Aesthetic composite layering of implant-supported restorations in an edentulous jaw

A good option for the lifelike recreation of gingival tissue

By Drs Patrice Margossian & Pierre Andrieu, France

Fig. 1: Initial photograph of the patient — Fig. 2: Extremely poor oral condition. The teeth could not be saved. The alveolar ridge in the upper jaw was considerably atrophied — Fig. 3: After bone augmentation, ten implants were placed. The photographs show the situation prior to the prosthetic phase — Fig. 4: Four implants were placed in the lower jaw. Bone augmentation measures were not necessary in this case — Fig. 5a & b: Recording of the aesthetic facial axes with the Ditramax system — Fig. 6: The denture was set-up with prefabricated teeth (SR Phonares IV) — Fig. 7: Try-in of the CAD/CAM-fabricated titanium framework in the upper jaw — Fig. 8: The ground-down composite resin areas were conditioned for receiving the light-curing laboratory composite SR Nexco (Ivoclar Vivadent) — Fig. 9: Application of the colour-saturated intensive gingiva materials (SR Nexco Poste Intensive Gingiva) — Fig. 10: The application of various translucent materials imparted the prosthetic gingiva with the desired depth effects — Fig. 11: The occlusion was repositioned with the help of a facebow. In this case, the maxillary model was positioned in the articulator with the help of an antagonist jaw relation record. If the centric relation was marked on the plaster base of the model (vertical and horizontal). The vertical axis represents the midfacial plane. From the front, the horizontal axis is aligned parallel to the interproximal ridge line and from the side to Camper’s plane. These markings, which should be very close to the working area, function as a guide for the technician in setting up the teeth. Therefore, the incisal line has a predictable parallel alignment with the interproximal line. The incisal axis is aligned parallel with the midfacial plane. The Camper’s plane markings indicate the alignment of the occlusal plane. All these elements provide a sound rationale for the tooth setup according to aesthetic and functional principles.

We selected the tooth shade and the teeth on the basis of the SR Phonares II tooth mould chart (Ivoclar Vivadent). Holding the teeth up against the lips of the patient quickly revealed whether the teeth were in harmony with her facial features. The set-up of the teeth according to the Ditramax markings (Fig. 6) allows the situation to be clinically validated. In this case, attention was given in particular to the aesthetic integration of the dentogingival complex when the patient was smiling. The lip dynamics were shown with video clips. The functional criteria were also checked. The vertical dimension of occlusion had to be harmonious in order to achieve a balanced lower facial third and proper phonation.

We felt that a CAD/CAM-fabricated titanium framework (NobelProcera, Nobel Biocare) would best fulfil this indication. The double-scan technique allowed the implant model to be superimposed on the tooth setup to construct the framework. In the next step, the framework was machined and then tried on the model and in the patient’s mouth (Fig. 7). The cast impression and the high-performance processing systems significantly contributed to providing the optimal passive (tension-free) fit of the framework, which is decisive for the long-term success of the restoration.

The areas that needed to be built up with gingival materials were blasted with aluminium oxide at 200 to 300 kPa pressure. Subsequently, the SR Link bonding agent (Ivoclar Vivadent) was applied, followed by a thin layer of the light-curing SR Nexco Gingiva Opaeur to mask the metal framework. The Opaeur was polymerised and then a second coating was applied and polymerised. The resulting inhibition layer was removed.

The determination of the occlusal plane and the ideal incisal line allows the dental arches to be integrated more easily in terms of aesthetics and function. Open-tray impressions were taken with a special plaster (Snow White, Kerr Dental) and unplanned impression posts. The considered stiffness of the impression material completely immobilised the impression posts, thereby preventing any errors in the casting of the study models. An articulator allows the kinematics of the jaw to be correctly simulated. The goal of this part of the treatment is to use the functional nature of the occlusion. It is intended to use optimal occlusal integration of the restorations and the proper jaw movements during mastication, speaking and swallowing. In this particular case, the maxillary model was positioned with the help of a facebow. Four impression posts were screwed on to the implants in order to provide strong support and enhanced reliability.

Alternatively, this step can take place directly on the immediately loaded provisional restorations. For this purpose, however, the model has to be mounted in the articulator. In the present case, the maxillary model was positioned in correct relation to the hinge axis-occlusal plane. Subsequently, we adjusted the bite patterns in order to record the vertical dimension of occlusion. The centric relation is regarded as the reference position for adjusting the muscles to the centric and functional jaw relation. The mandibular model was mounted in the articulator with the help of an antagonist jaw relation record. If the centric relation of the model is incorrect, the immediately loaded provisional restorations can be used for this purpose. The restorations have to be immobilised when they are mounted in the articulator. The Artex system (Amann Girrbach) allows the articulator of the dental practice and that of the laboratory to be synchronised. The Dintramax system was used to transfer the precise data on the aesthetic facial axes to the maxillary model (Figs. 5a & b). Two axes were marked on the plaster base of the model (vertical and horizontal). The vertical axis represents the midfacial plane. From the front, the horizontal axis is aligned parallel to the interproximal ridge line and from the side to Camper’s plane. These markings, which should be very close to the working area, function as a guide for the technician in setting up the teeth. Therefore, the incisal line has a predictable parallel alignment with the interproximal line. The incisal axis is aligned parallel with the midfacial plane. The Camper’s plane markings indicate the alignment of the occlusal plane. All these elements provide a sound rationale for the tooth setup according to aesthetic and functional principles.

Careful planning is indispensable in the treatment of an edentulous jaw with implant-supported restorations. The axes and positions of the implants must correspond to the given biological, mechanical and aesthetic conditions. In situations in which severe bone recession has occurred, the work of the dental team has to involve the reconstruction of the dental and the gingival tissue. The flawless reconstruction of gingival tissue requires sound teamwork, as well as excellent materials and exceptional skill. Layering with the light-curing laboratory composite SR Nexco (Ivoclar Vivadent) takes this procedure to a new level.

Surgical phase

Owing to the sufficient bone structure in the lower jaw, this part of the mouth could be restored at once with four immediately loadable implants. During the reconstructive phase, the upper jaw had to be treated with a provisional removable denture owing to the atrophied alveolar ridge. The tooth extractions from the upper and lower jaw were performed on one day. At the same time, four mandibular implants were placed and loaded. An immediate denture was seated in the upper jaw.

Fig. 7: Try-in of the CAD/CAM-fabricated titanium framework in the upper jaw.

During the osseointegration period of the maxillary implants, the maxillary bone was reconstructed. The maxillary sinus and the alveolar ridge were augmented in one appointment. At a later appointment, ten implants were placed according to the treatment plan and exposed after six months. As a result of well-planned soft-tissue management, adequate firm keratinised tissue had formed. The permanent restorations for the upper and lower jaws were fabricated two months later (Figs. 3 & 4). A 37-year-old female patient presented to our practice with her teeth and the surrounding bone structure in very poor condition (Figs. 1 & 2). Numerous teeth were missing from both the upper and lower jaws. In addition, the upper jaw showed considerable bone and gingival resorption. The patient wished to have her teeth returned to regain an attractive appearance. Owing to the extensive damage, complete restoration of both jaws with implants was indicated. The determination of the occlusal plane and the ideal incisal line allows the dental arches to be integrated more easily in terms of aesthetics and function. Open-tray impressions were taken with a special plaster (Snow White, Kerr Dental) and unplanned impression posts. The considered stiffness of the impression material completely immobilised the impression posts, thereby preventing any errors in the casting of the study models.

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The conventional flask technique with a heat-curing denture base material (ProBase Hot, Ivoclar Vivadent) was used to produce the denture. After the polymerisation process, the denture base was ground and space was made for building up the Gingiva composite. The surface was conditioned by blasting it with aluminium oxide (50 µm) at 200 kPa (Fig. 8). A bonding agent was then applied and left to react for three minutes before it was light cured.

In order to achieve very lifelike results in the layering of the gingival tissue, saturated (intensive) materials (SR Nexco Paste Intensive Gingiva) were used first (Fig. 9). Next, translucent, light-curing gingival materials (SR Nexco Paste Gingiva and SR Nexco Paste Basic Gingiva) were used to impart the gingival areas with the desired depth (Fig. 10). The colours of the Gingiva composites range from pale pink through reddish and orange to purple. A certain amount of time and effort are necessary to master the necessary mixing techniques and achieve a harmonious interplay of the intensive and the translucent materials. Practical experience is essential. With some technical skill, the gingival areas can be naturally reproduced in terms of shape, texture and shade.

All the individual layers were pre-cured (Quick curing light, Ivoclar Vivadent) in segments. A high-performance curing light was used for the final polymerisation. Prior to this step, a coating of glycerine gel (SR Gel, Ivoclar Vivadent) was applied to the surfaces to prevent oxygen inhibition, which could lead to an unattractive result that is difficult to polish. The surfaces of the teeth were characterised with a vertical and horizontal macrostructure. Particular attention was paid to mechanical polishing. Once the glycerine gel had been removed, the restorations were finished with different polishing instruments (various grit sizes, pumice, leather buffing wheels and universal polishing paste; Fig. 11). In the present case, mechanical polishing was preferred to glazing with a light-curing composite in order to prevent premature aging of the surface.

The dentures were seated manually with the help of multi-unit abutments from Nobel Biocare (Fig. 12). The screw channels were sealed with Teflon and light-curing composite resin. The position of maximum intercuspation was checked and the occlusal pathways were adjusted to protrusive and laterotrusive movements. In addition, the restorations were checked in terms of the ability to clean them with interdental brushes, and the patient was given special instructions regarding her oral hygiene.

Conclusion

For a long time, ceramics were considered to be the aesthetic benchmark. With the introduction of state-of-the-art industrially fabricated acrylic teeth specially designed for implant applications, the bar for aesthetics has been raised in this category of materials. The teeth used in this case exhibit a true-to-nature morphology, which allows the restoration to be functionally integrated without any problems. Using the laboratory composite SR Nexco to recreate gingival tissue is an effective restorative approach. In contrast to ceramic materials, the composite resin is easy to handle and delivers exceptionally aesthetic results (Fig. 13). The light weight of the material is an added benefit. An all-ceramic restoration (zirconium dioxide framework, layering ceramic, gingival mask) weighs almost twice as much as a titanium and composite resin denture. Another advantage of the type of restoration described here is its long service life. The success of an implant-supported denture depends on the systematic coordination of all the surgical and prosthetic requirements. A strict procedure needs to be followed from the treatment plan to the final outcome. Layering gingival portions with a laboratory composite represents a genuine improvement on previous materials and methods with regard to aesthetics, handling and hygiene (Fig. 14).

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