Removable prosthesis in digital times

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The main problem that brings patients to our surgery is an edentulous maxilla, which motivates the patient to want a functional restoration, with particular attention to the aesthetic result. The evaluation of the soft tissues of the face, from front and side view, shows a big reduction of the labial support induced by a centripetal bone retraction. More than that, the lack of sagittal and vertical bone support reduces the degree of dental-gingival exposure in case of peri-prosthetic crestal design (Figs. 1 & 2).

Considering the above parameters, to centre the aesthetic requirements it is proposed to the patient a removable implant-prosthetic rehabilitation; the goal is to achieve, with the prosthetic flange, a “prosthetic reconstruction” of the atrophic bone, thus favouring a suitable labial support with a correct teeth set-up.

The operating sequence therefore seeks to verify the soft tissues’ support by using an intraoral try-in of the set-up made on a model from a preliminary impression in alginate (Fig. 3).

The aesthetics were controlled and also confirmed by the patient’s involvement and approval who wanted a removable prosthetic solution without the palate area, and still have a good stability.

Fig. 1: Initial situation—patient’s profile.
Fig. 2: Initial situation—front view.
Fig. 3: Teeth try-in of the temporary prosthesis.
Fig. 4: Intraoral situation after implants placement and before the reopening.
Fig. 5: Teeth set-up on preliminary impressions after performing the occlusal jigs and mounted models in the articulator.
Fig. 6: Duplication of the teeth set-up with a transparent resin.
Guided by the duplication of the teeth set-up (replica), the implants were placed in the most suitable position and in a sufficient number to build a stable, aesthetic removable prosthesis without the palate. During the osseointegration period, the patient was provided with a temporary prosthesis in the zones adjacent to the implants. After the period of osseointegration, the implants were inspected.
and the gums had healed. The final phase also followed all the directions given to the patient about her experience with the temporary restoration.

All this information is critical to improving the aesthetics and the functional aspects in the final phase. For this reason, a new alginate impression was taken to produce an individual tray in order to produce an edentulous model and a preliminary registration rim for the mounting of the models in the articulator using a face bow. After the first phase was achieved, a teeth set-up restoring the aesthetics and the correct function was created (Fig. 5). Once these parameters were determined, the teeth set-up was duplicated using the silicone masks with a transparent resin (Fig. 6). The replica was perforated to correspondence with the implants in order to take a definitive impression in the centric relationship and with the same vertical dimension of the teeth set-up (Figs. 7 & 8).

After the production of the master model, a resin jig was created by screwing the transfers on the model and by connecting them with resin that was cut around each implant; the dentist reconnected it in the mouth, assuring the correct impression position of the implants. When the jig was returned to the laboratory, a small model was created with the new analogues; this is an important model for the verification of the passivity and the precision of the structures (Figs. 9 & 10). With the same model, the accuracy of the position of the analogues in the master model was verified. At this stage the models, the implants and the teeth set-up were scanned in order to have all the information to verify the available spaces, and the number and position of the implants; only now is it possible to correctly plan a suitable prosthetic project, according to the available spaces; this also means choosing the correct attachments that will guarantee a good retention without modi-

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**Fig. 15:** At this stage, the most suitable areas for positioning the retentive systems are identified, according to the aesthetics and functionality given by the teeth set-up. – **Fig. 16:** Side view scans. – **Fig. 17:** The vertical attachments are placed distally from the last implant in order to improve the prosthesis’ retention. – **Fig. 18:** Positioning of the distal attachment. – **Fig. 19:** Once positioned, the distal attachments from the tissues should be well evaluated; otherwise the cap and its housing may compress the soft tissues. In this phase, keeping the scan abutments in transparency also provides an opportunity to check the cuff height. – **Fig. 20:** Virtual bar. – **Fig. 21:** Buccal view of the virtual bar.
Fig. 22: The milled structure is tested on the model obtained from the resin jig, to verify its accuracy and passivity; this also ensures a better view of the contact areas. – Fig. 23: The structure is screwed and controlled on the working model. – Fig. 24: The structure is screwed on the working model to verify the soft tissues’ areas and the spaces for a correct hygiene. – Fig. 25: After the laboratory checks, the bar is checked in the oral cavity, paying attention to the soft tissues and the cuff height. – Figs. 26–28: Control of the connection with an X-ray. – Fig. 29: After a first polish, the attachments are selected and screwed into the bar. – Fig. 30: After screwing the attachments in, a final polish of the structure is performed. – Fig. 31: The superstructure was produced and the retentive caps are tested. – Fig. 32: Final polish of the two structures.
Restoration of the edentulous maxilla

The file was sent to the New Ancorvis milling centre for the production of a Cr-Co bar. After a few days, the bar was returned to the laboratory, and tried first on the replica model to ensure its accuracy and passivity (Fig. 22); then the bar was positioned on the master model to verify it was a good fit even compared to the soft tissues, the cuff height and the correct spaces for hygiene (Figs. 23 & 24). After that the bar was sent to the dentist to double check the precision, passivity, correct spaces for hygiene, with the help of X-rays (Figs. 25–28). After those checks had been carried out, the bar was finished and polished. At this stage, the attachments were chosen accordingly to the type of prosthesis and the project and screwed into the structure (Fig. 29).

Once the attachments were screwed in, the bar was thoroughly polished (Fig. 30). The counter-bar was produced, polished and the retentive caps were inserted (Figs. 31 & 32). With the help of silicone masks, the teeth were repositioned and waxed on the superstructure, for the final try-in in the mouth (Figs. 33–35). A final check that everything had been completed was carried out with the teeth set-up (Figs. 11–21).

With the help of some silicone keys, the teeth are easily repositioned on the superstructure.

Figs. 34 & 35: Final examination of the structures with the teeth reassembled on wax.

Fig. 36: With an injection muffle, the prosthesis is transformed in resin.
carried out, including: the phonetics, aesthetics and the correct support of the soft tissues. Once the pink flange was finished, the prosthesis was positioned in the muffle furnace for the curing steps (Fig. 36). These systems provide a good precision and an excellent detail reproduction. Once cured, the prosthesis was extracted and finished (Fig. 37) and then to the final polishing prior to the delivery (Figs. 38–40). Finally, the superstructure and the prosthesis were placed in the mouth (Figs. 41–43), verifying the good aesthetics, function and also the satisfaction of the patient (Figs. 44–46).

**Conclusion**

The teeth set-up, and digital systems allow us to accurately design a complete rehabilitation, and is important in highlighting from the very early stages which solution (fixed or removable) is most suitable for the patient. In this case, the solution of a removable prosthesis made possible an optimal functional and an aesthetic result.

**about**

**Dr Gualtiero Mandelli** graduated in Medicine and Surgery from University of Study of Milan in 1985. After graduating, he achieved three post-graduate specialisms in: Orthodontics, Stomatology and Pediatrics in the same University. He was Visiting Professor in Orthodontics at University of Parma from 2003 to 2010 and from 2011 he has been Visiting Professor at Specialisation School in Orthodontics at University of Brescia. His private practice is in Lombardia. He has been a member of SIDO from 1995. Dr Mandelli is also an author of various scientific works and has given talks and presentations at numerous courses and congresses.

**Carlo Borromeo** founded Dental Laboratory Borromeo in Italy in 1988, specialising in the construction of prosthesis for implants using CAD/CAM. He collaborates with Nobel Biocare Procera, Dental Wings, Rhein’83 and other companies to improve his expertise with their materials. He is a highly published industry author and presents and participates in many dental lab courses and conferences.