



INTRODUCTION

The mandibular staple bone plate (transosteal implant), introduced by Dr. Irwin Small in the 1960s, provided a solution for severe mandibular atrophy when bone volume was inadequate for endosteal implants. This system anchors a U-shaped plate to the inferior border of the mandible with transosteal pins, supporting overdentures in challenging cases. Made from Tivanium alloy (90% titanium, 5% aluminum, 4% vanadium), it offered strength and biocompatibility.

Survival rates of 80–90% over three decades have been reported, but prosthetic components are not available, necessitating custom digital solutions for remaining implants. By designing and fabricating a custom stud attachment that enhances prosthesis retention and function, while highlighting the functional longevity of first-generation transosteal implants.

The purpose of this poster is to illustrate a digitally guided protocol to rehabilitate a nearly 40-year-old mandibular staple bone plate (transosteal implant) in an edentulous patient.

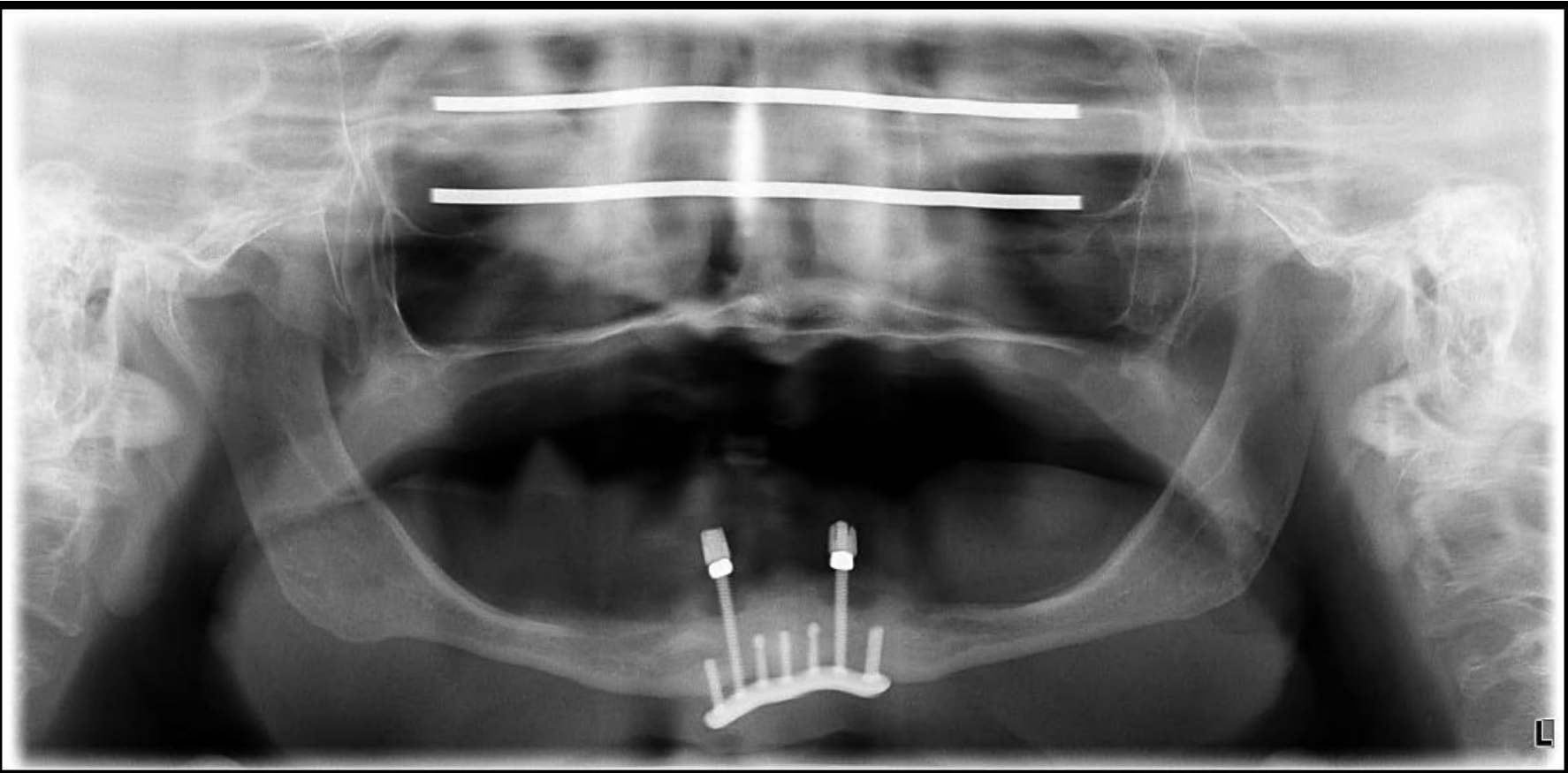


Fig 1. Pre-treatment panoramic x-ray

Methods

A 74-year-old female with a severely atrophic mandible presented with an ill-fitting mandibular overdenture supported by a transosteal implant placed in 1986. Since implant specific prosthetic components was no longer available deeming the implants non-restorable, implant removal was considered. However, after consulting oral surgery department, removal was contraindicated due to high fracture risk of the mandible, as well as the patient lacked sufficient bone to support new implants; therefore, the option of the use of custom stud attachments using digital design was pursued.

Previously, in 2005, a custom cast gold stopper was fabricated beneath the implant fastener, acting as a mechanical stop to allow secure torque, prevent soft tissue impingement, and promote peri-implant health and hygiene. This approach-maintained function for nearly a decade with regular relining.

To address current prosthodontic challenges, we adopted a fully digital workflow. Intraoral scanning captured the topography of the exposed implant pin threads and a reference stud attachment, generating a virtual model for prosthetic planning. Using EXOCAD, we designed both a custom stud abutment and a corresponding custom attachment to adapt to the transmucosal contour of the implant and optimize mechanical retention. The abutment was fabricated via 3D printing followed by noble alloy casting and intraoral adjustment.

A chairside pick-up procedure done, transitioning from passive friction to active mechanical retention and improving stability and patient function. Immediate clinical assessment confirmed intaglio adaptation and prosthesis stability. The patient is currently under treatment of increasing soft tissue thickness around preimplant mucosa.



Fig. 2. Pre-treatment documentation: extraoral and intraoral photographs illustrating facial form (a & b), mandibular staple implant abutments (c, d, & g), fastener and custom gold stopper (e & f) and the existing mandibular overdenture (h).

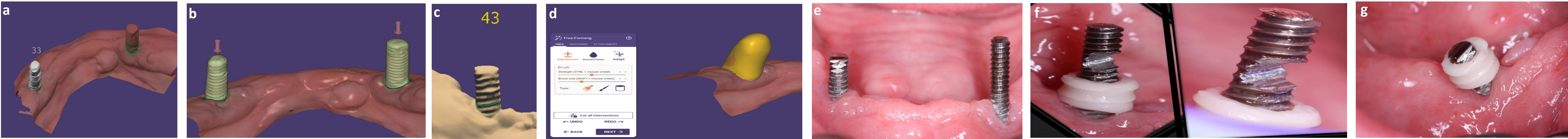


Fig. 3. Prosthetic phase: clinical removal of the implant fastener and vertical adjustment of transosteal pins using the initial 3D-printed custom stud prototype (a-g) as a surgical reduction guide.

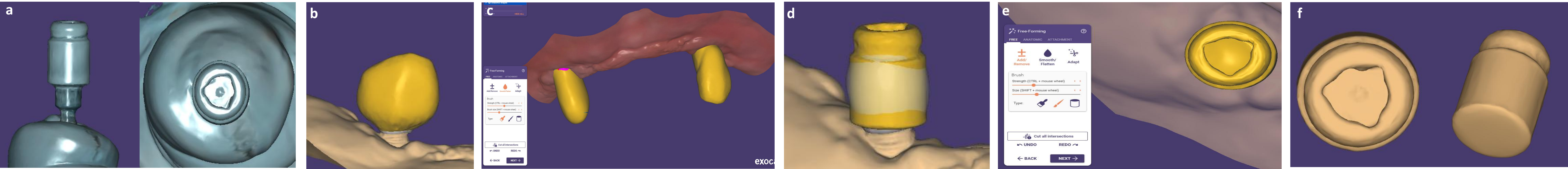


Fig. 4: 1st prototype of custom attachment of the stud STL (a), adapting the geometry to the transmucosal region of the implant (b & c) then import the stud STL as a custom attachment (d-f).



Fig. 5. Laboratory procedures: Clinical try-in of the initial 3D-printed stud abutment, fabrication of a working die from a (PVS) impression using GC pattern resin (a-e) final custom stud abutment cast in noble alloy, (f).

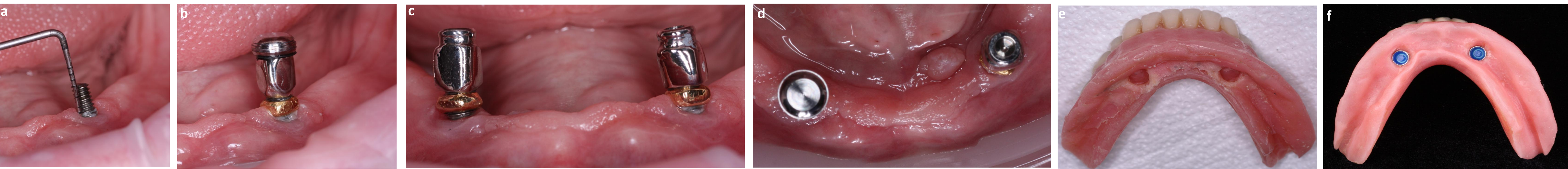


Fig. 6. Intraoral assessment of intaglio adaptation and locator engagement (a-d), and clinical evaluation of the locator assembly within the interim overdenture (f).

RESULTS

The digitally guided protocol successfully restored overdenture stability and function for this patient, utilizing a custom stud abutment specifically designed for a legacy transosteal implant. Integration of the custom attachment transitioned retention from passive friction to active mechanical engagement, delivering improved prosthesis stability, masticatory efficiency, and patient-reported quality of life. Clinical assessment confirmed proper intaglio adaptation, occlusal harmony, and peri-implant tissue health.

DISCUSSION

Historically, most literature has focused on surgical management of failing or obsolete mandibular staple implants. Small et al. (1974, 1986) and Helfrick et al. (1982) described staple removal and placement of endosseous implants. Kent et al. (1984) and Knapp & Small (1990) reported placing new implants lingual to or between residual pins. Prudenti et al. (2019) described cutting retention pins to enable implant placement, while Liposky (1982) and Wolfinger et al. (1996) discussed conversion to conventional dentures or implant replacements. These approaches often involve additional surgical risks or anatomical changes.

By contrast, our approach represents the first documented case of prosthetic management for an existing mandibular staple bone plate—without implant removal or additional surgical procedures. Through digital planning and the fabrication of a custom stud abutment, we demonstrated that contemporary prosthodontic principles and digital technologies can successfully rehabilitate and extend the serviceability of first-generation transosteal implants. This technique, underscoring the value of individualized prosthodontic solutions for managing complex, legacy implant scenarios.

CONCLUSION

A fully digital prosthodontic workflow—including intraoral scanning, virtual abutment and attachment design, and custom fabrication successfully restored function and retention for a legacy transosteal implant. This approach preserved tissue, avoided additional surgery, and provided a stable mandibular overdenture despite obsolete components. Customized digital solutions offer a minimally invasive, patient-centered option for extending the service life of first-generation implant systems.



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