THE USE OF AN EXTRAORAL VERIFICATION TEMPLATE FOR DENTAL IMPLANT-SUPPORTED PROSTHESES

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This article demonstrates the utilization of a preprosthetic extraoral verification template that could be used to ensure the accuracy of the master cast from which the laboratory working model is used as the in vitro foundation for the implant-supported prosthesis framework construction.

KEY WORDS

Verification template
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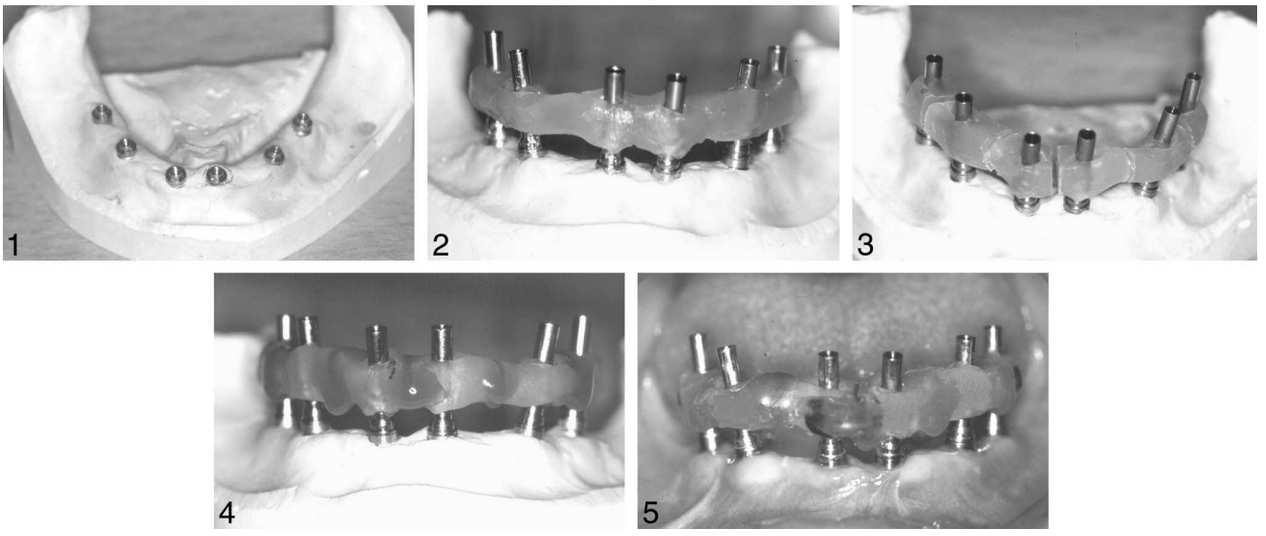
INTRODUCTION

It has been well established that osteointegration of a dental implant is fundamental to successful implant reconstructive assisted therapy. More importantly, this is only 1 of the fundamental components of implant prosthetics. A vital portion of this process is ascertainment of the appropriate prosthetic tooth position from which the ideal dental implant position is dictated within the alveolar bone.[1] It is equally imperative that prosthetically guided implant positioning be accomplished for predictable attainment of functional appearance-related and hygienically maintainable restorative outcomes.[2]

Another equally important component is the essential capture of the intraoral 3-dimensional position of the dental implant fixtures and associated peri-implant tissues and the subsequent exact transfer of this vital information to the laboratory master cast.[3] This component is also important when fabricating a dental implant-supported fixed partial denture, because any inaccuracies in the transfer of information from the patient to the lab can lead to the fabrication of a nonpassive fitted casting and/or a casting that rocks when seated or screwed down.[4,5] Either of the aforementioned conditions will have adverse effects on the dental implants by placing noncompressional forces and will mostly be detrimental to the long-term success of the prosthesis.

Unfortunately, the first indication that the exact spatial position of the dental implant abutments was not precisely transferred to the master cast is often at the chairside try-in appointment of the framework.[6] If the framework does not fit passively, or completely seat without ''rocking,'' the ill-fitted casting will need to be sectioned. This sectioned casting is indexed with materials, such as Duralay (Dental Manufacturing Co, Worth, Ill) or GC Pattern Resin (GC America, Alsip, Ill), then picked up in an impression and finally soldered in order to get a passively fitted framework.[7] Much to the dismay of the laboratory technician,



FIGURES 1–5. FIGURE 1. Photograph of master cast. FIGURE 2. Extraorally fabricated verification template (EOVT) fabricated on the working model with light-cured material on the provisional prosthetic abutments. FIGURE 3. EOVT light-cured material is sectioned between each dental implant. FIGURE 4. The EOVT on the working model with the previously sectioned segments luted together. FIGURE 5. The EOVT placed on the dental implant platforms without any fixation screws to check for proper and passive fit.

this conventional technique for the correction of a misfitted casting does have inherent drawbacks.[8] For example, the solder joint may break because of the porosity in the joint[9] and/or the weaker nature of the soldered metal as compared with the metal used for the casting of the FPD framework initially.[10] This inherent drawback may be obviated by the utilization of laser welds, which when used to join 2 pieces of a FPD framework, produces a union that is as strong as the original casting. However, there is generally an increased cost involved with the utilization of this technique.[11] Aside from being a detriment to the profitability of a case, an ill-fitting casting may diminish the patient's confidence in the expertise of the dental team.

The clinician can maximize productivity and profitability, decrease frustration, and demonstrate the proficiency of the dental team by eliminating, as much as possible, the fabrication of ill-fitted castings. This is best accomplished by the routine use of extraorally fabricated verification templates (EOVT).[12]

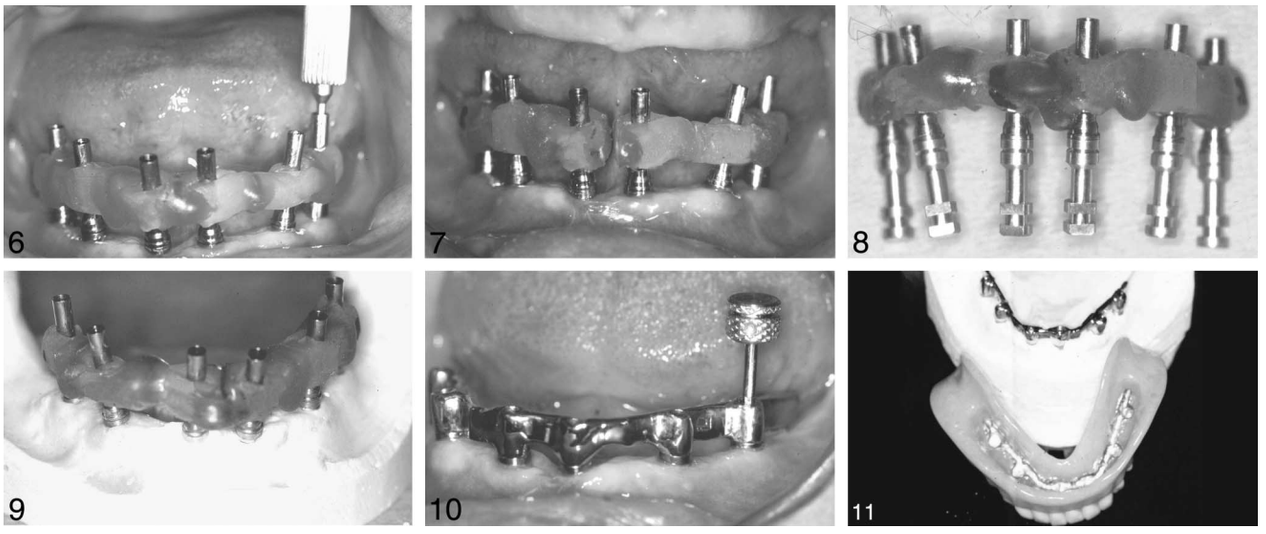
FABRICATION OF THE TEMPLATE

The fabrication of a verification template is clinically efficient, simple, and inexpensive. It is an invaluable procedure that allows the confirmation of the proper duplication of the 3-dimensional intraoral position of the dental implants as it relates to the master cast prior to initiating the fabrication of an implant-supported superstructure or FPD framework casting.[13] The verification template allows the clinician to have a high degree of certainty that the master cast is an accurate representation of the patient's intraoral condition, which then should enable a properly fitting casting to be made.

An EOVT is fabricated initially by the laboratory technician from the master cast that was produced from the intraoral impression. The EOVT can also be fabricated in the office by the doctor or his or her staff.

The case to be described illustrates the utilization of the EOVT systems. The patient had root form dental implants placed in the mandibular arch and 4 months was allowed for osteointegration before second-stage surgery was performed. Approximately 6 weeks later the healing abutments were removed and impression copings were seated on the implant platforms. Radiographs were taken to ensure that these prosthetic components were properly seated.[14] A closed-tray impression of the dental arches were taken of the dental implant impression coping assemblies using a heavy body or putty impression material and a syringeable medium body polyvinyl Siloxane impression material. Following removal of the impression trays, metal implant laboratory analogs were attached to the impression copings and were properly reinserted into their respective positions in the impression.

Prior to pouring the dental stone into the impression with the impression coping analog assemblies, a clear rubber-type material (ie, clear soft liner) would be poured first into the impression to produce a ''soft tissue'' master cast.[15] The dental stone to make a master cast is a low expansion (American Dental Association product classification III) type of die stone.[16] It is important to follow the manufacturer's suggested guidelines for the weight of material (stone) with regard to the amount of distilled water used when mixing the dental stone.[17] Using too little distilled water causes an increase in expansion of the dental stone during its set.[18] Increasing or decreasing the manufacturer's powder to water ratio will affect the expansion qual-



FIGURES 6–11. FIGURE 6. Fixation screw inserted into 1 of the distal prosthetic abutments and implant. Note the visual gap evident between some of the dental implant platforms and prosthetic abutments. FIGURE 7. The extraorally fabricated verification template (EOVT) was sectioned in between the 2 most anterior implants to achieve passive fit. FIGURE 8. The reluted EOVT with implant analogs attached. FIGURE 9. The intraorally confirmed, properly fitting EOVT on the new master cast. FIGURE 10. The implant casting inserted into the implant platforms in the patient's mouth. A fixation screw is inserted into 1 of the terminal implants, followed by careful inspection of the casting to ensure proper fit. FIGURE 11. The completed implant-supported overdenture.

ities of the set stone and will affect the accuracy of the finished cast.

The fabrication of an EOVT and its duplicate working model begins after fabrication of the master cast (Figure 1). The restorative dentist then places temporary titanium prosthetic abutments on each dental implant laboratory analog on the working lab model (Figure 2). Triad trans sheet material (Dentsply, York, Penn) is placed circumferentially (360°) around these abutments. However, the Triad material is limited to the middle portion of the prosthetic component so as not to interfere with the seating of these components or visualization of the prosthetic component-implant platform interface. The light cure acrylic (Dentsply) is then cured immediately with a light-curing unit.

In order to minimize the detrimental effects that could have been caused by ''curing shrinkage'' inherent with any and all acrylics,[19] the Triad material connecting all these provisional prosthetic abutments was sectioned by utilization of a separating disc or 558 bur (Figure 3). These cuts in the EOVT were made specifically between each implant-supported provisional prosthetic abutment.

To reattach these sections accurately and securely, they were luted together by syringing Triad gel (Dentsply) over and between the edges of the cut sections (Figure 4). This step made sure that the EOVT fit passively on the master cast and/or working lab model and was not affected by ''curing shrinkage.''[20]

The EOVT system (consisting of the provisional prosthetic implant abutments connected by the Triad light-cured material) was then removed from the master cast and inserted onto the dental implants in the patient's mouth (Figure 5). This important appointment allows an intraoral verification that the master cast truly duplicates the 3-dimensional intraoral position of the dental implants. Passive fit of the EOVT system (consisting of the provisional prosthetic abutments connected by Triad light-cured material) on the dental implant platforms intraorally.

The fit between the implant platforms and their respective provisional prosthetic implant abutments, which are connected by the Triad light-cured material are inspected thoroughly to ensure that the EOVT fits passively and properly prior to being secured with an abutment fixation screw. The interface is inspected to ensure no gap between the implant platforms and their respective provisional prosthetic abutments, or any rocking movement between this interface.[21] A prosthetic fixation screw is then inserted into 1 of the most distal provisional abutments and screwed down with finger pressure only (Figure 6). If a poor fit is detected at these 2 interfaces (ie, gap or a rocking movement was evidenced when this system was gently seated), then this would indicate to the authors that the master model was not an accurate representation of the patient's mouth.[22] A bitewing radiograph is taken to verify intimate fit between the implant and the prosthetic components.[23]

If the EOVT system is not passive, it should be sectioned near the middle of the stent as close to the facial midline as possible with a disc or high-speed handpiece using a 558 bur (Figure 7). Once again (as previously de-

scribed) the fixation screws are placed and radiographs are taken to ensure there is no ''gapping'' between the implant fixture platform and the provisional prosthetic abutment. Upon this confirmation, the 2 sectioned pieces are joined with Triad gel (Dentsply) as previously described (Figure 8). Subsequent to the reconnection of the sectioned pieces of the EOVT system, the fixation screws are removed and the verification template system is lifted off the implant platforms and out of the patient's mouth. The laboratory connects an implant analog to each of the provisional prosthetic abutments of the EOVT system with fixation screws.

The EOVT system already described is placed into a mixture of dental stone to fabricate a new master cast, known as the verification cast (Figure 9). From this new master cast the dental laboratory proceeds with the fabrication of the overdenture superstructure for this implant-supported bar overdenture case.

Following the fabrication of the implant superstructure, the restorative dentist schedules the patient for a framework try-in appointment, as was previously accomplished with the EOVT system. At this appointment, the cast superstructure is carefully inserted onto the dental implant platforms and inspected for passive fit. The superstructure is examined for any discrepancy in fit (ie, gapping, rocking) either before or after the terminal abutment is secured with a fixation screw to 1 of the most distal abutments (Figure 10).[24] It is also important for the clinician to be cognizant of the fact that there should have been no change in position or fit of the casting on the implant platforms as each screw is tightened. If the casting fits properly, the fixation screws when turned into place should not bind when tightened (barring a problem with the threads on the screw during manufacturing.) It is also very important that the doctor ask the patient if he or she felt any pressure or unusual sensation when the framework was screwed into place. Note that osteointegrated implants will not permit the classical proprioception offered by teeth, but bone will offer some sensation if the implants are spread or pulled together by a nonpassive framework. If these inquiries do not elicit a positive response and visual inspection as well as a dental explorer reveal no misfitting, then a periapical radiograph of each implant-abutment complex is taken to confirm that the superstructure casting is passive before the prosthetic fixation screws are secured into place with an appropriate torque wrench.[25] Again, as suggested previously, it is imperative that the patient is asked if he or she felt any discomfort in the jaw or experienced any tension within the bone once the casting was secured into place.

The restorative dentist should try in the casting with the artificial teeth positioned in wax on an acrylic record base and recheck the jaw relationship records and the occlusal contacts before completion of the prosthesis.[26] This allows the delivery of an aesthetic, hygienically maintainable, and properly functioning prosthesis (Figure 11).

Conclusion

The utilization of an EOVT can provide the clinician relative certainty that the laboratory master cast was an accurate representation of the 3-dimensional intraoral position of the dental implant fixtures. The accuracy of the master model is especially important when fabricating a fixed partial denture framework or an implant-supported superstructure casting. The utilization of the described extraoral verification system can be routinely used by the clinician to provide a high degree of confidence that the working model used to fabricate the superstructure or fixed partial denture framework castings is an accurate representation of the intraoral conditions.

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