Digital assisted precise planning and manufacturing of a fixed dental restoration

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Case report

A 66-year-old female patient presented to our clinic with diverse dental problems in the maxilla. The initial examination revealed several teeth with caries and defective fillings. The panoramic radiograph also showed severely decayed, fractured, and supraerupted teeth (Figs. 1 & 2).

The posterior maxillary teeth were subsequently extracted, and socket preservation grafting was performed. Following a three-month healing period (Fig. 3), a cone beam computerised tomographic (CBCT) scan was performed and imported into Simplant software.

Careful analysis of the clinical situation resulted in a treatment plan for placing two 4.8 mm OsseoSpeed EV implants in the molar region. These were distally angled by 30 degrees to support first molar occlusion. Two 4.2 mm OsseoSpeed EV implants were also placed in the first premolar positions. A 3.6 mm OsseoSpeed EV implant was planned for the maxillary right lateral incisor position. The Simplant software was used to plan the most suitable positions for the implants (Fig. 4).

A Simplant Guide was ordered and used for the first drilling steps (Fig. 5). All implants were placed by hand with the guide removed. HealDesign EV was used during the healing phase (Fig. 6). After three months, Implant Pick-Ups EV were connected to the implants.
Fig. 5: Simplant Guide for the first drilling steps. — Fig. 6: Colour-coded HealDesign EV in place. — Fig. 7: Implant Pick-Ups EV in position. — Fig. 8: After impression taking, the interfaces of the impression posts were revealed in the impression. — Fig. 9: Colour-coded Implant Replicas EV are assembled to the Implant Pick-Ups EV in the impression. — Fig. 10: Online Atlantis WebOrder showing the patient-specific abutments with a digital wax-up transparent overlay. — Fig. 11: Occlusal view of the full-contour digital wax-up prior to digital cutback. — Fig. 12: Patient-specific Atlantis abutments with corresponding screws. — Fig. 13: Full-contour CAD/CAM PMMA provisional restorations. — Fig. 14: Healthy and clean implant sulcus evident at all of the sites to be restored. — Fig. 15: Atlantis patient-specific abutments installed. — Fig. 16: Clinical situation on the day of final restoration.
After the final impression, the master cast was scanned. A fully anatomical digital wax-up was merged over the master cast and uploaded. Atlantis abutments were designed using the Atlantis VAD software (Fig. 10).

Atlantis abutments were machined and scanned, and a final digital wax-up was performed (Fig. 11). The corresponding colour-coded abutment screws were included (Fig. 12). Full CAD/CAM PMMA provisional restorations were manufactured and assembled with the Atlantis abutments. The distal angulation of the molar implants is shown in Figure 13.

A healthy and clean implant sulcus was evident at all of the sites to be restored (Fig. 14). The Atlantis abutments were delivered, installed, and tightened to 25 Ncm with the provisional restorations to assist in shaping the implant sulci (Fig. 15). Following a one-month provisionalisation period, the patient was scheduled for delivery of the final restorations (Fig. 16).

The restorative design called for all interproximal and occlusal contacts to incorporate high-strength zirconia. A digital cutback of precisely 0.8 mm was used for the veneering porcelain in the areas where stresses are low and aesthetic demands are high. Treatment of this patient utilised digital processes and multiple merged data sets to make planning and treatment more accurate and efficient. In addition, it enabled the creation of fixed dental restorations that are supported by dental implants and natural teeth. Figures 17 to 21 show the clinical and radiographic views of the final restorations and the highly aesthetic outcome.

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