



Multifunctional Prosthesis as a Surgical Guide Using Digital Jaw Motion in a Fully Digital Workflow for Implant-Supported Complete-Arch Fixed Prostheses

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Introduction

A 32-year-old male with partial edentulism and a history of ZMC, subcondylar, and parasymphysis fractures was rehabilitated using a fully digital workflow for implant-supported complete-arch fixed prostheses. Limited posterior mandibular bone required staged implant placement with bone augmentation. After osseointegration, a virtual articulator with a Cadiax digital axiograph was used to simulate mandibular movements and guide digital tooth setup. **A multifunctional prosthesis served as both a surgical guide and a provisional pick-up device.** Virtual articulator and AI-based jaw motion simulations were compared with patient-specific terminal eccentric movement scans to optimize tooth setup and cusp angles, and to minimize occlusal adjustments in the definitive prosthesis.

Initial examination



Complete arch treatment



Virtual articulation



Materials and method

After osseointegration, a fully digital workflow was implemented using the Complete Arch Scanbody Pillar System (CAPS) to capture implant positions.

A virtual articulator was generated by integrating DICOM data from CBCT imaging, facial scan data, and intraoral scan data to establish the terminal hinge axis and perform a **virtual facebow transfer**. **A Cadiax digital axiograph** was additionally utilized to record patient-specific mandibular movements and anatomical parameters, which were subsequently incorporated into the virtual articulator. Esthetic and functional evaluation of the digital tooth setup enabled fabrication of **a multifunctional prosthesis design** that served for mandibular posterior implant planning, surgical guide design, and provisional implant-supported complete-arch fixed prosthesis fabrication.





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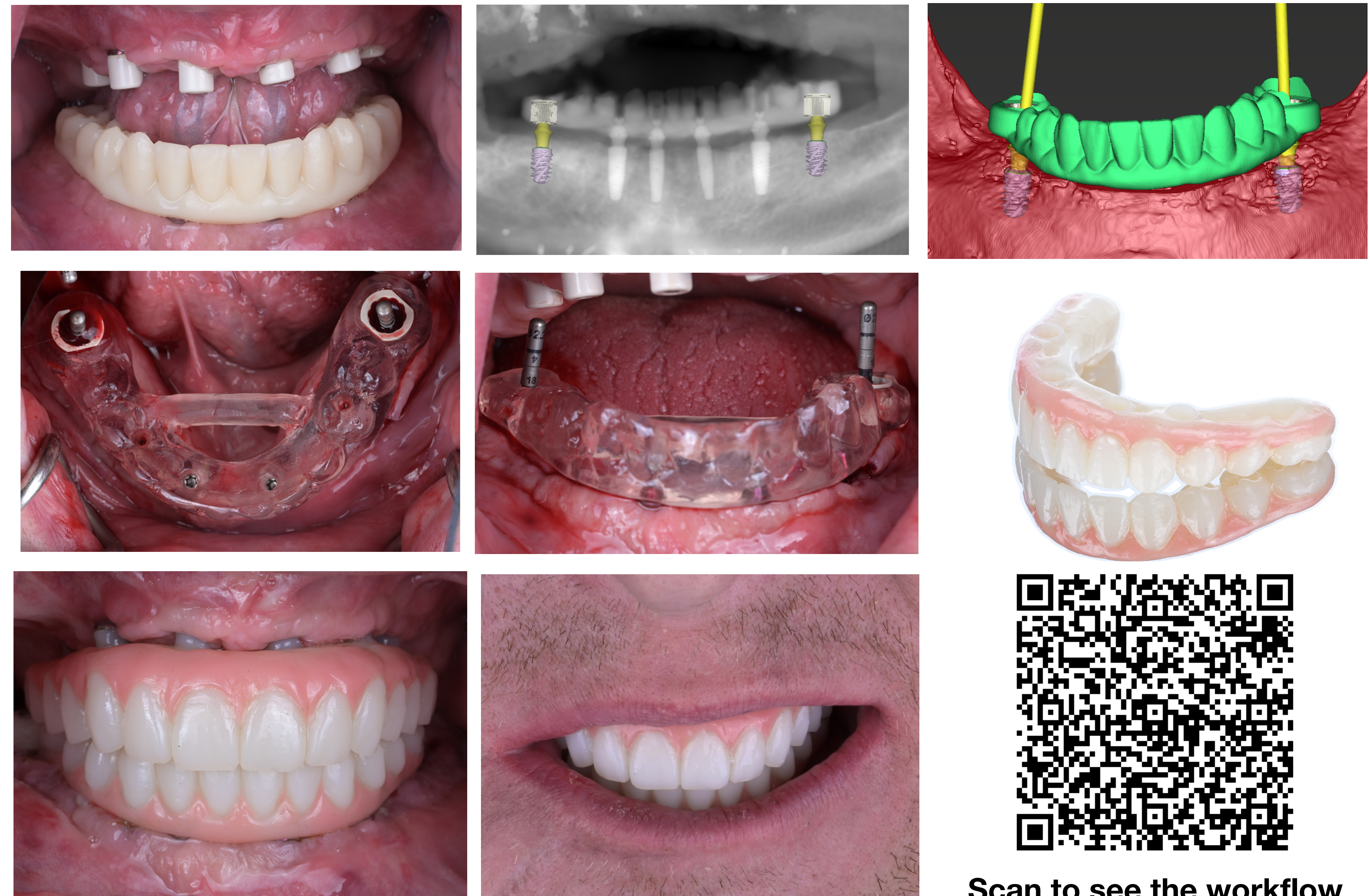
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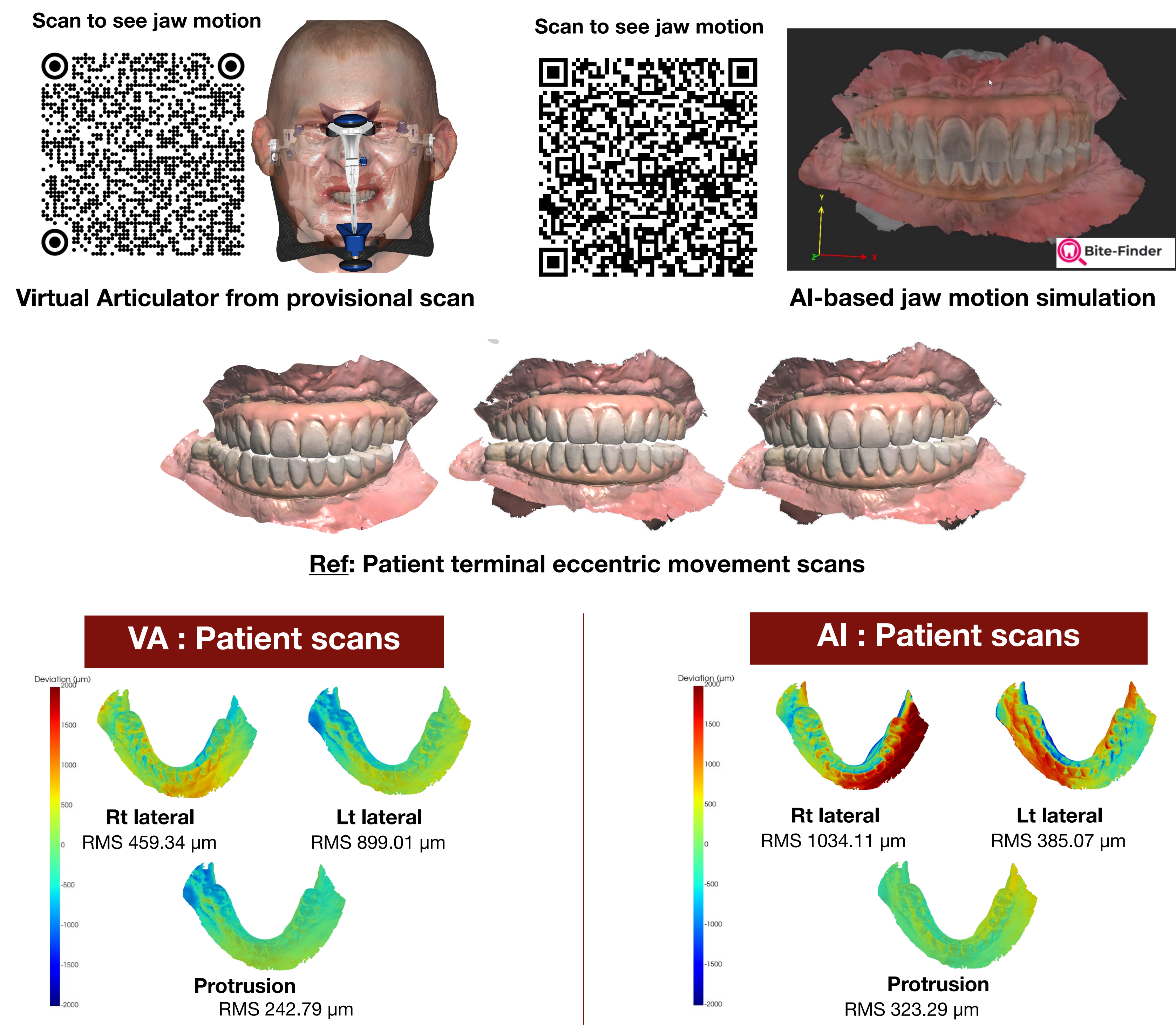
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Multifunctional design: Implants supported surgical guide and immediate provisional prosthesis



Comparison of simulated terminal position between : AI-based jaw motion simulation and Programmed Virtual articulator simulation



Discussion

A multifunctional prosthesis designed from virtual articulator data was used to fabricate:

1. a surgical guide for precise, prosthetically driven mandibular posterior implant placement
2. an immediate provisional prosthesis.

Owing to the accuracy of the virtual articulator simulation, the provisional prosthesis required minimal chairside adjustment after delivery.

Three months after provisionalization, the provisional prosthesis was scanned to generate AI-based jaw motion and update virtual articulator data, enabling direct comparison using patient-specific terminal eccentric movement scans as the reference. The simulated jaw motion data were subsequently incorporated into the digital workflow for final prosthesis design.

