

Evaluating the fit of removable dentures with magnification systems

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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

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Fig. 1: Lower removable prosthesis anchored with a CAD/CAM milled cobalt chromium bar with 2 degree of inclination with micro screwed attachments, with a cast cobalt chromium superstructure and incorporated in the resin.



Fig. 2: After preparing the master model mounted in the articulator, the teeth set-up is executed looking for the aesthetics and the function without worrying about the position and the type of the implants.

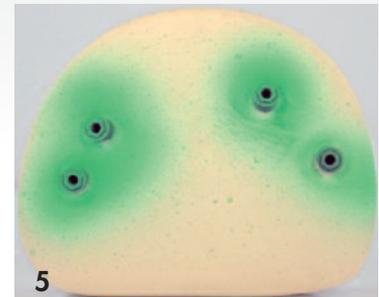
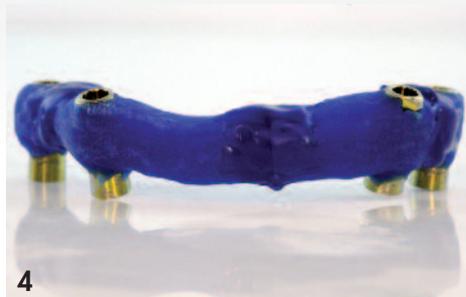
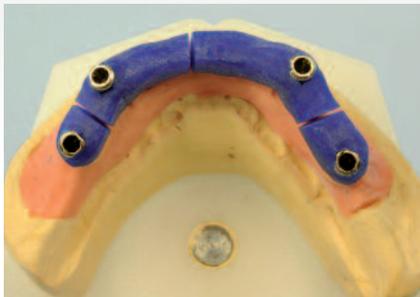


Fig. 3: Over the master model a resin jig is produced after positioning the four metal transfers, and once cured it has been cut to eliminate any shrinkage or inaccuracy during the polym

Figs. 4 & 5: After the jig has been re-joined in the oral cavity, the wax-up was screwed in the transfers and a probe model was built for the verifying the accuracy and the passivity of the structure to be achieved.

accuracy of the wax-up's position and their passivity against the master model (Figs. 4 & 5). 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). Sitting 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 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 screw 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

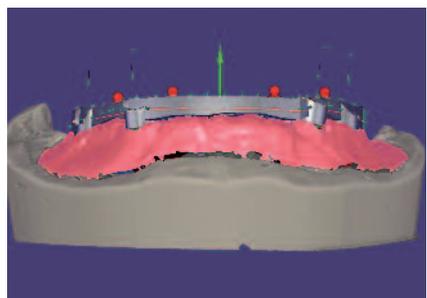
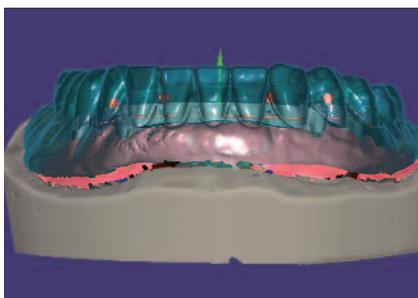
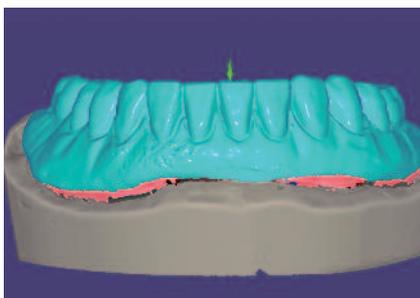


Fig. 6: With the resin jig the correspondence between the position of the wax-up and the implants located in the oral cavity is searched; after that the teeth set-up, the model and the implants position were scanned.

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.

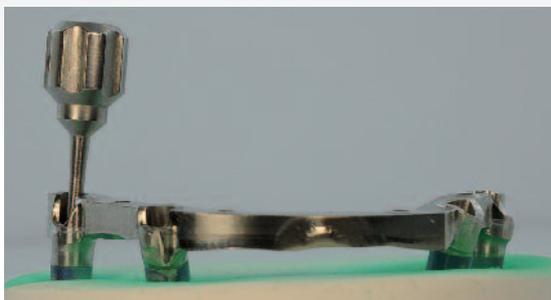


Fig. 9: After sending the file, the structure was produced by the milling centre, and the first check to be carried out is the precision and passivity test, which was performed on the verification model built with the help of resin jig.

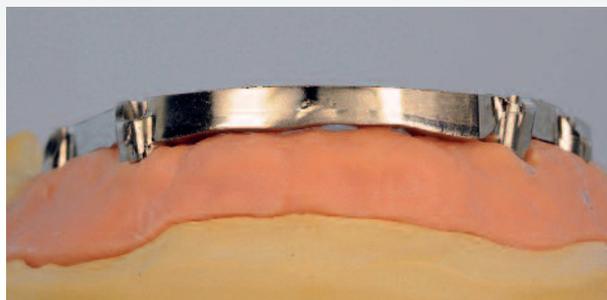


Fig. 10: Detail of the structure positioned with the silicone gums, checking the areas around the implants and adjacent to the bar to locate the correct positioning.

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

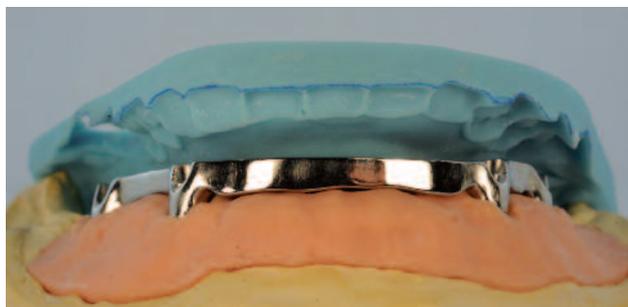


Fig. 11: After the bar was complete, the silicone of the set-up is positioned and the available spaces are checked.

(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 its 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 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

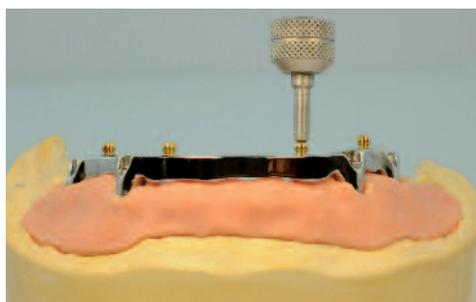


Fig. 12: The possibility of screwing and unscrewing the retentive attachments gives not only the advantage to change them in case of wearing over time but also to change them at any time during the design of the superstructure.



Fig. 13: After carrying out all the necessary checks, the structure is finely polished before building the superstructure.



Fig. 14: After polishing, the hygiene maintenance is checked towards the whole bar extension.



Fig. 15: Once polished, the structure was built directly onto the superstructure with pattern resin and preformed castable pieces, and everything is controlled with the palatal silicone key.



Fig. 16: The sprued superstructure with main and accessory pins and the stabilising bar.

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



Fig. 17: Cast superstructure.



Fig. 18: The superstructure is checked with a marking spray to verify the friction and the wrong points of contact for a proper sitting on the bar.



Fig. 19: Detail of a pre-contact area during the insertion of the superstructure on the bar, the bar at this stage still had no retentive caps.



Fig. 20: View with microscope of the friction points of the superstructure; during the test you can see the green areas and the abrasions.



Fig. 21: At a higher magnification, the areas of abrasion to be polished with adequate burs are searched to obtain proper friction.



Fig. 22: The proper sitting of the superstructure was performed excluding the attachments in order to avoid any interference so that the correct interface can be searched.



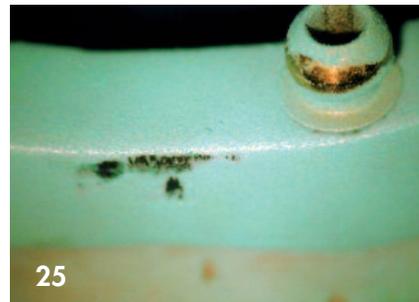
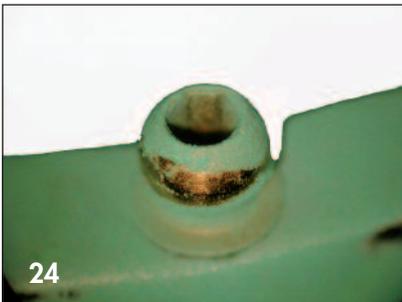
Fig. 23: After checking the good friction of the superstructure all the retentive laboratory caps were placed, the bar and attachments sprayed anew with the marking spray and the correct sitting is checked.

of friction were removed at a second test, the structure sat better over the attachments (Fig. 26).

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



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.

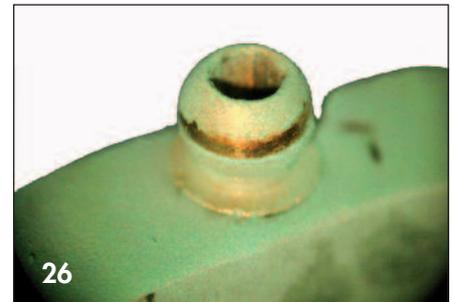


Fig. 26: After correcting of those points that interfere with the proper function of the attachments, the superstructure sits correctly over the bar and this is showed by the correct contact areas on the attachments.

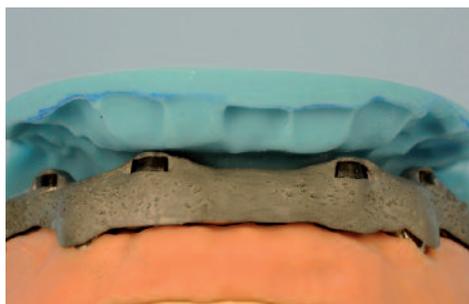


Fig. 27: After all these functional tests between the structure and superstructure, the available spaces are checked with the lingual silicone key.



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.

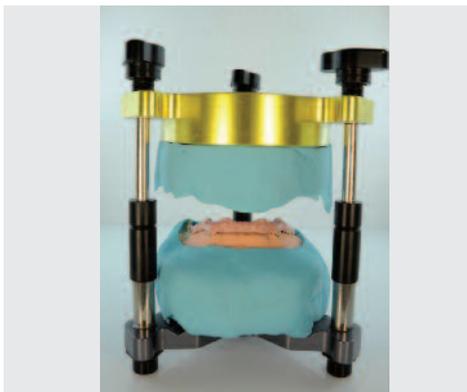


Fig. 31: The model with the prosthesis was inserted in the flask furnace for the processing.

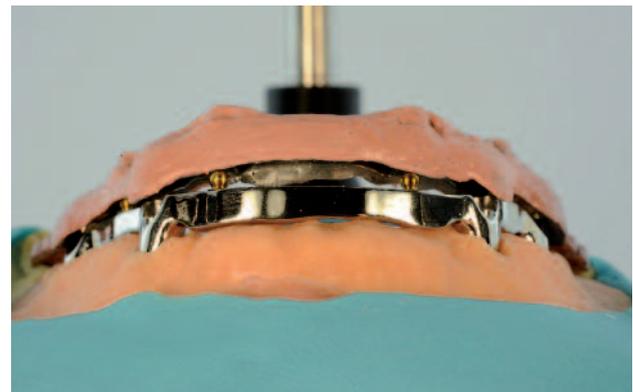


Fig. 32: The superstructure is being sandblasted and daubed with the prime and an opaque layer.

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



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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. 36: Prosthesis and structures have been polished and ready for the final test.



Fig. 37: The structure screwed into the oral cavity.

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.

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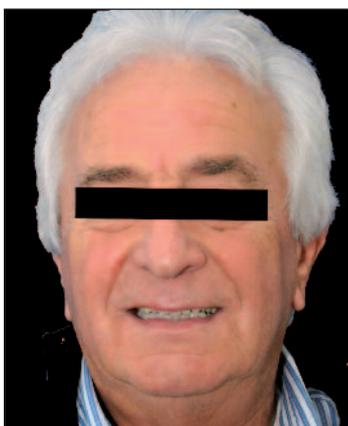
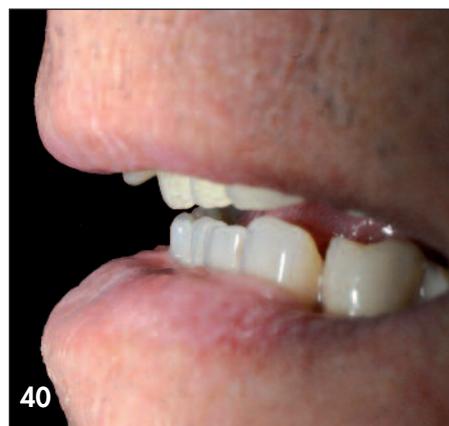


Fig. 38: Final exam with prosthesis inserted; at this stage the prosthesis stability is tested.



Figs. 39 & 40: Patient with the inserted prostheses.

