Implant-prosthetic restorations – the challenge of creating an aesthetically pleasing smile in an edentulous patient

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Rehabilitation of the edentulous jaw can be achieved with various treatment modalities. Removable implant-supported overdentures can provide a comfortable, aesthetic and functional option even in cases in which only a limited number of implants can be used. Since the number of patients desiring an alternative to complete dentures is on the rise, this treatment option is becoming a frequent choice.

Patients' expectations regarding prosthetic tooth replacements are similarly high compared with fixed ceramic veneered restorations. With the emergence of new materials and their combination with CAD/CAM technology, outstanding clinical outcomes can be achieved for this indication. An adequate solution can be found for almost every patient and budget.

Generally, overdentures offer several advantages over conventional removable prostheses, including improved stability, functionality, comfort, confidence in the ability to interact socially, straight forward rehabilitation and easy maintenance for the patient. Quite simply, overdentures result in a significant improvement in the quality of life of the patient.

In our case, a 58-year-old patient presented at the practice with discomfort caused by her complete maxillary denture. When looking at her history, we found a prosthetic restoration retained on six implants in the lower jaw and a complete maxillary denture that was aesthetically and functionally inadequate (Fig. 1). An initial aesthetic evaluation established that the shape and shade of the teeth were inappropriate. In addition, the midline was misaligned and the curvature of the maxillary anterior teeth was shaped incorrectly.

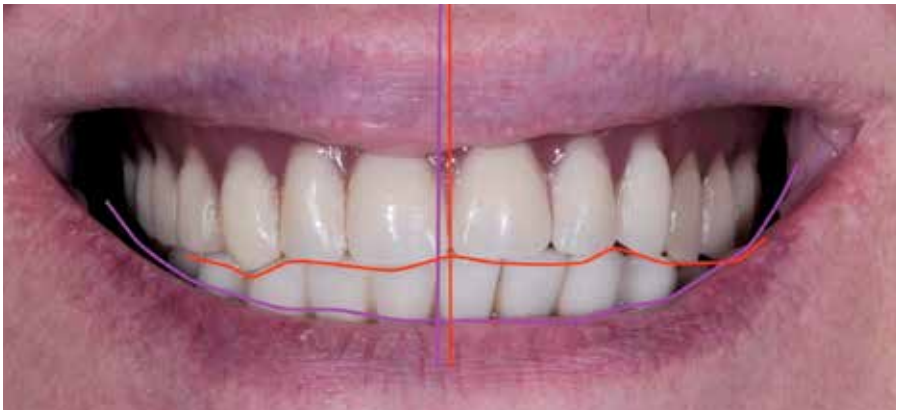

Figure 1: Aesthetic evaluation prior to treatment: the edentulous upper jaw had been provided with a conventional complete denture.

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Figure 2 and 3: After the healing and osseointegration process of the four implants, an impression of the oral situation was taken. The impression posts were splinted together prior to impression taking.

Figure 4: Implant model for the reconstruction of the overdenture.

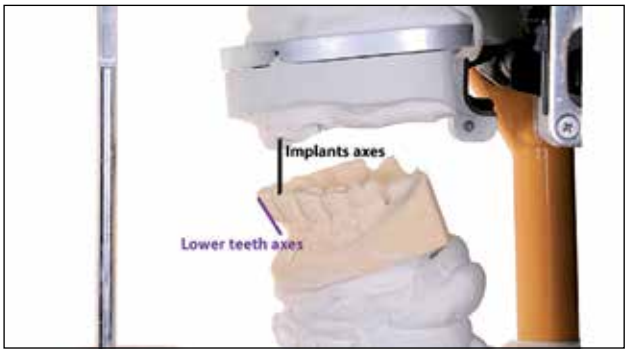

Figure 5: The models mounted on the articulator clearly demonstrate the challenges involved in this clinical case.

The poor stability of the denture was caused by insufficient prosthetic support and by the method with which it had been produced. Taking the patient's requirements and financial constraints, as well as the clinical condition of the maxillary prosthetic field, into account, we decided in favour of an implant-supported prosthetic treatment modality. The plan was to insert four maxillary implants to retain an overdenture prosthesis using the double-crown method. This procedure is frequently followed in such cases and has seen constant improvement with the emergence of new technologies and materials.

Our protocol required primary telescope crowns milled from zirconia at an incline of 2 degrees and secondary copings obtained by electroforming. This approach combines the advantages of zirconia (primary telescopes) with those of hydraulic retention (galvanic copings). After a complication-free period of healing and osseointegration, the four implants were uncovered and a preliminary impression was taken. Also, a customised tray was created from the resulting model.

In order to proceed to the next stage of the treatment, we required a functional impression that would transfer the exact position of the implants. For this purpose, the four impression posts were splinted together on a custom tray with composite material (Figs. 2 & 3). After creating the working models (Fig. 4), we determined the patient's vertical dimension of occlusion, the length of the future teeth, as well as the gingival smile line, by means of an occlusal plate (bite rim). In the upper jaw, the occlusal rim was shaped in such a way that 2 mm of the edge was visible when the upper lip was in rest position. The lower edge of the rim was aligned parallel to the bipupillary plane and smoothly followed the curve of the lower lip when the patient smiled. On the maxillary rim, the midline, the smile line and the line

Figure 6: Try-in of the wax set-up and evaluation of the aesthetic parameters.

Figure 7: Customised titanium abutments.

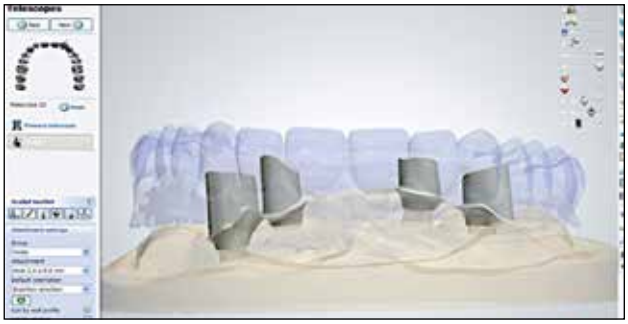

Figure 8: Reconstruction of the primary structure after scanning the model, abutments and set-up.

of the canines were outlined. A facebow was used for the transfer of the maxillary position in relation to the base of the skull.

Once all of the relevant ratios had been obtained, the models were mounted on the articulator (Fig. 5). The difficulty of this case was that we had to make allowance for the existing mandibular restoration in the design of the maxillary rehabilitation. The implant axes of the mandibular prosthesis in particular posed some problems. Shade selection was dictated by the mandibular restoration and, consequently, our room for decision-making was reduced to deciding on the shape of the teeth. To this end, a photograph of the patient as a young adult was useful, as it was her wish that the shape and size of her teeth as they were when she was young should be re-established in the prosthetic reconstruction. With the aim to attain as perfect a prosthesis as possible and to make the most of the available space, we created a wax set-up using prefabricated denture teeth (SR Phonares II, Ivoclar Vivadent).

Primary structure

A try-in of the set-up was performed to check the phonetics, aesthetics and occlusion (Fig. 6) and then a silicone key was created over the set-up. This acted as a guide in the subsequent working steps. In order to manufacture the primary structure, the four titanium abutments were customised (Fig. 7), the resulting abutments were scanned together with the model and set-up (double scan), and these datasets were imported into the design software. The CAD program proceeded to suggest the shape, height and angulation of the telescope crowns, which we adjusted and optimised as required (Fig. 8). The primary telescopes were milled from zirconia and sintered to their final density at 1,500 °C. After the accuracy of fit had been checked, the zirconia crowns were permanently bonded to the titanium

Figure 9 and 10: Grinding and smoothing of the primary structure made from zirconia in a milling unit using CAD/CAM technology.

Figure 11: Intra-oral bonding of the electroformed secondary structure with the tertiary structure.

abutments (Multilink Hybrid Abutment, Ivoclar Vivadent). Finally, the zirconia telescopes were adjusted using a laboratory turbine and parallelograph. The walls of the telescopes were given a 2-degree incline and smoothed using appropriate diamond grinding tools and sufficient water-cooling (Figs. 9 & 10).

Secondary structure

The primary crowns could now be prepared for manufacturing the secondary crowns by means of the electroforming technique. For this purpose, the zirconia surfaces were covered in a thin coating of conductive silver using the airbrush method. Upon completion of the process, the galvanised gold crowns were detached from the telescopes and the conductive silver coating was removed with a solution containing nitric acid. In the process, a highly accurate secondary structure was obtained.

Tertiary structure

All of the components were repositioned on to the working model. Before the tertiary structure was fabricated, the electroformed crowns were covered in a thin layer of wax to create the space necessary for the cement that would later be used. The tertiary structure was invested, cast in a cobalt-chromium alloy using induction casting technology and then finished. The tertiary structure was intra-orally cemented on to the electroformed telescopes (Multilink Hybrid Abutment and Monobond, Ivoclar Vivadent) in order to obtain a tension-free restoration (Fig. 11).

Aesthetic design

The structure obtained was covered in an opaque light-curing laboratory composite (SR Nexco, Ivoclar Vivadent) in pink and white prior to finishing the prosthesis. Again, the silicone key was used as a guide. The SR Phonares II teeth were repositioned from the wax set-up to the framework. The occlusal parameters were checked again and then we proceeded to complete the restoration. In order to reconstruct the pink gingival portion, we used the IvoBase Injector system (Ivoclar Vivadent). First, the denture was invested in two specially designed flask halves using Type III and IV plaster. After removing the wax and isolating the plaster surfaces, we prepared an IvoBase capsule and placed it together with the flask into the polymerisation chamber. The IvoBase injection and polymerisation process is fully automated and takes about 60 minutes. Users can choose between two programme options. Running the standard programme takes about 40 minutes. If the RMR programme is additionally activated, the pressing time increases, as a result of which

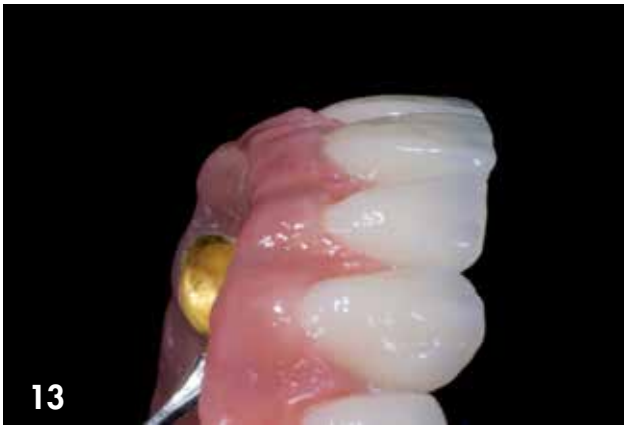

Figure 12 and 13: Detailed view of the completed denture: customised prefabricated teeth and soft-tissue parts.

Figure 14: The macro-texture and shade effect of the denture were individualised in a straight forward manner to achieve a result that is true to life.

Figure 15: The implant-retained overdenture in the patient's mouth.

the monomer concentration is reduced to less than one per cent. This aspect is beneficial to patients because the risk of allergies and irritation of the mucous membrane is virtually eliminated.

After the injection programme was complete, the flask halves were opened, and the denture divested from the stone core and processed with milling and polishing instruments. In order to create a tooth replacement that closely met the expectations of the patient, we decided to customise the visible areas of the denture by applying additional material (SR Nexco). To this end, the vestibular surfaces of the anterior teeth and the corresponding pink parts were sand-blasted. SR Connect (Ivoclar Vivadent) was applied and the teeth and prosthetic gingiva were characterised with SR Nexco. The shape was adjusted in accordance with the requirements of the patient. Final polishing was carried out with biaxial brushes and pads. The result proved very lifelike (Figs. 12–15).

Conclusion

Many patients are reluctant to be given removable dentures. If dentures are optimised by adding the stability of implants and the effectiveness of telescopes, dental professionals will be able to help patients overcome their reservations and offer them a tooth replacement that provides the level of comfort they expect. Completely edentulous patients have the same high aesthetic expectations as patients requiring fixed restorations. However, some of these requirements are more difficult to satisfy in the edentulous patient, because we have to replace soft tissue in addition to missing teeth. In order to achieve this, we need to find a way to create harmony between the pink and white aspects of the denture.

Today's patients tend to be well-informed. They have ever higher expectations of the aesthetic and functional aspects of tooth replacements. Therefore, we need to be well trained and know which materials and technologies can aid our work and increase our efficiency. This will enable us to solve any clinical case, regardless of its difficulty.

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