

BACKGROUND

Vertical Ridge Augmentation is a major challenge in implant dentistry. Various methods have been employed such as guided bone regeneration (GBR) with non-resorbable membrane, onlay autogenous block bone graft, distraction osteogenesis and others with variable results. GBR with particulate bone graft material is generally less invasive and is often the first choice of treatment. Various barrier membranes have been described for GBR including:

1. Collagen membrane with tented screws
2. PTFE membrane
3. Titanium reinforced PTFE membrane
4. **Titanium mesh**
 - Pre-fabricated
 - **Patient specific**

PURPOSE

This case report details the innovative use of a fully digital workflow to design and **3D print patient specific Titanium Mesh for Guided Bone Regeneration (GBR)**, to address a patient's severe vertical alveolar ridge deficiency.

REFERENCES

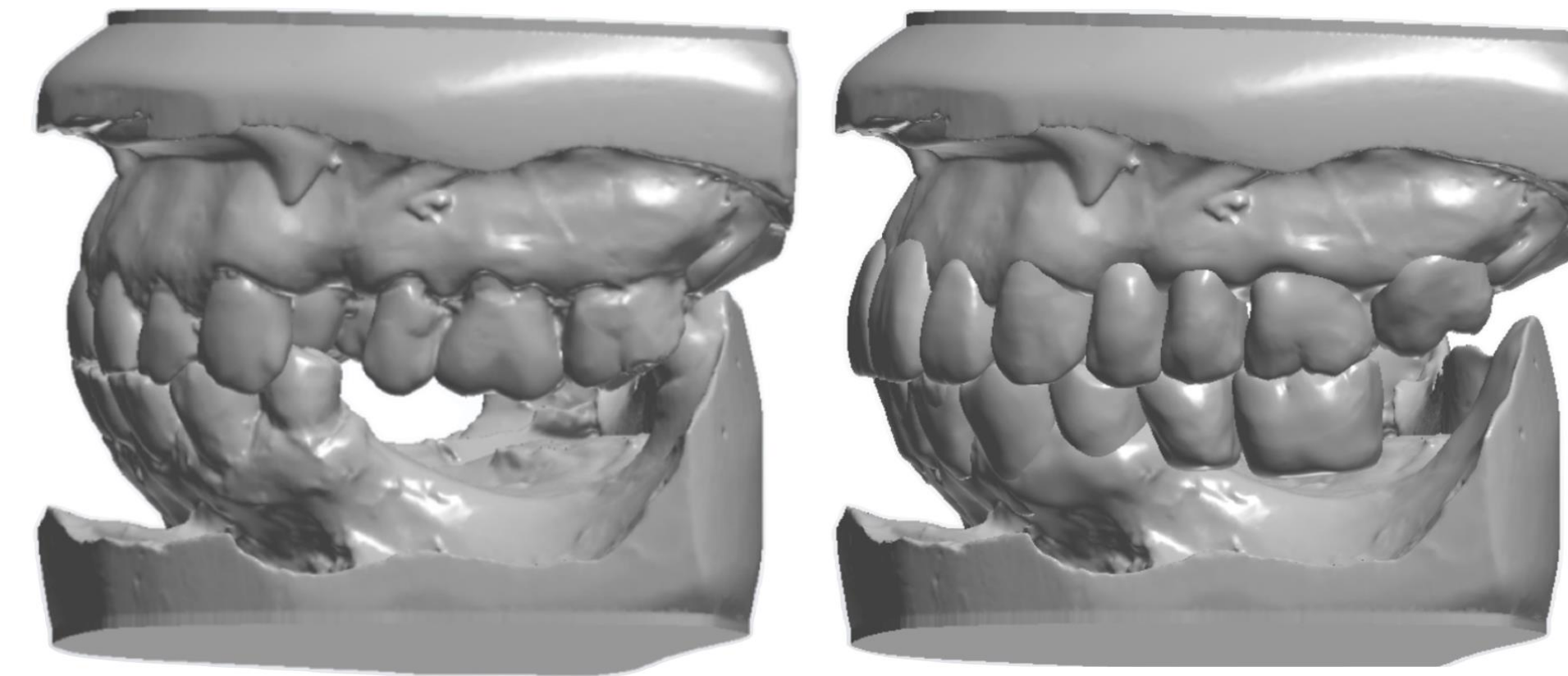


Fig 1 : Pre-Operative Scan Fig 2 : Wax Up

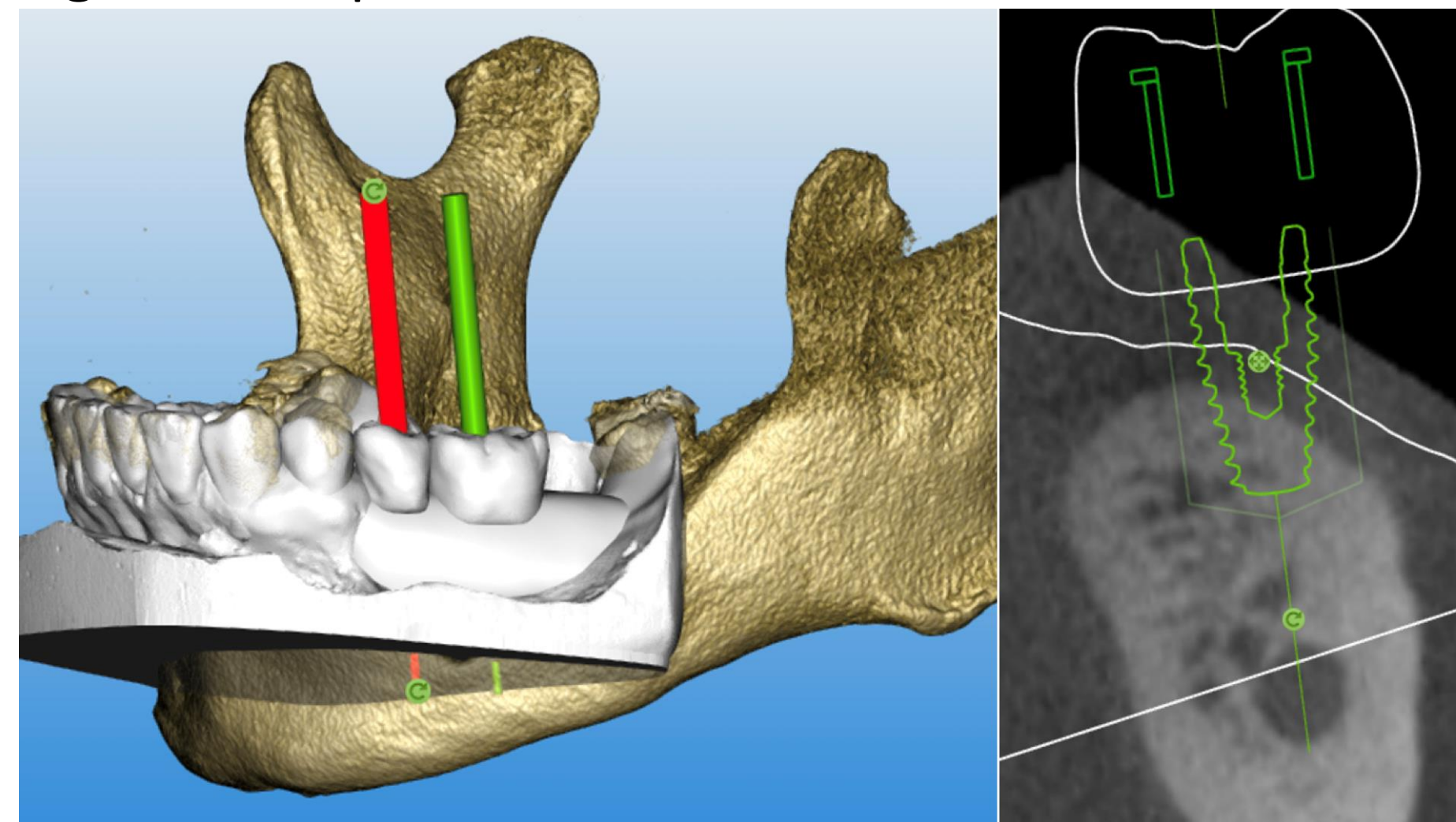


Fig 3 : Prosthetically Driven Implant Planning

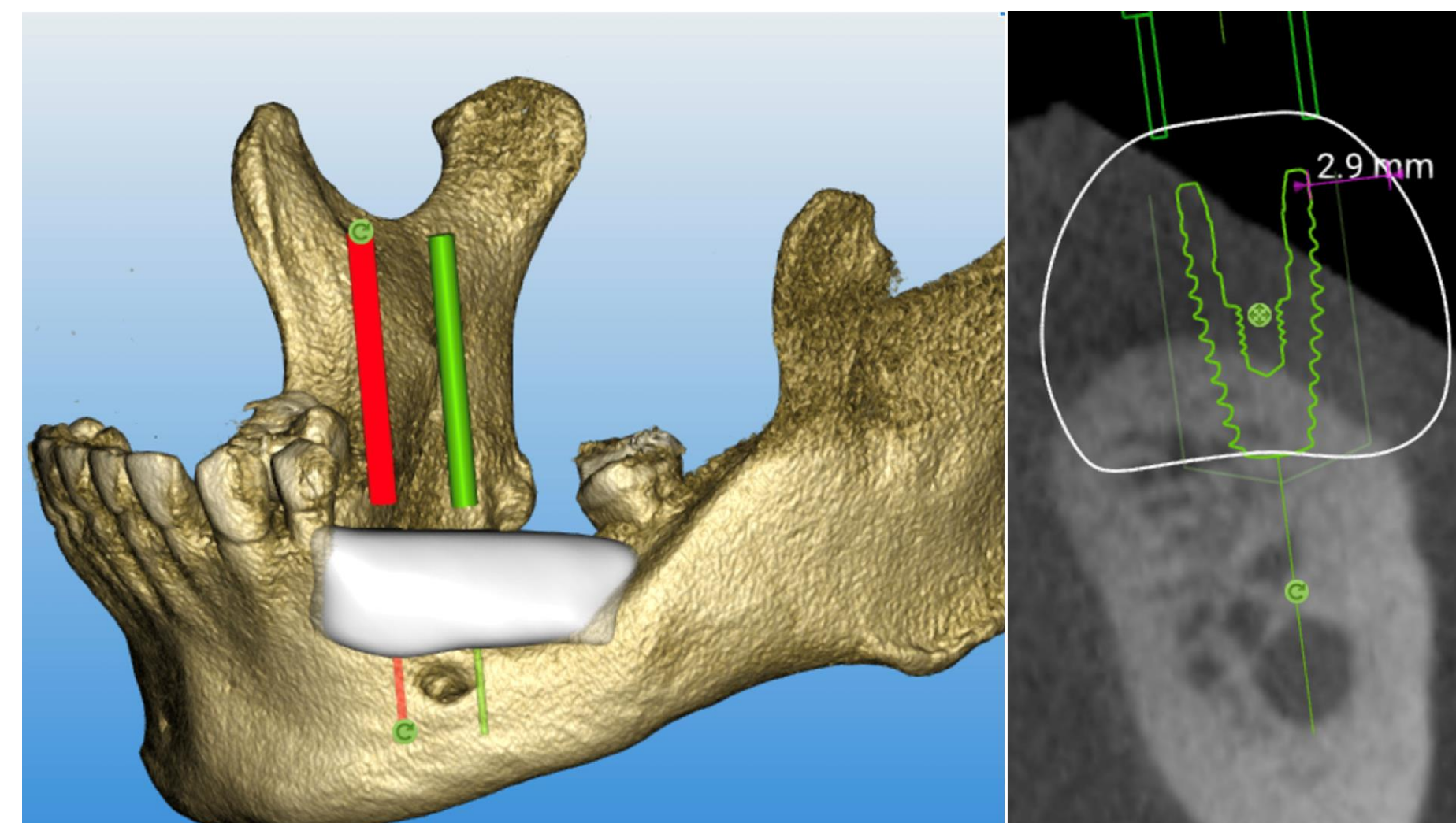


Fig 4 : Digital Bone Augmentation around Implant

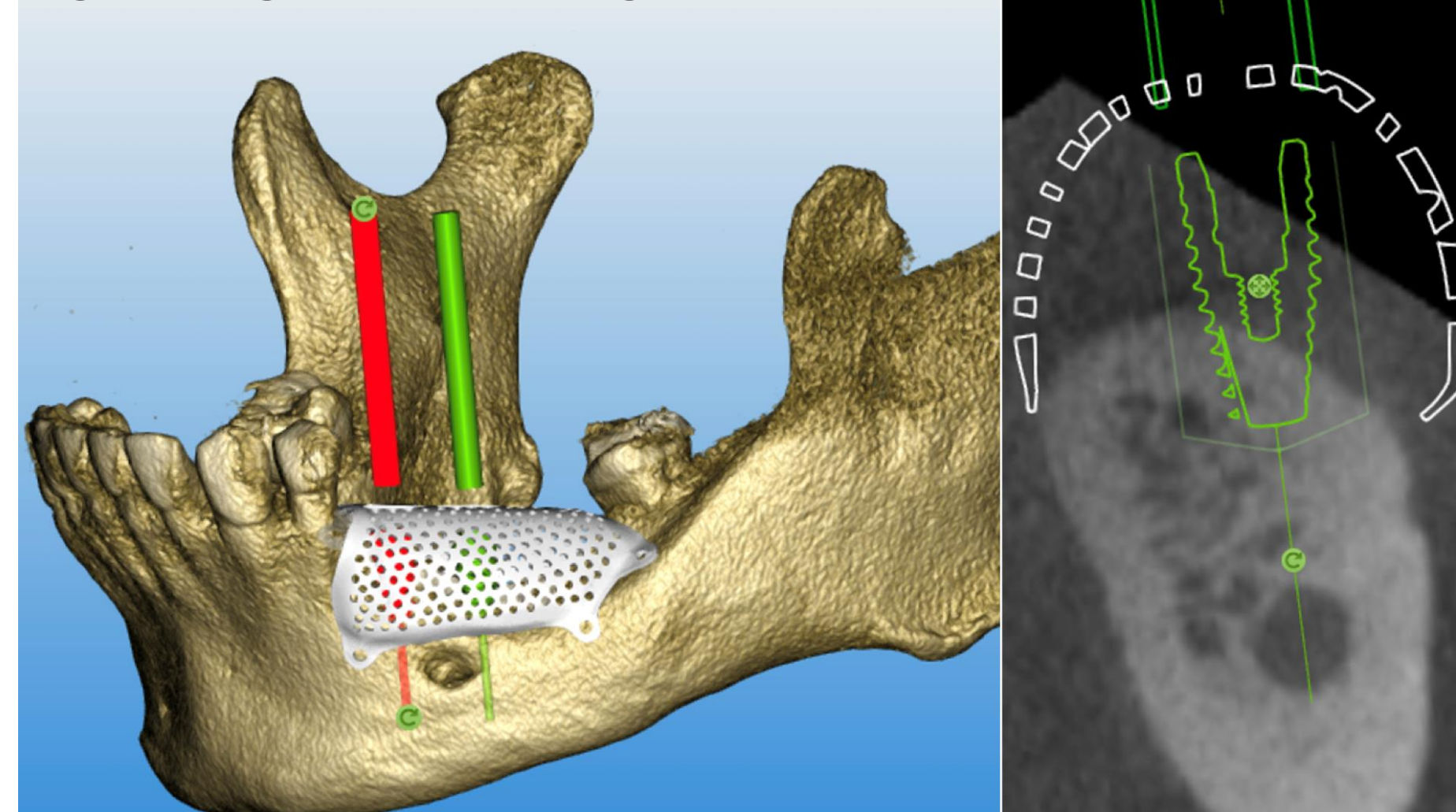


Fig 5 : Mesh Overlayed on Implant

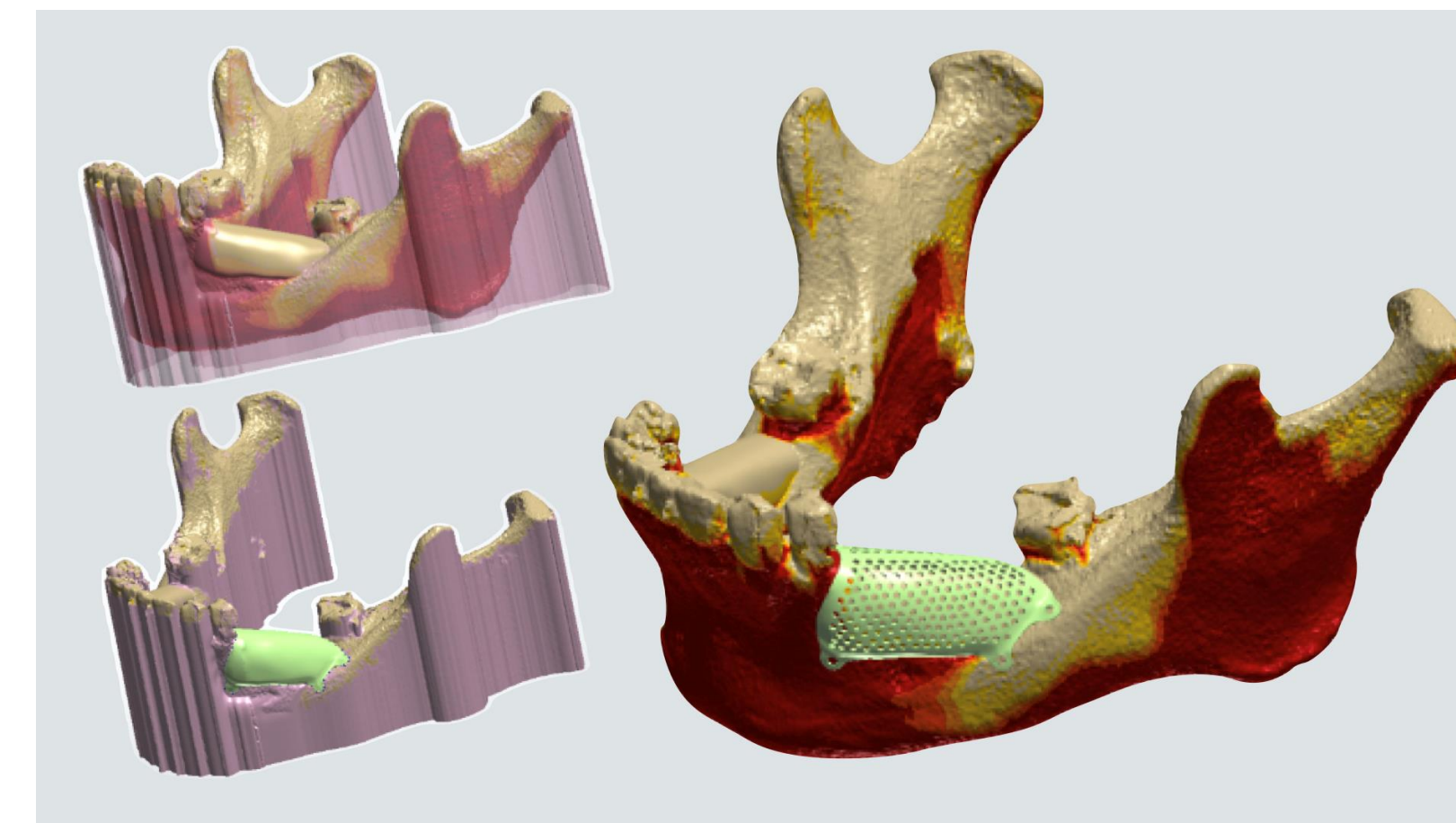


Fig 6: Mesh Design on 3Shape



Fig 7: Verification of the Mesh

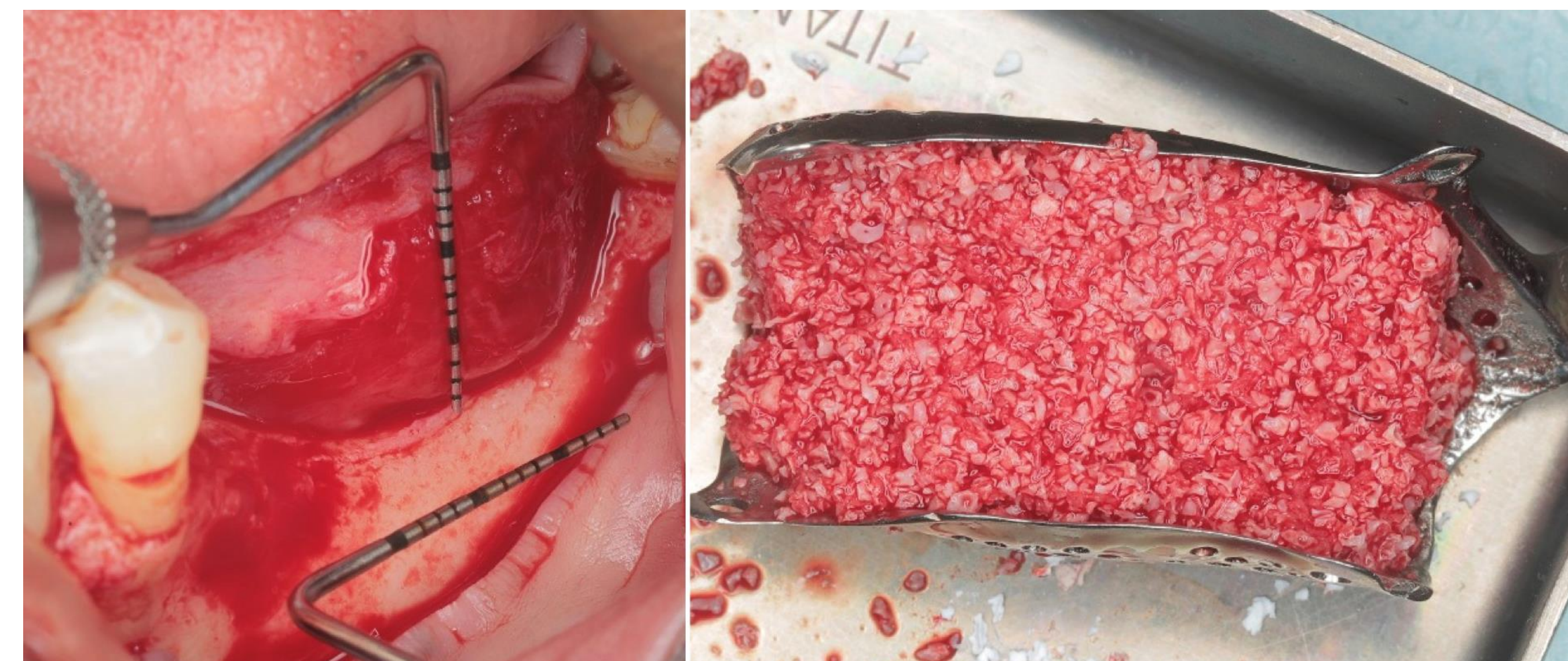


Fig 8: Defect Size and amount of Bone Grafting Material Used

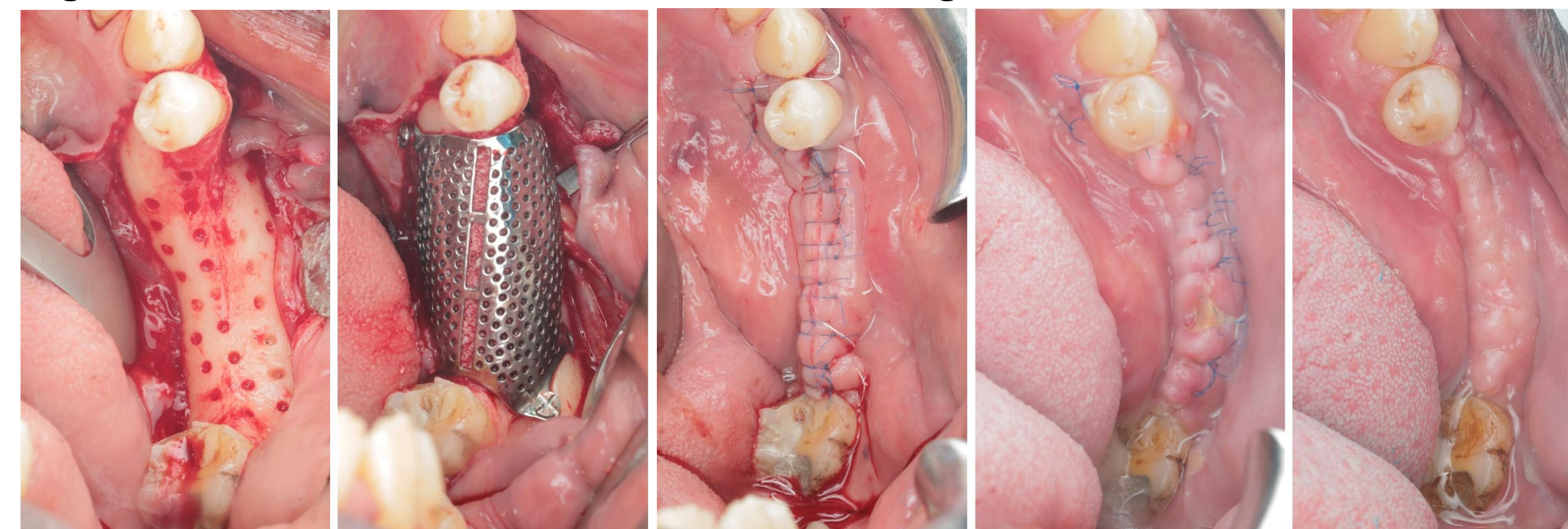


Fig 9 : Surgical Steps of PS TiMesh Placement



Fig 10 : Healing with No Events



Fig 11 : Pre-Operative Site



Fig 12 : 3-months Post Operative

METHODS

1. Comprehensive diagnostic treatment planning,
2. Wax-up of the final restoration (**prosthetically driven implant placement**). [Figure 1,2].
3. Digital implant planning and **bone augmentation** using (RealGuide; Zimvie). [Figure 3]. *Accounted for 20 - 40% bone resorption often reported after GBR* [Figure 4](Hur et al., 2017).
4. Titanium mesh designed using 3Shape software with the following characteristics. [Figure 6].
 - Thickness of 0.5 mm,
 - Accommodated critical anatomical structures. [Figure 5]
 - Five 1.5 mm screw channels designed to secure mesh
 - Designed windows to ease removal of Titanium Mesh
5. Exported STL file was 3D printed using SLS 3D printer (3DRPD; Canada)
6. Titanium mesh seating was verified on 3D printed model of mandible. [Figure 7].

RESULTS

With custom titanium mesh we were able to:

1. Reduce chair time [Figure 8]
2. Minimize surgical complications Increase predictability
 - eliminated guesswork associated with bending mesh
 - accounted for potential bone resorption
3. Ensure bone grafted site was prosthetically driven
4. **No postoperative complications** (ex: exposure of mesh, wound dehiscence, etc.)

Seating the mesh during surgery was straightforward [Figure 9]. Follow up was Uneventful. [Figure 10,12]

DISCUSSION

Integrating a fully digital workflow for the design and fabrication of a titanium mesh has been shown to enhance the precision, customization, and overall success of bone grafting procedures. This case report highlights the potential of digital technology to revolutionize complex dental surgeries, offering predictable and reproducible outcomes.

Surgical pictures are a courtesy of Dr. Yu-Chang Wu, DMD, MS