Reduce treatment time with digital dentistry

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Case description

A 72-year-old female patient complained of a loose lower denture that was painful to wear and chew with. A routine examination revealed a pronounced lack of bone volume in the lower ridge in conjunction with a relatively high floor of the mouth, making relines ineffective. The decision was made to proceed with a screw-retained, provisional fixed denture supported by four implants. The restorative protocol for this case used state-of-the-art techniques to improve the accuracy of implant placement, optimize the function and esthetics of the provisional, and reduce the time required for treatment.

Treatment objectives

The objective of the treatment plan was to improve patient comfort and chewing function by replacing the patient’s existing mandibular denture with a screw-retained fixed implant bridge. The provisional denture and final restoration would be designed with dental CAD software, using the setup from the existing denture.

Treatment planning

The patient’s existing denture was modified with fiduciary markers to serve as the CBCT scan appliance. To ensure maximum accuracy of the surgical guide, an extraoral scan of the denture was then taken. A CBCT scanner was used to scan the intraoral lower denture, maxillary denture and the bite. From these DICOM datasets, stereolithography (STL) files were extracted. The bite scan was used to articulate the scans of the lower denture and the maxillary denture.

Once the datasets were accurately merged in the treatment-planning software, the implants were virtually selected and placed at the optimal positions and angulations for the available bone volume and prosthesis support. Multi-unit abutments were used to correct the angle of the two posterior implants and to provide a common restorative platform across all implant sites (Fig. 1).

The DICOM data was segmented for density, and models of the patient’s mandibular arch, provisional denture and surgical guide were 3-D printed and articulated, so the entire surgical and prosthetic stack could be examined and a surgical index fabricated on the articulated model between the guide and maxillary cast (Figs. 2a-c).

Implant placement

After administering mandibular anesthesia, the surgical guide was placed with the aid of the surgical index.

The surgical guide was used to prepare the

Fig. 1: After digitally evaluating the quality and quantity of mandibular bone, implants and multi-unit abutments were virtually placed with the appropriate angling and depth for the bone morphology of the patient.
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osteotomies and guide the placement of four 4.7 mm implants. Primary stability of all four implants was acceptable, and multi-unit abutments were mounted on top of the implants.

The temporary prosthesis was held in place with a luting index, and cold cure acrylic was used to fix the prosthesis to the multi-unit temporary cylinders. After curing, the prosthesis was removed and finished extraorally.

_Final restoration_

The final restoration protocol made use of intraoral scanning, dental CAD/CAM and 3-D printing to deliver the final prosthesis in just three appointments.

- **First appointment**: The patient’s provisional prosthesis was used to guide the design of the final restoration. First, a scan was taken of the provisional in the mouth, taking care to capture adjacent anatomical landmarks. Next, the opposing denture was scanned extraorally.

  Two additional scans were taken of the lower denture seated in the mouth as well as the edentulous arch. At the laboratory, technicians used the scan data to design the final prosthesis, which included the milled titanium bar.

- **Second appointment**: The denture setup was placed with one screw tightened on the milled bar, and radiographs were taken to verify passive fit of the substructure. After making a minor fit adjustment, the provisional was reinstalled and the verified denture setup was sent back to the lab.

- **Third appointment**: The lab processed the denture to the titanium bar with acrylic to finish the final prosthesis (Figs. 3a–c). The provisional was removed and the final fixed implant denture was delivered (Figs. 4a–d).

_Conclusion_

Guided surgery and dental CAD/CAM are complementary technologies that can make the surgical and restorative phases of implant therapy more efficient and predictable. Because we can predict the implant position using guided surgery, prosthesis design can be done presurgically.

Advanced treatment protocols that leverage digital impressions, treatment planning, guided surgery and dental CAD/CAM technology are transforming implant therapy, shortening treatment times and improving prosthetic outcomes.