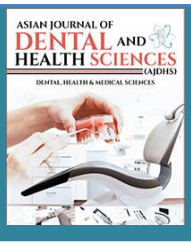

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Open Access Short Communication

Subperiosteal Implant Distortion After Surgical Placement: A Case Report

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Abstract

Subperiosteal implants provide a valuable treatment option to patients with severely atrophic ridges when conventional implant therapy is not possible. This type of reconstruction has a history of well-documented biological and mechanical complications. This can result in removal of the implant and concomitant destruction of the surrounding bone. The use of subperiosteal implants have made a return to the market due to advancements in technology such as the use of virtual surgical planning (VSP) and improved surgical techniques, yet problems persist. One area of interest involves the deformation of the implant during surgical placement. Prior to treating the patient presented in this case report, the authors observed clinically significant misfit of the prefabricated prosthesis. This finding was perplexing because the fit of the interim prosthesis was confirmed prior to surgical placement. This case report demonstrates the distortion of a subperiosteal implant before and after placement, and possible solutions to prevent this distortion. To date, the authors are unaware of any publications about pre- versus post-placement distortion of subperiosteal implants.

Keywords: Dental implants, Edentulism, subperiosteal implants, virtual surgical planning (VSP)

INTRODUCTION

Endosseous implants tend to be the dental implant of choice for replacing missing teeth, however some cases require a different type of implant design due to severely resorbed ridges.[1] In 1943, Dahl was the first to describe the use of subperiosteal implants to restore atrophic ridges.[2] Subperiosteal implants are placed between the periosteum and the alveolar crest, held in place by the mucoperiosteum instead of anchored into the bone like endosseous implants.[1] Historically, oral rehabilitation using subperiosteal implants was fraught with complications, to include infections, framework exposure, and mobility, each potentially leading to implant failure.[3] These complications arose from a combination of compromises that were necessary to design, fabricate, and surgically place subperiosteal implants prior to advancements in technology (imaging and manufacturing), biomaterials, surgical techniques, and prosthetic procedures.[4] Due to the rapid advancements in technology, especially 3D printing, there has been an invigorating re-emergence of subperiosteal implants.[5]

This once controversial treatment option for atrophic ridges has been applied to the rehabilitation of extremely compromised and complex clinical situations, such as immediate surgical obturation.[6] Even though there has been wide-range acceptance for rehabilitation utilizing subperiosteal implants, this treatment option still has a high rate of complications. In a six-year follow-up of 36 cases, Onica et al. concluded that only 25% of patients rehabilitated with subperiosteal supported hybrid prostheses were successful, meaning free of complications.[7] The exploration of subperiosteal use is further justified by Goh's 2025 review, who concluded subperiosteal implants as an acceptable alternative when endosseous implants are not possible.[1] A systematic

review by El-Sawy and Hegazy in 2024 looked at 302 cases with a success rate of 87.7% and a survival rate of 95.3%.[8] The authors claimed that advancements in digital technology have made subperiosteal implants a treatment option for those with severe bone resorption.[8] The authors also state that the following factors were critical to the success of these prostheses: correct design, surgical procedures, prosthesis placement, patient selection, and maintenance.[8] This article focuses on one complication that has not been thoroughly investigated – distortion of the subperiosteal implant during surgical placement. This case report shows the fabrication of a verification jig using the pre-surgical framework and the inability to verify passivity after surgical placement of the same subperiosteal framework.

CLINICAL REPORT

A 64-year-old female presented to the dental clinic for prosthodontic rehabilitation with failing dentition. The treatment included extraction remaining natural dentition and rehabilitation with complete removable dentures. After extractions, healing, and delivery of complete dentures, the patient was not satisfied with the retention of the maxillary complete denture. Following clinical and radiographic evaluation (panoramic radiograph and CBCT), it was determined that the patient had an insufficient amount of bone for traditional root form endosseous dental implants (Fig. 1). Multiple surgical options were discussed to include buccal bone augmentation in conjunction with sinus floor elevation, but the extent of augmentation was not suitable for an endosseous implant retained prosthesis. The surgical and restorative teams and the patient decided that a subperiosteal type of implant would be a suitable alternative. CBCT data was used to initiate the design of the subperiosteal implant (IPS Implant, Preprosthetic, KLS Martin). Using virtual surgical planning, the extension of the subperiosteal implant onto the maxilla and associated positions for surgical fixation were made (Fig. 2). Surgical and restorative teams consulted on the proposed design, made the necessary modifications, and agreed to the final design.

In addition to the subperiosteal framework, a screw retained PMMA full arch interim prosthesis was fabricated. This allowed for proper design and orientation of the MUA abutments to be seated under the prosthesis at the correct OVD immediately after implant placement. A stone implant verification jig of the unstressed subperiosteal implant was fabricated (Fig. 3). This jig was fabricated using multi-unit abutment replicas (Nobel Biocare) imbedded into type-IV dental stone (Peach ResinRock, WhipMix). This verification showed an intimate fit of all implant-abutment connection when the subperiosteal implant was in an unstressed state. (Fig. 4). Additionally, the prefabricated PMMA full-arch prosthesis showed the same intimate connection as the verification jig (Fig. 5)

Surgical placement of the subperiosteal implant was performed in the operating room. This procedure consisted of a full maxillary arch crestal incision from tuberosity to tuberosity. Consistent with the VSP, no bony reduction was indicated or performed. The fit of the printed titanium subperiosteal implant was verified visually, fixation screw sites were predrilled, and fixation screws were placed according to the manufacturer's recommendations. No distortion of the framework was observed during the surgical placement of the subperiosteal implant, and the interim prosthesis was attempted to be verified for fit. Upon seating of the prosthesis, there was a perceivable misfit. It was determined that when the subperiosteal implant was fixated upon the maxilla, the titanium structure had slightly distorted, which could only be perceived when the prefabricated prosthesis was placed on the MUA abutments. This misfit necessitated the misaligned area to be trephined out of the prosthesis and a new temporary multi-unit coping (Nobel Biocare) was picked up and incorporated into the prosthesis with auto-polymerizing acrylic (Quick Up, VOCO GmbH). This procedure allowed the prosthesis to be passively secured to the framework. The remainder of the surgery proceeded as planned, and the patient left the surgical area with both implant and prosthesis in place with no other complications (Fig. 6).

After 3 months of healing, the verification jig was used to assess the pre-surgical abutment orientation. Upon insertion and evaluation with the one-screw test, it was noted that verification jig was unable to be fully seated (Fig. 7). In order to record the new abutment orientation, the stone was sectioned into four components and secured with auto-polymerizing acrylic (Quick Up, VOCO GmbH) (Figs. 8 and 9). This reconnected jig verified accuracy and was used to proceed with the final prosthesis fabrication (Fig. 10).

Figure 1: Pre-operative panoramic radiograph.

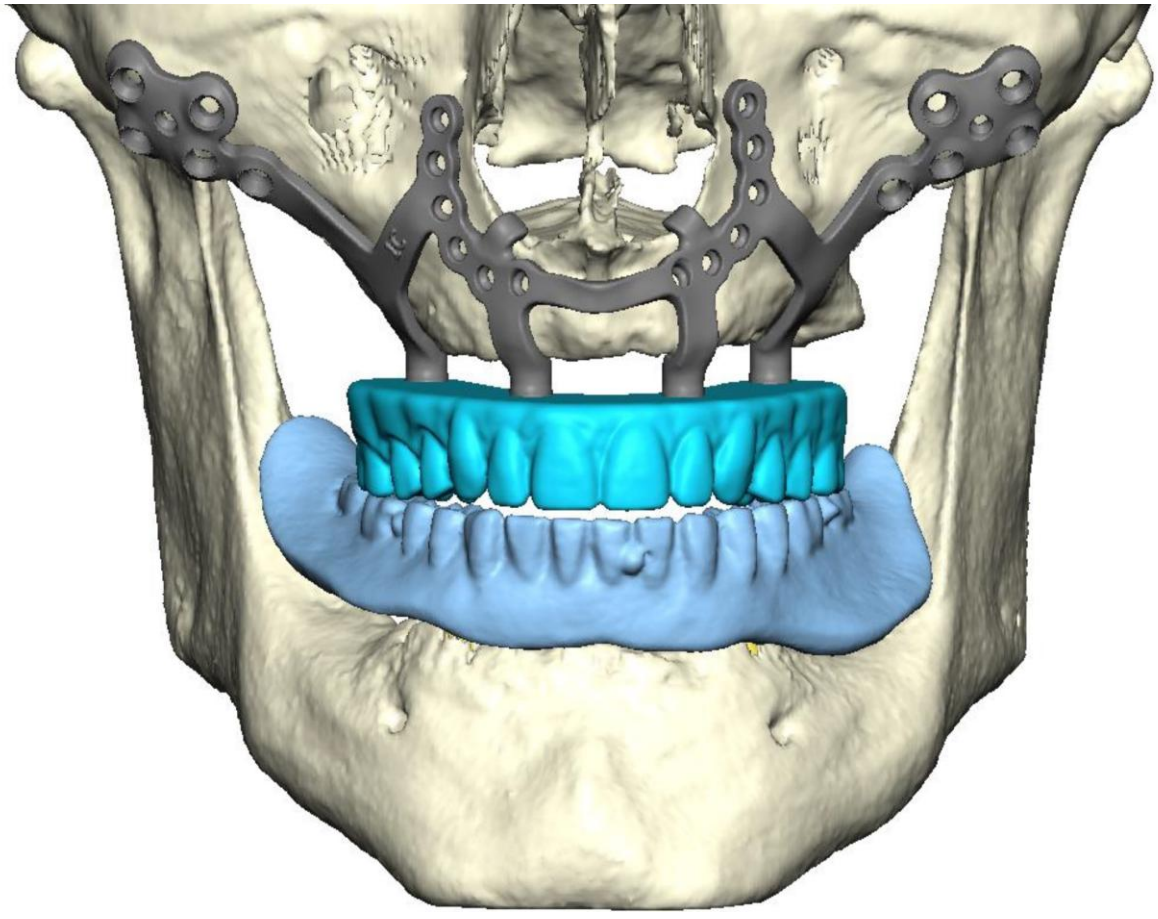

Figure 2: Patient's atrophic maxillary ridge and Virtual Surgical Plan of KLS Martin subperiosteal implant.

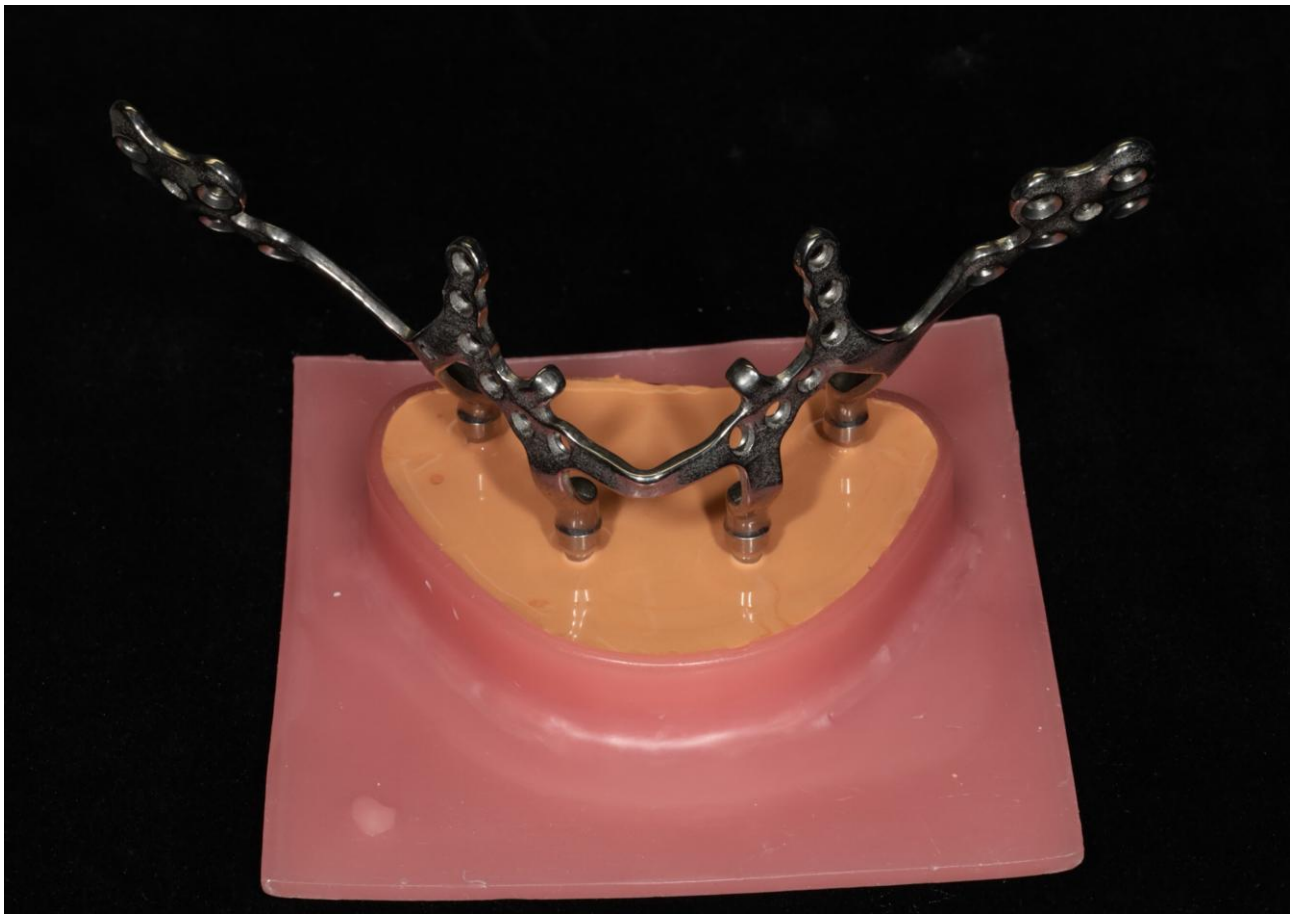

Figure 3: Fabrication of verification jig when the framework is in an unstressed state.

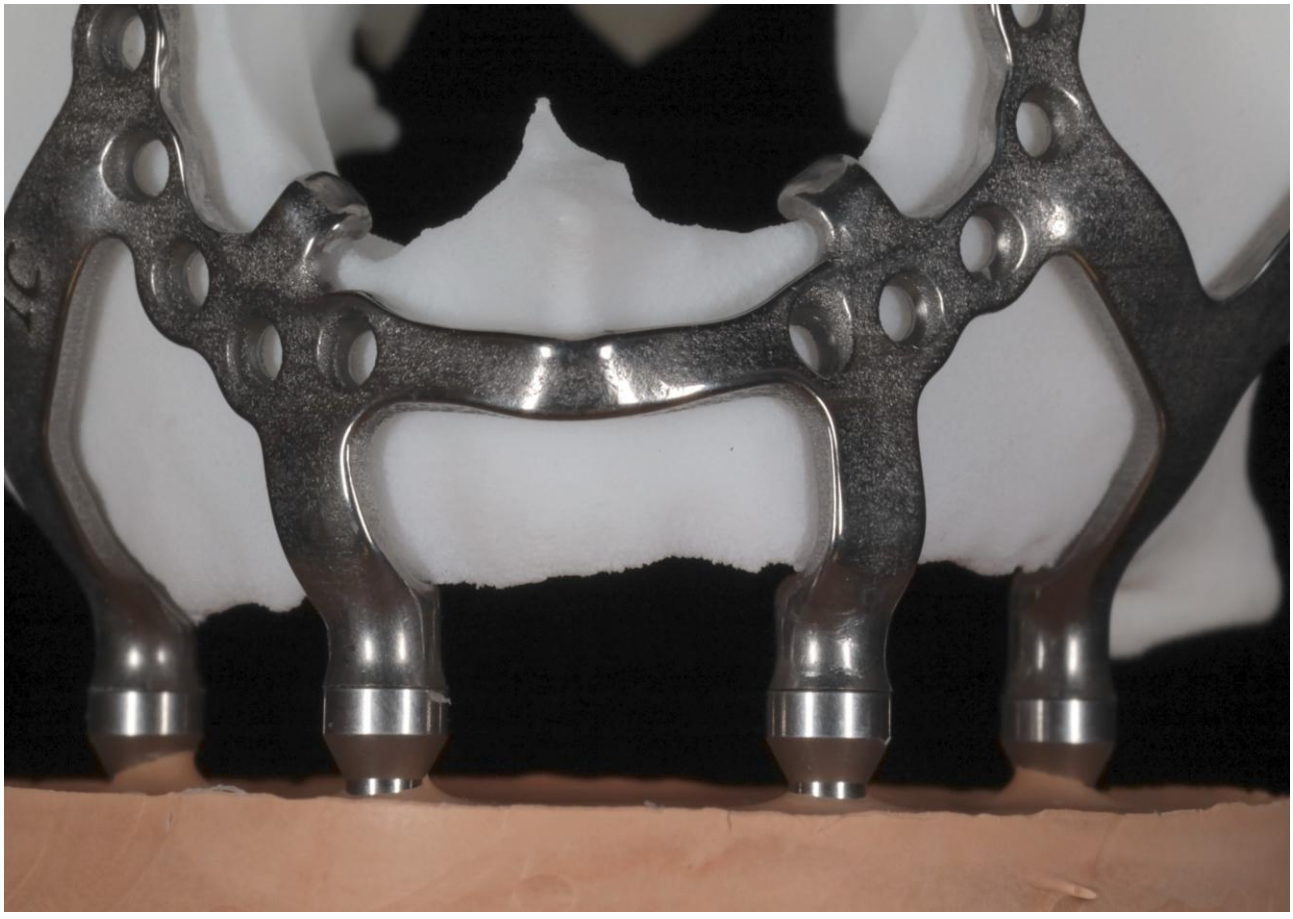

Figure 4: Verification of implant-abutment connection prior to surgical placement of subperiosteal framework.

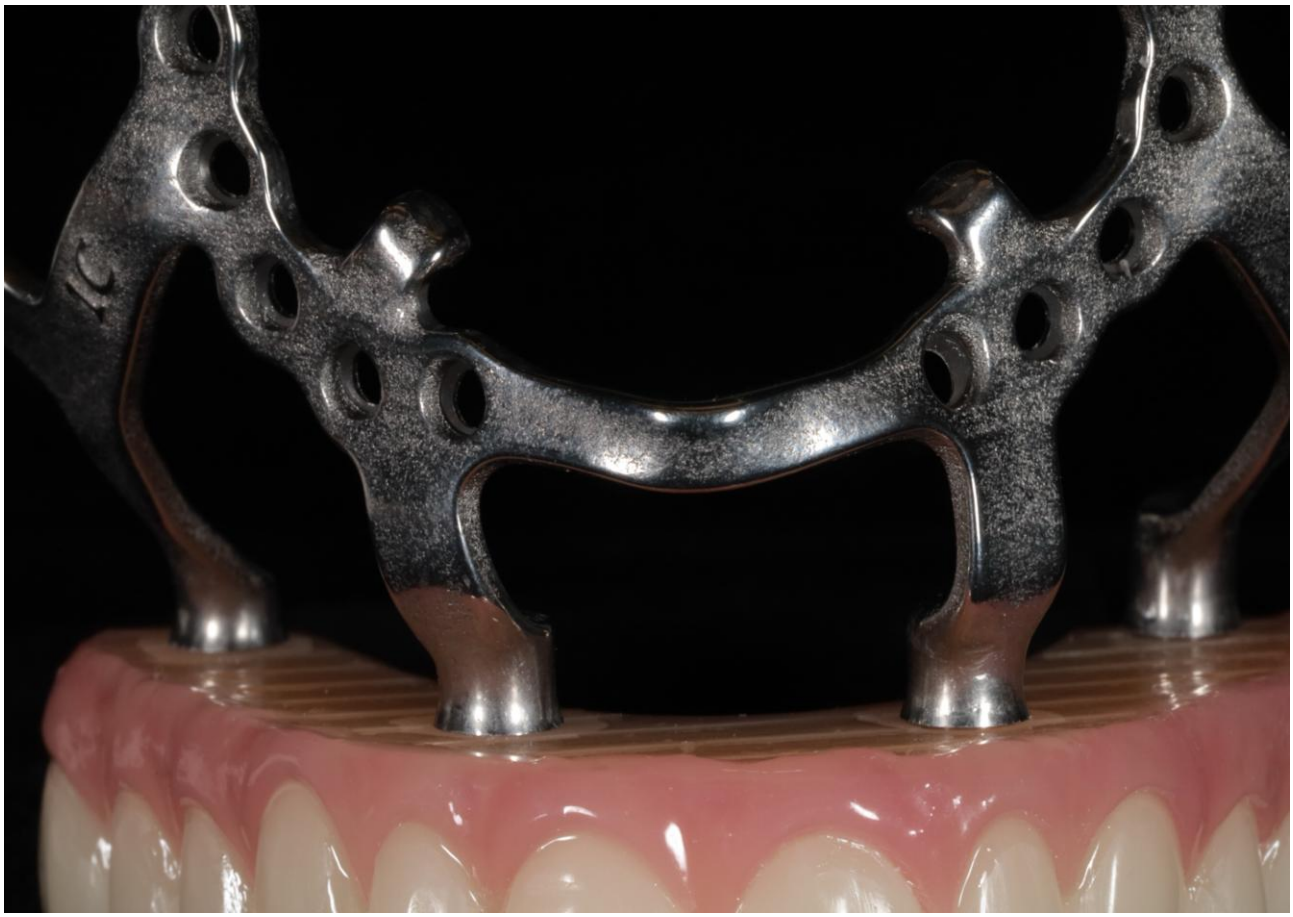

Figure 5: Observation of the intimate fit between the prefabricate interim prosthesis and the titanium framework.

Figure 6: Post surgical panoramic showing subperiosteal implant and interim prosthesis.

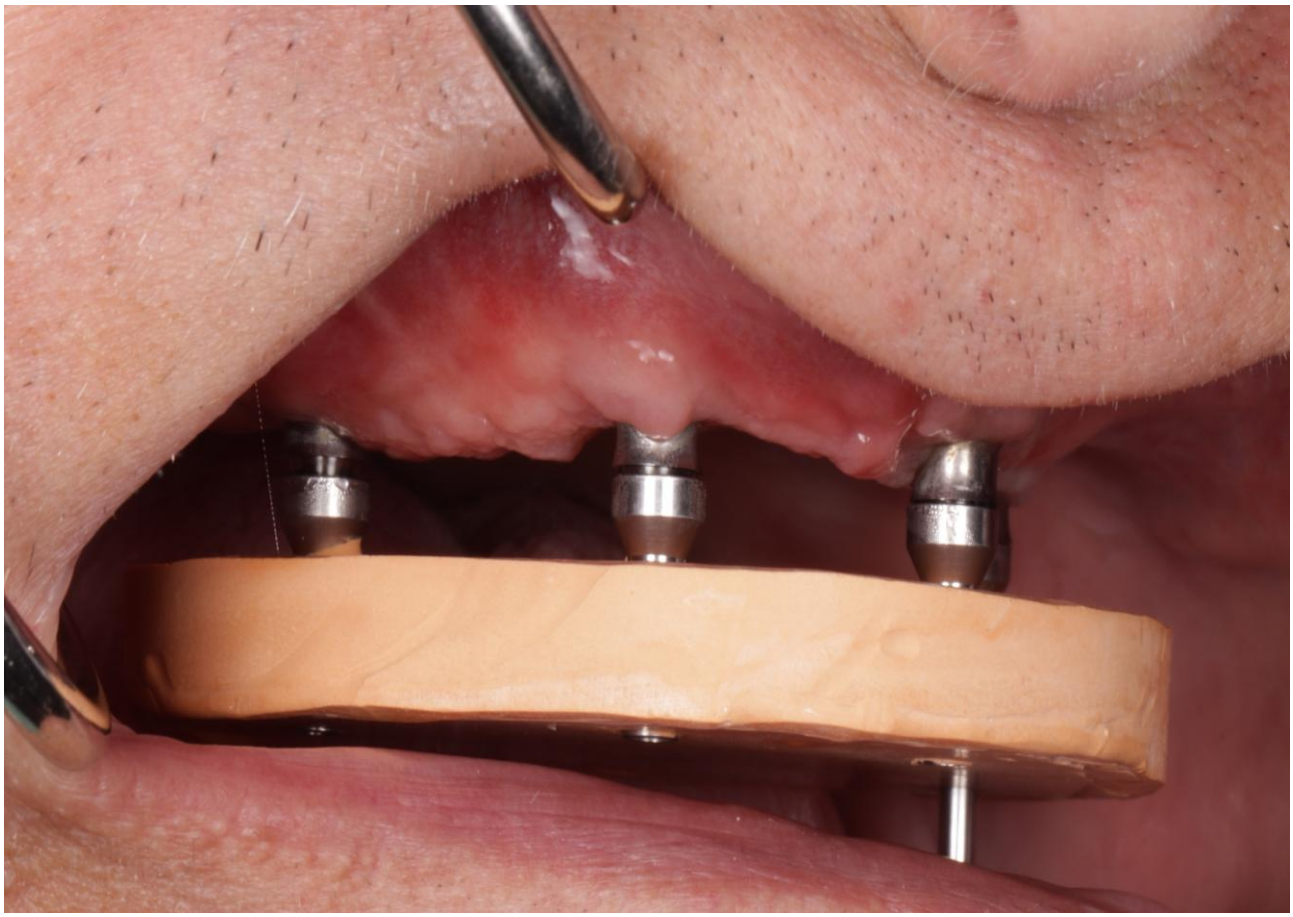

Figure 7: One screw test showing misfit of the pre-surgical verification jig.

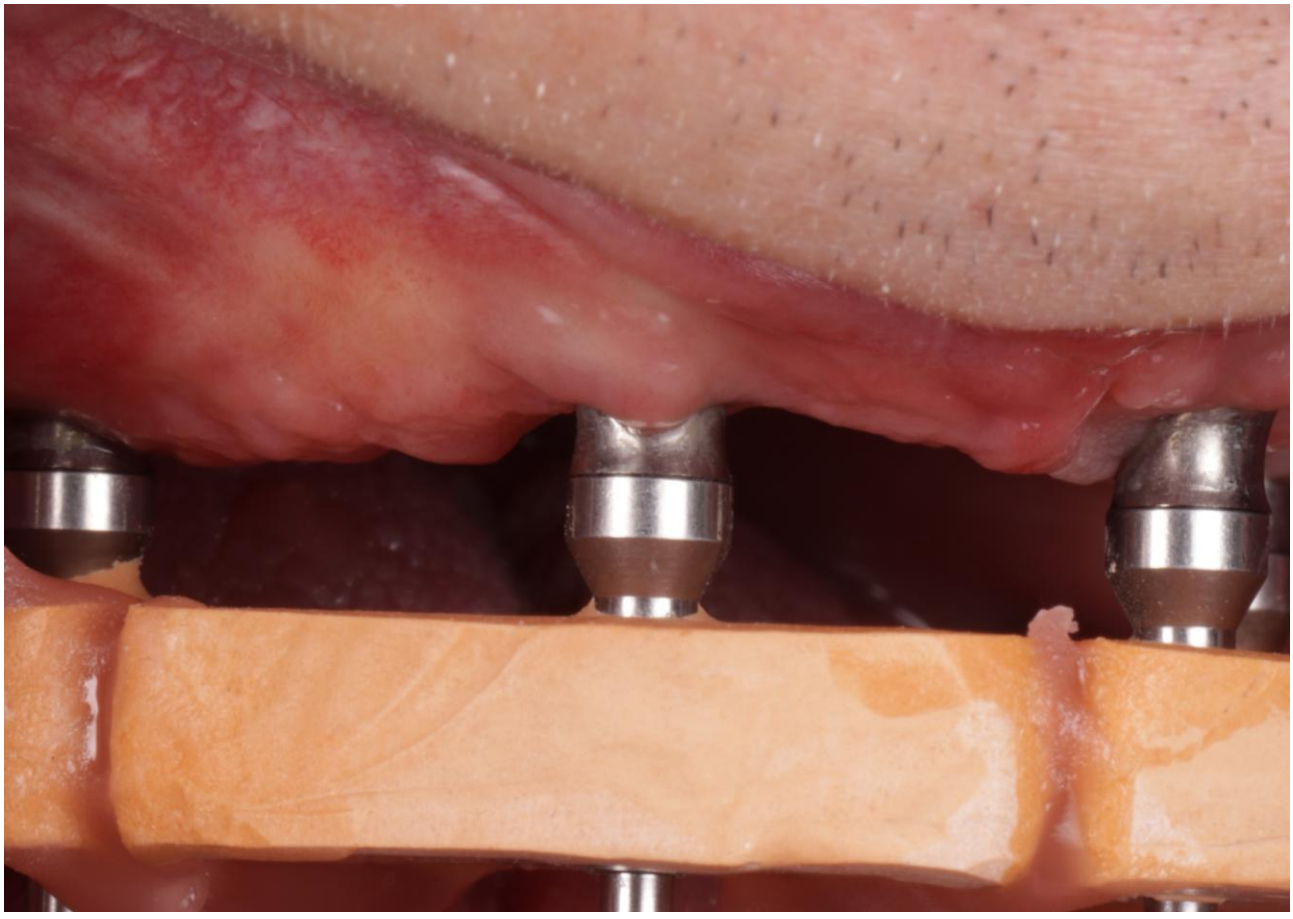

Figure 8: Sectioning on the verification jig prior to securing with auto-polymerizing acrylic.

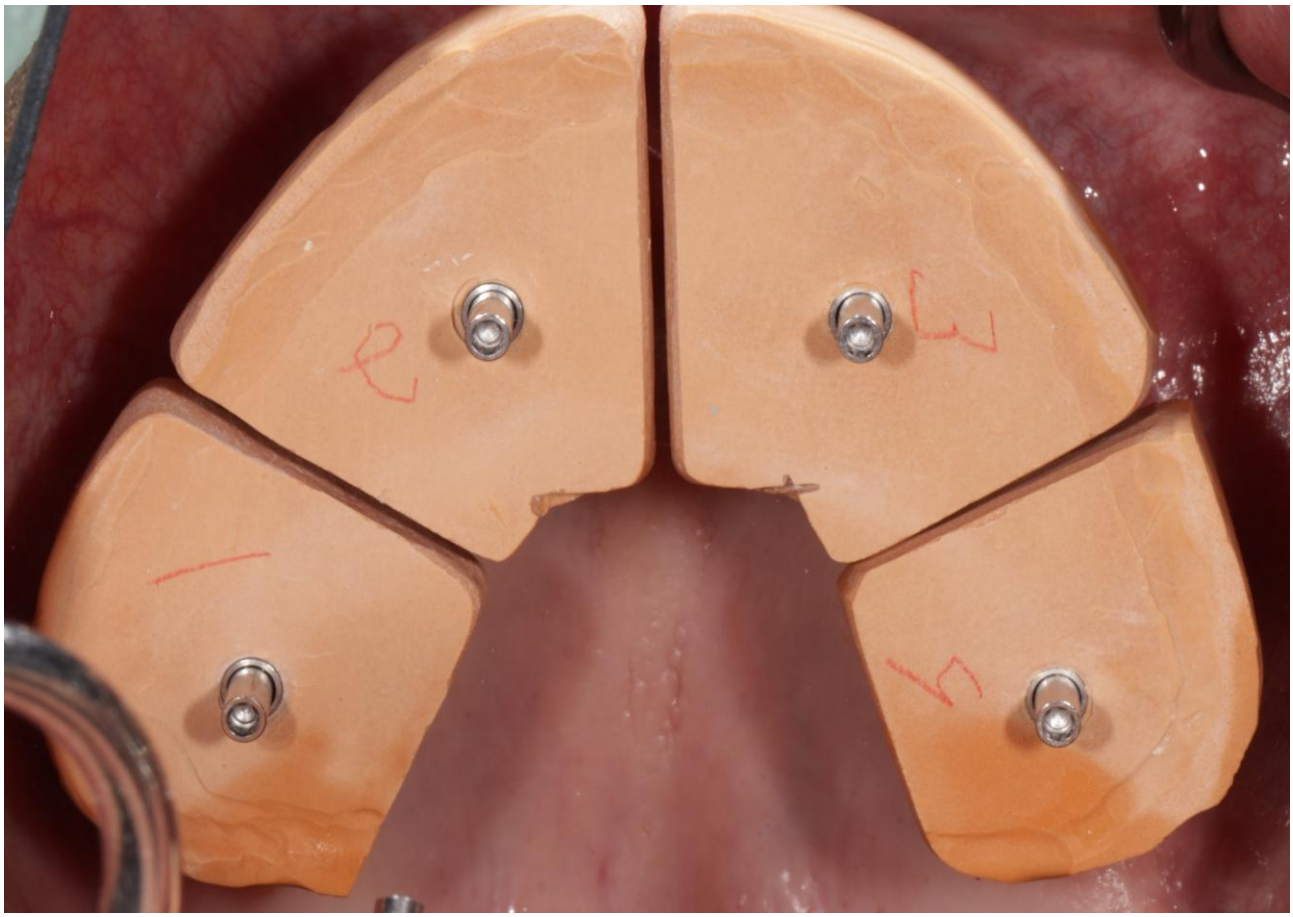

Figure 9: Resecured verification jig used to fabricate final prosthesis.

Figure 10: Smile with final zirconia prosthesis.

DISCUSSION

The use of subperiosteal implants in a severely atrophic ridge will allow patients to have the improved comfort and function with removable or fixed prostheses when endosseous implants are not possible.[1] As these implants and associated prostheses become more widely used with widespread adoption of digital technologies, the practitioner must be aware of possible pitfalls and how to prevent them from occurring.[3,8]

Delivery of a screw retained prosthesis at the time of surgery relies on precision that should be attainable using the VSP and subperiosteal framework that fits well before the surgery.[9] However, due to the pliability of the titanium framework and distortion that can occur during placement, the MUA abutments may have a slight shift in position that would prevent sound seating of the interim immediate prosthesis.[10] Without previously understanding this phenomenon, the surgical team may think that the subperiosteal implant was misaligned or the interim prosthesis was inappropriately fabricated. Both situations could prolong the surgery, increasing the potential for further complications.

One potential way to prevent this distortion is to place the prefabricated prosthesis on the titanium framework during the seating and fixation to the bone. This may prevent distortion of the MUA abutments into an unusable position. The problem with this solution is that it may obstruct the surgeon during the surgery, interfere with soft tissue coverage, or there may be a possible damage to the prosthesis if the misalignment coincides with thin areas of PMMA around the MUA-type of abutments.

An alternative method to prevent distortion is to fabricate a titanium girder or buttress that will link all MUAs during the fixation phase but not be so large and obtrusive as the prefabricated prosthesis. This will allow for accessibility for the surgeon and prevent movement of the areas of fixation without possible damage to the prosthesis.

SUMMARY

Although some authors have noted a high rate of complications, subperiosteal implants are becoming more widely used. Understanding and mitigating potential complications will improve the success rates of this treatment option. Within the confines of current evidence, the use of subperiosteal implants can assist with rehabilitation of patients with atrophic residual ridges when conventional dental implants are not an option. Yet, knowing that there could be distortion to the framework when the subperiosteal is placed will assist restoring providers and surgeons with understanding why their immediate prosthesis may not have a passive fit. Further research is needed to fully determine and understand this complication of subperiosteal implants and how to prevent distortion from occurring.

Patient Consent: Written informed consent was obtained prior to initiating her treatment and included the use clinical images used for this publication.

Disclaimer: The opinions and assertions expressed herein are those of the presenter and do not reflect the official policy or position of the Uniformed Services University of the Health Sciences or the Department of Defense.

Conflicts of Interest Statement: Neither I nor my family members have a financial interest in any commercial product, service, or organization providing financial support for this presentation.

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