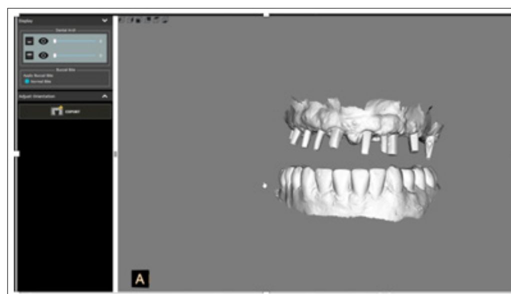

Figure 16: Impression of the Stumps with Detection of the Joint Space

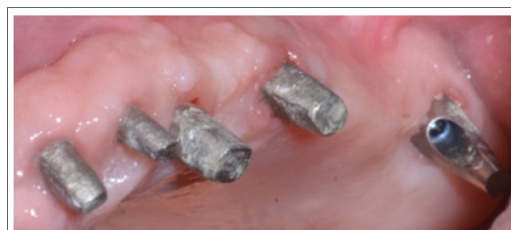

Figure 17: Peri-Implant Soft Tissue Control

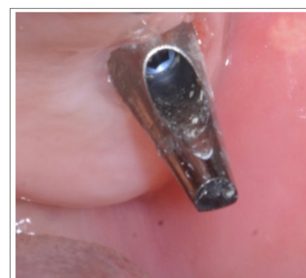

Figure 18: Soft Tissue Control Around the Biphasic Implant

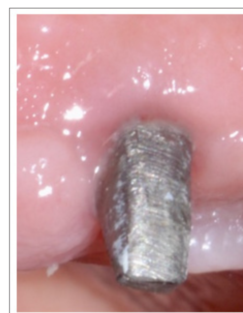

Figure 19: Soft Tissue Control Around the Monophasic Implant

A polyurethane resin prototype was then 3D printed to allow esthetic-functional evaluations intraorally, and a printed model was created to assess the 3D spatial position of the implant abutments (Figure 20, 21) [19-21].

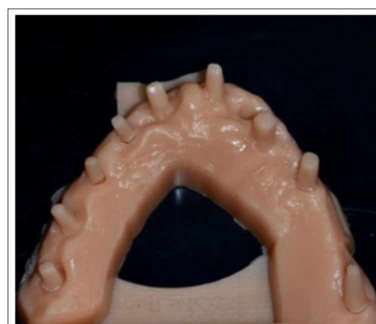

Figure 20: 3D printing of the STL file

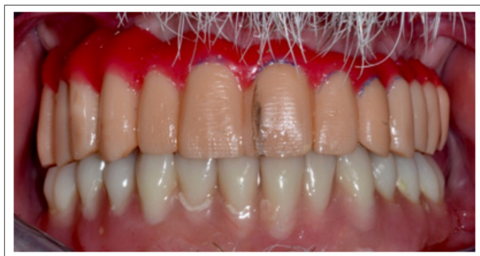

Figure 21: Prototyped Resin Ceck

After making the necessary adjustments and validating the prototype, it was scanned, and the primary bar was digitally designed using a subtractive process (Figure 22) and milled from chrome-cobalt (Figure 23).

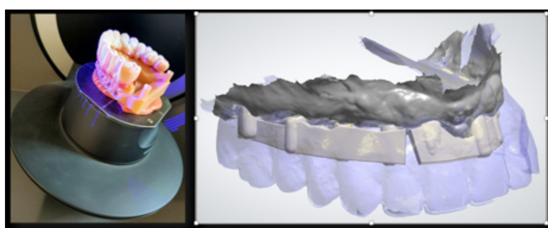

Figure 22: Modeling of the Bar by Subtraction

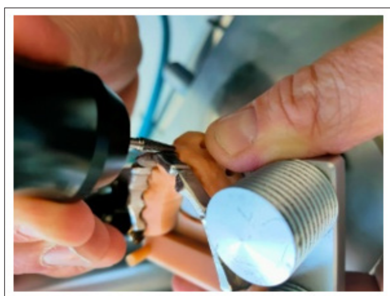

Figure 23: Aluminium Bar Test

The bar was milled at a 6° taper following the conometric principle and cemented onto the one-piece abutments, replacing the intraoperative electrowelded bar (Figure 24). This primary bar allowed both the splinting of the one-piece implants and, through the creation of the secondary structure, the application of the Roman arch principle in dissipating occlusal and lateral forces-contributing to longer-term preservation and clinical longevity of the implants [19,20].

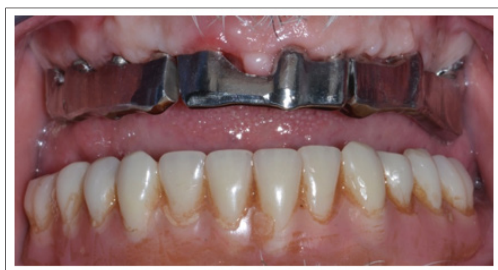

Figure 24: Chromium/Cobalt Bar Test

An aluminum prototype of the secondary structure was milled, on which a try-in was performed using commercially available composite teeth (Figure 25), allowing verification of the proper intraoral fit between the primary and secondary components.

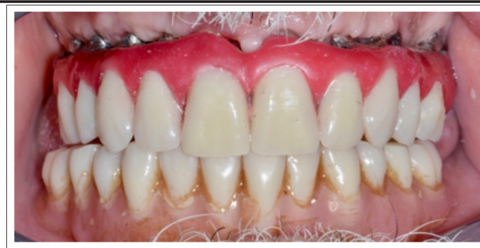

Figure 25: General Test of the Teeth

Once the try-in was validated, it was scanned in the lab and the secondary framework was produced using a laser melting process in chrome-cobalt (Figure 26), with pivot elements corresponding to the teeth.

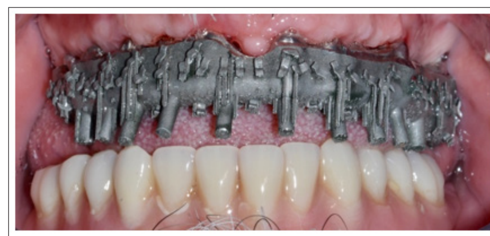

Figure 26: Testing of the Superstructure in Laser-Melting

The composite teeth were bonded to the framework using a composite resin cement, and the prosthesis was finalized with a polyceramic composite (Figure 27, 28).

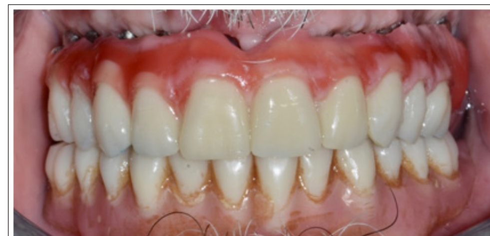

Figure 27: Finished Work with Composite Teeth and Gums

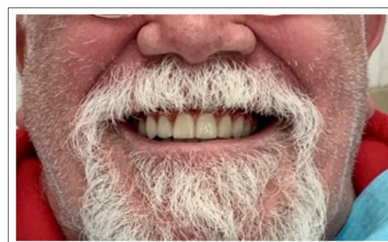

Figure 28: Photo Final

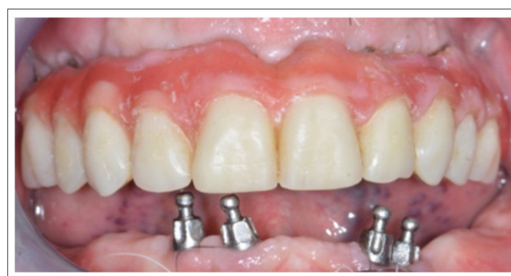

Figure 29: Clinical Monitoring of the Upper Rehabilitation After 6 Years

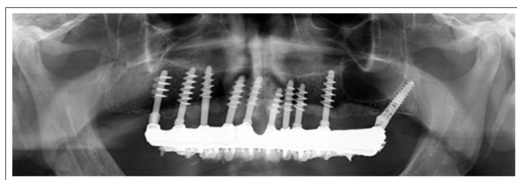

Figure 30: Six Year X-Ray Check

Results

The patient was followed clinically and radiographically over a six-year period. All implants maintained osseointegration, with no signs of peri-implantitis or significant bone loss (Figure 29, 30). Thanks to the use of the electrowelded bar and, subsequently, the cementation of a milled 6° bar, none of the implants exhibited the typical "resorption cone" commonly seen in two-stage techniques. The prosthesis remained stable and functional over time, with high esthetic and functional satisfaction reported by the patient. No major mechanical or biological complications were recorded.

Discussion

The use of one-piece implants with intraoperative electrowelding allows for immediate and rigid primary stabilization, a favorable condition for osseointegration. The rigidity of the splinted unit compensates for the typical drop in stability due to bone remodeling in the weeks following surgery.

The integration of a two-stage implant in the posterior region made it possible to utilize the available bone volume in the tuberosity, improving occlusal load distribution and enhancing resistance to osteo-neuromuscular forces-especially during oropharyngeal swallowing phases. The adopted prosthetic solution provided satisfactory esthetics and excellent long-term function. Functional restoration was particularly supported by the presence of posterior implants, crucial for counteracting the forces generated by the masseter, temporalis, and pterygoid muscles.

Conclusions

The combination of electrowelded one-piece implants, a posterior two-stage implant, and a bar-supported prosthesis represents an effective strategy for the implant-prosthetic rehabilitation of the maxillary arch. The flapless approach reduced postoperative pain and edema, typical of open-flap procedures. The six-year follow-up confirms the biological and prosthetic reliability of this technique.

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