Nowadays, implant-supported prostheses are used more and more in people’s daily routines and removable prostheses in case of large rehabilitation offer aesthetic and functional advantages especially when support of the soft tissues is necessary. In this article, much attention will be given to the analysis and the design of the prosthesis in order to achieve predictable and repeatable results. During the construction of the structure and superstructure the microscope will be critical to achieve the maximum precision.

**Introduction**

Removable prostheses are increasingly being used in everyday practice; in many cases you can achieve excellent functional aesthetic results even in the presence of a reduced number of implants, mostly when the patient wishes a stable total rehabilitation without the insertion of many implants. After the construction of a total temporary prosthesis in...
the lower jaw and the evaluation of all the problems and expectations of the patient, it is planned to produce a full denture anchored to a bar screwed on four implants (Fig. 1).

**Step by step procedure**

In the first phase, after the implant surgery guided by a replica of the temporary restoration, the definitive impression was taken with a set-up created to restore aesthetics and function (Fig. 2). During the try-in, the template that was prepared in the laboratory over the master model was also checked (Fig. 3) in order to verify that there was agreement between the implants and the wax-up. The template was screwed on the implants, and blocked with the resin where it was separated; doing this we can be sure of the implants’ position. The template was returned to the laboratory to check the accuracy of the wax-up’s position and their passivity against the master

Fig. 6: With the resin jig the correspondence between the position of the wax-up and the implants located in the oral cavity is searched; after that the teeth set-up, the model and the implants position were scanned.

Fig. 7: After making the teeth set-up translucent, the design of the structure was begun, considering the available space and the position of the teeth and of the implants. It is also evaluated the masticatory plane in relation to the main plane of the structure.

Fig. 8: The project of the bar continues, verifying all the details before sending the file, even the choice of the kind of anchor should be carefully evaluated according to the type of structure and the available spaces.

Fig. 9: After sending the file, the structure was produced by the milling centre, and the first check to be carried out is the precision and passivity test, which was performed on the verification model built with the help of resin jig.

Fig. 10: Detail of the structure positioned with the silicone gums, checking the areas around the implants and adjacent to the bar to locate the correct positioning.

Fig. 11: After the bar was complete, the silicone of the set-up is positioned and the available spaces are checked.

Fig. 12: The possibility of screwing and unscrewing the retentive attachments gives not only the advantage to change them in case of wearing over time but also to change them at any time during the design of the superstructure.

Fig. 13: After carrying out all the necessary checks, the structure is finely polished before building the superstructure.
At this point, after checking the set-up and the correct positioning of the wax-up, the model, the scan abutment, and the teeth set-up (Fig. 6) were scanned.

With the teeth set-up in light transparency, the design of the bar began, taking into consideration the available spaces, and keeping in mind the kind of prosthesis to create (Fig. 7). The design of the bar has to be accurate in all its details, including the surfaces facing the gums that should enable the patient to clean their teeth daily. Only at this stage is it possible to identify what kind of attachments to use and where to put them in order to allow a good retention and a proper function (Fig. 8).

Once the design was finished, the file was sent to the milling centre, where it was milled in chrome-cobalt and returned to the laboratory where the first verification of its passivity and precision with the measuring gauge was performed (Fig. 9). After obtaining the evidence of its passivity on the master model, another test was done mainly on the area around the implants (Fig. 10). Setting the lingual silicone key on the model the available space for the construction of the superstructure and the prosthesis was also checked; at this stage it is still possible to intervene modifying the project.

The structures were sent to the dentist for tests in the oral cavity (Fig. 11). During the design, the
The correct areas where to locate the attachments were carefully evaluated and the milling centre was asked to produce the threads inside the bar in order to screwed the attachments directly into it after polishing and finishing; the most suitable attachments were then screwed to reach the retentiveness that was planned beforehand (Fig. 12). Once polished, the bar superstructure can be produced (Fig. 13).

A crucial step is to refine and perfectly polish the areas around the implants and the soft tissues, because the superstructure did not have to compress any area (Fig. 14). The superstructure may be made with an indirect technique duplicating the model, or with CAD, or directly on the structure with resin, as presented in this case report. Once done and before the casting, a further control with the silicone keys of the volumes and spaces available (Fig. 15) was made. After the checks, the superstructure was sprued with injection pins and with a stabiliser bar in the rear area (Fig. 16).

Immediately after the cast, the superstructure was controlled in all its parts to verify the quality of the alloy, and checked it fit over the bar with a marker spray and with minimal pressure (Figs. 17 & 18). With magnifier systems, every area of friction or incorrect pressure, both on the bar and in the superstructure, was searched; this allows the maximal function of the retentive systems (Figs. 23 & 27).

Fig. 23: After checking the good friction of the superstructure all the retentive laboratory caps were placed, the bar and attachments sprayed anew with the marking spray and the correct sitting is checked.

Figs. 24 & 25: After removing the superstructure, the retentive areas of the attachments are searched with the microscope; the wrong areas of contact on the attachments show how they do not work properly. This because there are some points on the structure that have to be discarded as they will interfere with the bar insertion.

Fig. 26: After correcting of those points that interfere with the proper function of the attachments, the superstructure sits correctly over the bar and this is showed by the correct contact areas on the attachments.

Fig. 27: After all these functional tests between the structure and superstructure, the available spaces are checked with the lingual silicone key.

Fig. 28: Using the vestibular silicone key, the teeth were repositioned.

Fig. 29: Having built the structure and the superstructure with the silicone keys, the teeth repositioning is easily done, having all the necessary space and without affecting the teeth.

Fig. 30: Detail of the modeling of the soft tissues after the replacement of the teeth.
The use of the magnification systems

industry report

The structure and of the retentive systems to be checked (Figs. 19 & 20). These magnifying devices, such as microscopes, allow for a better identification of the areas to be eliminated, and to distinguish those only to be polished, as metal abrasions must be eliminated (Fig. 21). As soon as all these points are correctly managed, the result will be a good fitting of the superstructure with a smooth friction, with the location of the attachments perfectly in the centre of the housings (Fig. 22). Only at this point were the black lab caps inserted, and the superstructure was inserted on the bar after being sprayed with marking spray; this allows you to check how the attachments act during the insertion (Fig. 23). Once the superstructure was extracted, the attachments were checked using the microscope and it was detected that some areas were wrongly involved; indeed when the lacquer was removed (Figs. 24 & 25) around the attachments, incorrect contacts could be seen. As a consequence, the caps will not work in the retentive areas of the spheres, this is because some points of the bar will hinder the superstructure’s insertion. Once those points of friction were removed at a second test, the structure sat better over the attachments (Fig. 26).

Fig. 31: The model with the prosthesis was inserted in the flask furnace for the processing.
Fig. 32: The superstructure is being sandblasted and daubed with the prime and an opaque layer.
Figs. 33 & 34: Details of the prosthesis after the resin injection.
Fig. 35: The internal part of the superstructure has been polished and all the retentive caps are inserted, during the try-in test it will be decided whether they have to be replaced with more or less retentive caps.

Fig. 33: Prosthesis and structures have been polished and ready for the final test.
Fig. 37: The structure screwed into the oral cavity.
Years of research, opinions and wishes of users as well as mutual cooperation have led to the creation of the efficient CAD/CAM solutions. Simple application, excellent technology and fine materials are backed by professional support, which is available throughout the process, i.e. from your desire and idea of a purchase to the training and fast solutions to any problems you may encounter during use.

Zr DISCS
- CC Disk Zr
- CC Disk Zr coloured
- CC Disk Zr HT
- CC Disk Zr HT coloured
- CC Disk Zr Smile
- CC Disk Multicolour

CoCr DISCS
- For all metal ceramics
- CTE 13.9 - 14.0 × 10^-6K
- Contains very little oxides

Ti DISCS
- Ti2; for crowns, bridges and simple implant substructures.
- Ti5; for crowns, bigger bridges and complex implant substructures.

PMMA DISCS
- CC Disk PMMA
- CC Disk PMMA Transparent
- CC Disk PMMA Pink
- CC Disk PMMA X-ray Opaque
At this stage, the prosthesis could be finalised using the silicone to control the spaces and to relocate the teeth (Figs. 27 & 28). The importance of using the silicone keys throughout the design and final is visible in Figure 29, where the available space for the repositioning of the teeth is clearly visible. Without damaging the individual teeth, the set-up is reproduced in a practical and quick way, keeping all the features of the initial project (Fig. 30).

After repositioning and the new waxing was completed, the model with the denture was inserted in the injection flask, and attached with a silicone base (Fig. 31). When the wax was removed and the model cleaned and isolated; the teeth were repositioned in the silicone key, the superstructure sandblasted, treated with primer, opaque and cured and put back on the model (Fig. 32). The flask was injected with resin and after its curing, the prosthesis is finished, rechecked in the articulator and polished (Figs. 33 & 34). Even the inner side was refined and polished, and only after this final steps, the retentive caps were inserted inside the prosthesis. These caps have the retention that the patient desires and the project necessitates (Fig. 35). After the structure was polished, it was delivered to the clinician; polishing is a crucial part of the process to avoid plaque adherence (Fig. 36).

During the final test after the bar is screwed in the mouth, it is good to double check the surrounding areas of the implants and the correct spaces for daily hygiene (Fig. 37). After its insertion, the prosthesis is re-checked and eventually discarded or remodeled; after a few days the patient was reviewed with great satisfaction of the work done and had a smile on his face (Figs. 38–40).

**Conclusion**

As pointed out in this article, the importance of using magnification systems is evident, including removable prosthesis, as they provide the possibility to check the good sitting of the superstructure on the bar and the proper function of the retentive systems; this eliminates the negative internal tensions of the whole system that can be transmitted to the implants, thus extending the life of attachments and of the whole system._

**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.