Implant-prosthetic workflow based on STL files of optical impressions

It is common knowledge that implant-based restorations are highly demanding in terms of accuracy. This is why most dental practitioners rely only on highest quality polyether material for precision implant impressions. Consequently, the most accurate intraoral scanners are recommended for this task when a digital workflow is chosen.

In our clinic, we use the 3M™ True Definition Scanner to produce a reliable basis for the computer-aided design and manufacture even of complex implant-based reconstructions. While there are Trusted Connections available for processes around Biomet 3i and Straumann implants, an open STL connection I used when implants of other manufacturers are placed. The following two patient cases are used to illustrate this open workflow.

Three-unit bridge on two implants

Figure 1: Patient with two implants in the regions 24 and 25 (FDI numbering system) after successful healing.

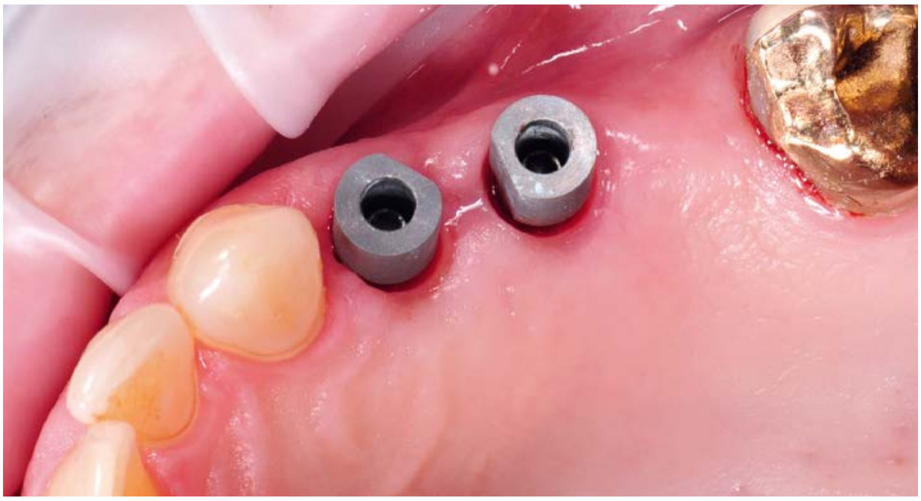

Figure 2: Intraoral scanbodies in place.

A patient whose maxillary left premolars and first molar were missing had received two external hex implants (Southern Implants) in this region. Figure 1 shows the clinical situation after a healing phase of four months. In order to allow for an exact transfer of the implant positions and angulations into the virtual world, two sandblasted titanium intraoral scanbodies were connected to the implants (Fig. 2). The teeth were dusted with 3M™ High-Resolution Scanning Spray and an impression of both jaws was taken with the 3M True Definition Scanner (Fig. 3).

Figure 3: Screenshot showing the optical impression of the upper jaw incluing the two scanbodies.

In order to assign the two three-dimensional models to each other in the correct static occlusion, a digital bite registration was taken via a buccal scan of the teeth in occlusion. The final 3D model is shown in Figure 4. It can be checked in detail on the screen of the intraoral scanner and is then uploaded to the 3M™ Connection Center at the touch of a button.

Figure 4: Matched data of the maxillary and mandibular model on the screen.

The dental technician downloaded the STL file of the impression, checked it and ordered a physical model at 3D Medical Print. Some laboratories have their own 3D printer that allows them to manufacture the models inhouse. For the desired three-unit bridge, a zirconia framework was designed with the CAD software DentalCAD (exocad).

Due to open interfaces, any software may be used. A precise fit on the implant is ensured by titanium bases available from the implant manufacturer. Their geometries can be deposited in the design and the manufacturing software so that the framework can be attached to the base without adjustments. The framework was layered with porcelain and subsequently glued to the titanium bases. In this way, stress in the zirconia substructure that might occur when a prosthetic screw is tightened can be avoided and the strength of the restoration is increased. The result is shown in Figures 5 and 6.

Figure 5: Individualized three-unit bridge with titanium bases.

Figure 6: View of the abutment-implant connection.

In order to allow for optimal contouring of the bridge, the model was printed with a separate gingival mask. In the laboratory, implant analogs were glued into the model (Fig. 7).

Figure 7: 3D-printed model with implant analogs.

The restoration had a passive fit and could easily be screwed onto the model (Fig. 8).

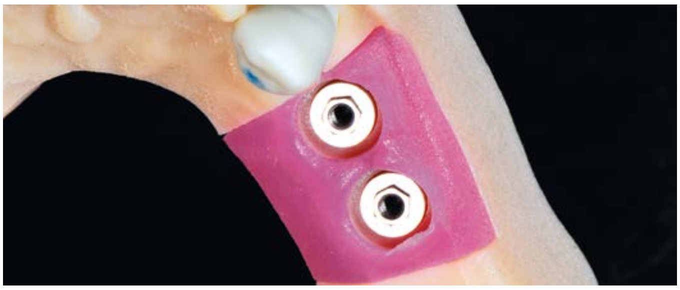

Figure 8: Bridge on the model.

The same applied at the intraoral try-in. The screw-retained bridge was placed immediately without requiring any adjustments (Fig. 9).

Figure 9: Treatment result immediately after placement of the restoration.

The control-radiograph confirmed a perfect fit of the restoration on the implants (Fig. 10).

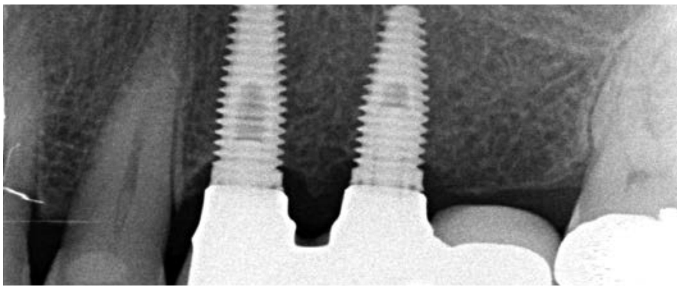

Figure 10: Control radiograph of the final situation.

Reduce time and increase patient comfort – just by using an intraoral scanner.
Bart Vandenberghe reveals which scanner provides virtually endless opportunities. **https://youtu.be/pZwzB4eEqyk**

Full-arch rehabilitation in the maxilla

The 62-year-old female patient had received four implants (Southern Implants) in her partially edentulous maxilla in region of the right first molar and the left canine, first premolar and first molar in order to restore the function (Fig. 11).

Figure 11: Initial situation with four implants in place.

Mainly for aesthetic reasons, the patient also desired restorative treatment of her remaining natural teeth in the anterior and right posterior region (15 to 22 according to the FDI numbering system). The teeth showed discolouration, unfavourable proportions and some insufficient direct restorations (Fig. 12).

Figure 12: The maxillary teeth needed new restorations.

Therefore, it was decided to place all-ceramic crowns. Prior to tooth preparation, a diagnostic wax-up was made and tried in intraorally to assess functional and aesthetic aspects. Subsequently, crown preparations were made (Figs. 13 and 14) and scanbodies attached to the implants.

Figure 13: Frontal view of the prepared teeth.

Figure 14: Occlusal view after preparation and soft tissue management.

Apart from taking an optical impression of this situation (Fig. 15), the wax-up was scanned. This allowed the dental technician to superimpose the two data sets and thus facilitate the designing of the frameworks (Fig. 16).

Figure 15: STL file of the optical impression.

Figure 16: Superimposed data sets of the prepared teeth and the wax-up as a basis for computer-aided design.

The full-contour design was completed with a few clicks and then automatically reduced to the desired framework structures that ensured optimal support of the veneering ceramic (Figs. 17 and 18).

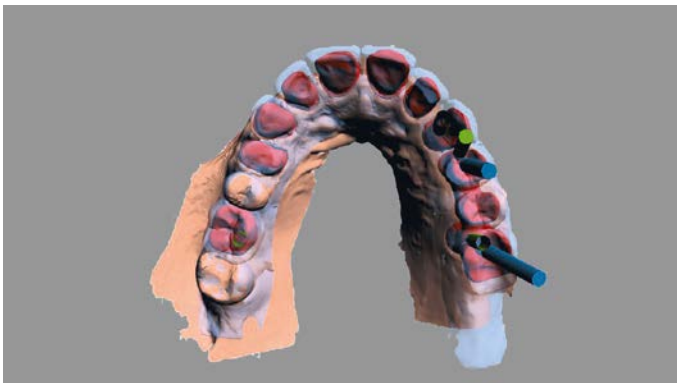

Figure 17: Computer-aided design of the frameworks under the transparent full-contour wax-up.

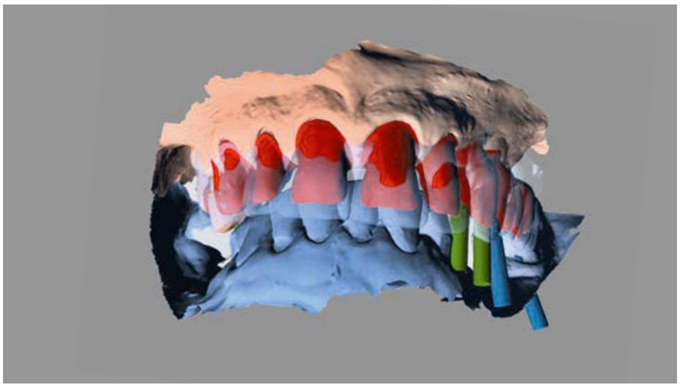

Figure 18: Frontal view of the virtual design including the opposing dentition.

Six crowns based on natural teeth, one implant-based crown and one 4-unit implant-based bridge were produced. All have a zirconia core structure layered with porcelain. The implant-based restorations were glued to titanium bases (G-Cem) for optimal connection to the implants. Figure 19 shows all restorations on the printed model which is equipped with implant analogues and a gingival mask.

Figure 19: Restorations based on natural teeth and implants.

The restorations were tried in intraorally, where they showed a precise fit. After minimal adjustments, the implant based restorations were fixed with screws, while the crowns were cemented to the natural teeth using 3M™ ESPE™ RelyX™ Unicem 2 Self-Adhesive Resin Cement. The patient was highly satisfied with the aesthetics and function of this complex reconstruction (Figs. 20 and 21).

Figure 20: Treatment result.

Figure 21: Close-up view of the aesthetic anterior restorations.

Summary

The two case examples show that the use of the 3M™ True Definition Scanner and its open STL connection can contribute to highly efficient and reliable prosthetic workflows in implant dentistry. An important precondition for high-quality outcomes, however, is the creation of a precise protocol and fine-tuning of the workflow in close collaboration with the partner in the dental laboratory, in this case the ceramist Els Dullaert.

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