Impression and registration for full-arch implant dentures

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Introduction

Usually, a full denture is delivered following tooth extraction or implant insertion of a fully edentulous arch. A denture is usually used until the final restoration is performed. A well-designed full denture should fulfill the following criteria: 1) correct vertical height and maxilla-mandibular relationship; 2) accurate occlusion; 3) appropriate choice of teeth with regard to shape, length, width and position; 4) adequate lip support; and 5) proper function and aesthetics to meet the patient’s expectations. The final restoration should fulfill or surpass these requirements. Obtaining a correct impression and accurately evaluating the interocclusal relationship (e.g., interocclusal distance, occlusal recording and determination of the exact position of the placed implants) are often challenging and time-consuming tasks.

The aim of the current report is to present an impression and registration technique that allows the transfer of the interocclusal relationship, occlusal recording and esthetics that were initially applied to produce a full denture base were corrected (Fig. 1a). After the extraction sites had healed #13, a full denture was fabricated. If necessary, angulations, shape and color of the denture teeth and the shape of the denture base were corrected (Fig. 1a). The resulting denture was used by the patient until the final restoration was delivered. For the final restoration of the maxilla, an implant-retained denture with telescopic crowns as attachments was planned.

After the implant was uncovered, the denture was modified to allow sufficient space for the healing abutments. A duplicate of the denture (DentDu) was made out of clear resin (Paladur, Heraeus, Hanau, Germany, Fig. 1b). A trial of the DentDu was performed and minor occlusal discrepancies were corrected (Fig. 1c). Bite records were taken in centric occlusion with modeling resin (pattern resin®, GC, Alsip, IL; Fig. 1c), using the casts of the original denture. Afterwards, the DentDu was placed in an articulator and a controlling of the occlusion was made (Fig. 2a) with the bite records. A pickup transfer system consisting of a titanium impression post and a plastic impression sleeve was employed (Dentegris, Dussburg, Germany, Fig. 2b). The DentDu was carefully modified by creating internal clearance in the area of the implants so that it could be applied as an individualized custom tray. This permitted it to be fully seated (Fig. 3c) and with the plastic impression sleeve (will be left in the impression). (DentDu) was made by a polyether material (Impregum, 3M ESPE; St. Paul, MI). During this process, the DentDu was kept in centric occlusion using the bite records (Fig. 3a).

The titanium impression posts were connected with the implant analogues and with the plastic impression sleeves (Dentegris), which were embedded in the impression material (Fig. 3b). A master cast was then fabricated and articulated with the help of the bite records (Figs. 3c, Figs. 4a & 4b).

Customizable abutments (Dentegris) were taken to fabricate the implant abutments. Parallelism, angulation, position and shape of the implant abutments were determined using a silicon key fabricated from a pattern resin®, GC; Fig. 5). The dentist and the dental technician relied on two alternatives for customized abutments selection: 1) UCLA customizable abutments (UCLA, Dentegris) for casting with a gold alloy (for example, Ankait, Anka Guss, Waldaschaff, Germany, Fig. 6b).

After casting, the customized implant abutments were grinded, polished and served as the basis for the fabrication of electroformed puregold copings with a thickness of 0.25 mm (Au > 99.9 %, Wieland, Fig. 6c). The framework was then constructed via CAD/CAM. To ensure proper functioning of the framework, a plastic mock-up and a temporary fixed denture (TFD) were milled (ZENOMIPMA, Wieland). The customized implant abutments, the electroformed copings, the mock-up and the TFD were delivered by the dental laboratory for the next clinical session.

The abutments were transferred, positioned on the implants and torqued to 35 Nm using a resin transfer key (pattern resin, GC; Figs. 7a & b). From this point on, the customized abutments remained fixed in order to avoid any possible inaccuracies. The electroformed copings were placed on the implant abutments (Fig. 7c). The mock-up was placed over the electroformed copings and the occlusion was checked with the bite records (Figs. 8a & b) to ensure proper functioning of the framework, a plastic mock-up and a temporary fixed denture (TFD) were milled (ZENOM-PMMA, Wieland). The customized implant abutments, the electroformed copings, the mock-up and the TFD were delivered by the laboratory for the next clinical session.

The new master cast was articulated with the help of the gold copings and the mock-up. The metal framework...
of mouth cancer. The same applies to alcohol. There are some nuances as regards the type of tobacco or alcohol that may affect risk but these are really not of notable concern when communicating a disease prevention message. Of significance is that the risk of cancer developing if someone smokes and drinks is much higher than if someone smokes or drinks (i.e. there is a synergistic rather than additive effect).

Of course, many dentists will indi-
cate that they have no experience of having seen oral cancer or having managed any patient who has previously had such disease. However, there are some simple rules. If a lesion is solitary, has been present for more than three weeks and has no local cause, the patient should be referred. Any lesion that strikes a dental professional as odd and/or destructive warrants referral.

Dentists should always keep an accurate and contemporaneous record of what is observed during clinical examination and be familiar with the contact details of local oral cancer specialists (typically oral and maxillofacial surgery or oral medicine).

Finally, the patient should be told the truth, i.e. that the dental professional has concerns that a lesion is possibly malignant or premalignant, and that they are referring the patient for further investigation.

Figure 12A–C: A case of fixed-implant rehabilita-
tion, right site (a), anterior area (b), left site (c).

Figure 13A–C: Impression of a case with an implant overdenture, palatal; (a), anterior, (b) and right side (c).

Figure 14: DentDu modified for open-tray impression technique. A customized implant abutment was designed as a cover denture. From this cover denture, a DentDu could be fabricated and further used as described above (Figs. 13a–c).

Porcelain is a possible material for veneering of fixed-denture frameworks. If the angulation of the implants does not allow for taking impressions in the above-described way and an open-tray impression is preferable, fenestrations can be fabricated into the DentDu (Fig. 14).

Discussion

The reconstitution of the fully edentulous arch with implant-retained dentures necessitates thorough planning and a precise and passive fit of the superstructure. A previous study demonstrated that a passive fit between the implant superstructure and the underlying abutments is essential for the long-term success of the implant prosthesis.1 To achieve a passive fit, an accurate positioning of the implant replicas in the master cast must be assured. The impression technique and the splitting of the implant copings are factors which may contribute to errors in the final positioning of the implant analogs, thus leading to inaccuracies in the fit of the final superstructure.10 Furthermore, the angulation or proxim-
ity of the implants may inhibit proper seating of the impression copings and caps, which may also have a detrimental effect on the registration of the implant position.10

The precise recording of the maxillo-mandibular, e.g. interocclusal relationship, is a prerequisite for achieving proper occlusion and a successful treatment outcome.10 The initially delivered denture allowed for the correction of the interocclusal relationship, tooth shape and color and angulations during the entire healing period. In this way, the patient was able to acclimatize to the function and esthetics of the denture. In the method described in this report, an accurate impression and recording of the full denture was achieved by using a duplicate as a custom tray for the impression. Therefore, it was not necessary to repeat all the steps usually needed for recording the interocclusal relationship, e.g. wax-
tup, etc., at the time of the fabrication of the final restoration.

If an open-tray impression is preferred, only minor changes to the procedure are necessary. This method is based on a previous publication.11 In cases such as this, it is advisable to fabricate two DentDus. The impression can be taken by the first DentDu; the second DentDu is used for the remaining steps. Customized abutments are applied instead of a bar, galvano copings allow a precise transfer coping, and secondary tele-
scopes as well as different technologies are employed for the transfer of implant positions and for the construction of the superstructure.

Customized implant abutments allows for better angulations and shape, for improved occlusal force transmission from the crown to the implant and the bone, and also for facilitating the fabrication of an esthetically pleasing implant-supported denture. Ways in which abutment design contributes to improved esthetics include changes in the location of the crown and changes in the dimension and/or form of the restorative platform.

Additionally, features of the abut-
ment design contribute to the health and dimensional stability of the soft tissue. Current attempts to objectively define implant-restorational esthetics have focused on perimplant mucosal parameters.11,12 The introduction of the UCLA abutment provided a custom solution for implant resto-
trations. This direct-restorational resto-
ration concept provided adaptability. Through waxing and casting, the height, diameter and angulations can be addressed in order to provide a wide range of clinical solutions for problems associated with limited interocclusal distance, interproximal distance, implant angulations and related soft tissue responses.10

The customized implant abutments served as primary telescopes, and the electroformed copings served as secondary telescopes in cases where a removable denture with telescopic crowns was used as the attachment. Electroformed gold copings are asso-
ciated with several advantages, in conjunction with both removable and fixed restorations. The galvano-forming and electroforming process yielded a precisely-fitted secondary coping for the implant abutment with a gap of only 12–30 μm. The gold electroformed coping saves space and is made of high-quality material.12 Using gold copings for the impression allows for the exact transfer of the form, angulations and position of the inserted customized implant abutments.

With the help of the milled mock-up, the future fit of the CAD/CAM fabricated framework can be evaluated and necessary changes in the shape of the restoration and occlusion can be made. Making these changes on the mock-up was easier and less time consuming than making them on the metal framework itself, and it was then possible to transfer them directly to the final frameworks. Furthermore, the mock-up almost “splitted” the electroformed gold copings during the impression, allowing for the exact transfer of the abutment position. At the same time, the vertical height and interocclusal relationship were recorded. The delivery of a milled temporary restoration permitted a slow and non-progressive loading of the implants, which then leads to bone remodeling.10 Abutments were left in place after mounting. Combined with the fabrication of a new cast, this further decreased the risk of inaccuracies during the transfer process.

Conclusion

The method described here can be used for full-arch restorations with both fixed and removable implant supported dentures. Accurate impres-
sions can be accomplished and occlu-
sions, vertical dimensions, as well as implant positions can be trans-
ferrized while facilitating the full-arch rehabilitation process. In addition, this technique resulted in a reduction of the required chair time.

Disadvantages of this technique lie in the fact that the quality of laboratory technician’s work meets higher demands than usual, and that the clinician also needs to acquire some additional skills. Further disad-
vantages of this method include the need for a highly qualified technical lab and higher technical costs relative to those associated with prefabricated titanium implant abutments.

To date, this method has not been applied in conjunction with immediate implant loading. However, dentists and patients have come to expect this level of rehabilitative accuracy, precision, long-term success and aesthetics.10

Editorial note: A complete list of references is available from the publisher.

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Figures

Figure 10: Placement of the electroformed copings onto the frame.

Figure 11A & B: Final telescopic crown retai-
ted implant denture, palatal; (a), anterior teeth (b), right side (c), left side (d).

Figure 12A & B: A case of fixed-implant retained denture for the maxilla full-arch re-
building, right site (a), anterior area (b). The customized implant abutments were fabricated using a light-cured indirect ceramic polymer (Ceramage, SHOFU, Munlo Park, CA, Figs. 9a–d). The electro-
formed gold copings were fixed in the metal framework using a self-

curing composite cement (AGS Cem, Wieland, Fig. 10).

The above-described procedures can be also performed in cases in which a fixed denture was planned for the rehabilitation of the full-arch (Figs. 11a & b, Figs. 12a–c) and in cases where part of the natural denti-
tion is periodontally stable and can be applied as abutments. In these cases, the immediate full denture can be fitted.