More Than Just a Denture

Authored by John R. Nosti, DMD

Upon successful completion of this CE activity, 3 CE credit hours may be awarded.
CONTINUING EDUCATION

More Than Just a Denture

Effective Date: 04/01/2015  Expiration Date: 04/01/2018

About the Author

Dr. Nosti is a member of the ADA, American Academy of Cosmetic Dentistry, American Academy of Craniofacial Pain, American Academy of Dental Sleep Medicine, American Equilibration Society, and the Crown Council. He holds Fellowships in the AGD, the Academy of Comprehensive Esthetics, and the International Congress of Oral Implantologists. He practices full-time in Mays Landing/Somers Point, NJ, as well as in New York City with an emphasis on functional cosmetics, full-mouth rehabilitations, and TMJ dysfunction. He is the clinical director and advisory board chair for the Clinical Mastery Series, a continuum geared toward advancing the cosmetic/functional practices of dentists worldwide. He can be reached at tmjcenter@aol.com.

Disclosure: Dr. Nosti has received honoraria for lecturing in the AGD-approved seminar, Smile Designed Dentures, sponsored by Ivoclar Vivadent. He received honoraria from Ivoclar Vivadent for writing this article.

INTRODUCTION

It is estimated that 38 million people in the United States are either fully edentulous, or edentulous in one arch.¹ This number is expected to increase by the year 2020 due to the aging population and population growth.² The options for the edentulous patient remain to be implant-supported fixed bridgework (fixed/detachable), implant-supported overdentures, tissue-supported overdentures, or conventional dentures. Despite the success, availability, and the patient’s ability to afford implants, each of the restorative options for the edentulous patient requires a variation of the full-denture procedure for their fabrication. Based upon this fact, it is imperative for the practicing dentist who wants to be successful in implant-retained prosthetic reconstructions to also be proficient in being able to offer and deliver complete dentures.

Unfortunately, most dentists are not exposed to advanced training in removable prosthetics beyond dental school. Without proper knowledge of the denture tooth materials available, dentists may select a material that is contraindicated for their recently fabricated implant-supported hybrid, or they may choose the wrong posterior set up for compromised ridges. Likewise, many of the complaints commonly reported by dentists are caused by processing error/shrinkage which can lead to poor retention and fit of the final complete dentures, or an ill-fitting implant-supported overdenture, despite following proper protocol throughout each appointment.

This article seeks to provide steps to help the clinician in simplifying the complete denture process. In addition, it will serve as a reference guide for denture tooth material selection, an anterior and posterior tooth selection rationale, and to understand differences in processing techniques that are now available.

VISIT ONE

Many dentists have their favorite impression material and technique for their complete dentures, or implant prostheses. Regardless of the type of prosthesis being fabricated (ie,
More Than Just a Denture

complete denture, implant-supported, or fixed/detachable), the required next steps, in the process following final impressions, are the fabrication of the wax rim and wax try-in. Many dentists are erroneously taught that bar design and try-in follows the impression process for fabrication of fixed/detachable prostheses; however, this can lead to a bar that provides little to no room for the denture teeth within the patient's smile. Thus, the bar should be designed following the wax try-in, fabricating the bar according to the room necessary to provide the desired aesthetic result for the denture teeth positions.

Once the final impression(s) have been completed, there are a few additional steps to be completed at this visit that can allow the clinician to streamline the following visits and, as a result, to provide a more predictable outcome. It should be noted that the instruments used and described herein can be found in the IVR Smile Design Kit (Ivoclar Vivadent) (Figure 1). This kit has been developed and designed to assist the dentist in communication with the dental laboratory team. Following impressions, a custom wax rim or implant verification jig can be ordered by measuring the patient's maxillary lip length. The purpose of the wax rim is to determine the desired position of the maxillary central incisors, and the occlusal plane for the posterior teeth.

The Papillameter (Ivoclar Vivadent) (Figure 2) is designed to allow the dentist to measure the length of the patient's maxillary lip at rest, using the incisive papilla as a landmark; this is needed so that the lab team can fabricate a wax rim or implant verification jig to the desired measurement recorded. This also prevents the clinician from having to spend time to “find the incisal edge position” by adjusting the traditional 22.0 mm wax rim at the following visit, which is often too long for the patient or, occasionally, too short.3-7 The Papillameter is placed under the patient's lip with the horizontal component opposite of the ruler placed against the incisive papilla (Figure 3). This allows the dentist to measure and accommodate for the various lip lengths quite often seen (Figures 4 and 5). Also, this allows the lab team to fabricate a custom implant verification jig that can be screwed into place, and that can also serve as the “wax rim” in implant hybrid reconstruction patients (Figures 6 and 7).

After the vertical position of the wax rim is determined, the horizontal position of the wax rim can also be dictated by using the patient's current denture. Visually determine if the patient's existing profile is correct, too excessive, or too deficient. If the horizontal position is correct, this can be measured and recorded using a Denture Gauge (Alma Gauge) (Ivoclar Vivadent) (Figure 8). If the horizontal position is deficient, the dentist can choose to add flowable composite to the facial surfaces of the existing denture teeth to determine the ideal position. As the denture is placed on the Denture Gauge, the incisive papilla is once again used as a landmark. The plunger is depressed so that the point of the plunger lands in the incisive papilla area on the denture. The position of the incisal edges are
then recorded using the ruler on the flat surface of the Denture Gauge (Figure 9).

If the patient is fully edentulous, the next step during this visit would be to record a dual-arch bite registration with the Centric Tray (Ivoclar Vivadent) (Figure 10). This step is done so that the lab team can preliminarily mount the patient’s models on an articulator, allowing for both proper construction of wax rims and, more importantly, to properly mount a gothic arch tracer on a second set of baseplates. The patient’s existing vertical dimension of occlusion (VDO) is measured with calipers and then marked for future reference. Next, the Centric Tray is loaded with putty material on both sides, placed intraorally, and then the patient is instructed to close until he or she is within a reasonable proximity to the previous VDO measured (Figure 11). This is sent to the laboratory team (Figure 12) along with the impressions and the measurements recorded with the Papillameter and Denture Gauge.

**VISIT TWO**

At the next visit (wax relation visit), the dentist first confirms the incisal edge position of the wax rim/implant verification jig. If an implant verification jig is being used, it is imperative to radiograph each implant housing to ensure proper seating. The next step would be to confirm that the incisal plane is parallel with the interpupillary line, and that the posterior plane is parallel with Camper’s plane (Ala-Tragal line) with the use of the bite plane (Figures 13 and 14). When adjustments are required, they can be accomplished with the use of the wax rim former (Figure 15). If the wax rim is too long, the desired incisal edge position can be marked, then the wax rim former can be heated and the raised edges are placed in the hamular notch areas of the master model (Figure 16). While keeping constant contact on the model in this area, the wax rim former is lowered until the wax has been melted to the previous desired incisal edge position marked in the wax (Figure 17). The benefit of the design of the wax rim former over a conventional flat spatula is that the raised edge of the rim former will build in an occlusal plane nearly equal to the hamular notch-incisal plane (Figure 18). Camper’s plane (Ala-Tragal line) can then be reconfirmed using the bite plane (Figure 19). This will facilitate mounting of the wax rim in the lab and will also make setting the denture teeth easier. The lower wax rim should be placed to verify the incisal edge position as compared to the lower lip. Although it is normal to show an increased amount of mandibular teeth as we age, many patients disapprove of this. Typically, a majority of patients will like and/or approve of zero to 1.0 mm of mandibular tooth display at rest.

Following proper design of the wax rim to the patient’s ideal

---

*Figure 10. Centric Tray (Ivoclar Vivadent).*

*Figure 11. Measuring the vertical dimension of occlusion with the Centric Tray recording.*

*Figure 12. Completed Centric Tray.*

*Figure 13. Bite plane.*

*Figure 14. Confirming the interpupillary line with the bite plane.*

*Figure 15. Wax rim former included in the IVR Smile Design Kit.*
incisal edge position and occlusal plane, the next step in construction of full maxillary and mandibular dentures is to record the VDO and to record a centric relation (CR) bite registration.

The VDO can be determined several ways. The first is to replicate this from the patient's previous/existing dentures, if they are determined to be aesthetically and functionally correct. If this existing vertical is to be replicated, marks should first be placed on the patient's nose and chin with indelible marker. Calipers in the IVR Smile Design Kit are used to measure the existing VDO (if this was completed in the first visit, simply check your notes for the existing VDO measurement) and replicate this in the patient's wax rims or gothic arch tracer.

A gothic arch tracer is used to predictably record the CR position. In addition, it is used to set the existing VDO when fabricating maxillary and mandibular full dentures simultaneously. Postoperative adjustment appointments can be reduced by taking the time to perform a gothic arch tracing; this is because many complaints of sore spots, or difficulty in wearing prosthetics throughout the day, are attributed to an improper occlusion rather than ill-fitting denture or intaglio surface issues. Several gothic arch tracers/centric recorders currently available are the Candulor Registration Set (CRS) (sets 10, 15, or 20) and Vertical Centric Recorder (Candulor) (Figure 20), Y&M Intraoral Tracer (Edmonds Dental Lab), Intra-Oral Establishe (Massad-Davis), and Coble Balancer.

The dental laboratory team uses the Centric Tray recording from the initial visit to mount the CRS gothic arch tracer on a second set of baseplates fabricated independently from the wax rims. This allows freedom of mandibular movements, without the possibility of interference of the occlusal rims. The pin height of the tracer is initially set to the desired VDO chosen for the patient. If the VDO is not to be duplicated from the previous set of dentures, the patient's rest position can be determined and the VDO is set 2.0 mm to 4.0 mm less than this position.

The tracer is then removed from the mouth and the strike plate is painted using a black marker to completely cover the surface opposing the pin. Once the baseplates with the tracer are placed back into the patient's mouth, the patient is instructed to move the mandible into left and right excursions; next into protrusive; and then finally to “pull” the mandible back in retrusive. The pin will remove the black magic marker from the strike plate, creating an arrow; the tip of the arrow is the patient's CR position (Figure 21). Take care to identify the normal erroneous marks on the strike plate that can occur during the insertion of the appliance. The baseplates and tracer are removed, the pin holder is then placed over the tip of the arrow with sticky wax or compound (Figure 22) and placed back into the patient’s mouth. The patient is then instructed to
open and close until the pin goes into the hole of the pin holder. A rigid bite registration material, such as Futar D (Kettenbach LP), is then used to secure the base plates together (Figure 23).

The last step of the wax relation visit is to select the desired size, color, and type of denture teeth. Typically, most dentists only select the shade of the denture teeth desired, allowing the lab team to select the type and quality of the denture teeth. In the past, the size of the mold selected was based upon the measurement from the distal of the canine to the distal of the canine on the wax rim. For many dentists, this became a difficult process because it was imperative that the wax rim was formed correctly. Studies have indicated that the nasal width can be used as a guideline for placement of the maxillary anterior 4 incisors. The Facial Meter (Ivoclar Vivadent) (Figure 24) allows the dentist to measure the width of the nose, which translates into small, medium, and large denture teeth molds.

**DENTURE TOOTH SELECTION**

The materials available for denture teeth selection include acrylic (PMMA), double cross-linked resin, nanohybrid composite (NHC), and porcelain. With the strength, wear resistance, and ability to customize NHC denture teeth, few dentists choose to use porcelain teeth in denture reconstructions anymore. Acrylic teeth (PMMA) usually have the least wear resistance, and aesthetic characterization of the materials is available. Resin teeth typically have higher wear resistance and characterization than acrylic teeth, and they usually have a 7- to 10-year warranty associated with them from most manufacturers. NHC teeth typically have the highest wear resistance and characterization available (besides porcelain) and often have a lifetime warranty. Depending on the situation, NHC teeth may be contraindicated in fixed/detachables over implants if the laboratory team has to heavily adjust the teeth to “fingernail-like” thickness due to space issues between the bar and facial position of the teeth required. This may compromise the bond between the denture base and the teeth, causing pop-offs to occur. In these situations, it is important to have great clinician-lab team communication to decide if a PMMA or porcelain selection is more appropriate. Table 1 provides a list of denture teeth by manufacturer, material, wear rates, and aesthetic levels.

**SET UP FOR SUCCESS**

Many anterior mold selections are shifting from the square/ovoid forms from the past and are now focusing on “bold versus soft” and “youthful, universal, and mature” for age depiction. The Phonares II (an NHC composition) (Ivoclar Vivadent) has become the author’s preferred anterior and posterior tooth selection; this is due to the aesthetic shade layering present, as well as the...
variations in positional setups that allow for a more natural appearance (Figure 25) as compared with a more traditional appearance (Figure 26). For females, this can be accomplished with rotation of the mesial aspect of the lateral incisors to be more facial than the distal (labial version) for a softer look, and, for males, having the lateral slightly lingual to the central incisor (lingual version) or a distal flare creates a bolder look. Placing the premolars slightly off the facial plane from the canine to the molar, mimicking a slight decrease in the buccal corridor, or angling one of the canines so more of the distal aspect of the tooth shows over the other also allows a break in the sequence and provides a more natural appearance.

Communication with the lab team regarding gingival contours, zeniths, muscle attachments, and shading of gingiva is required to provide the patient with a more aesthetic result (Figure 27). I have found that most lab teams will not take the liberty to custom characterize the denture bases without the dentist’s permission or direction. Due to the increased lifelike effect that this provides, I feel this is an important step to do in the denture process. Many times we see that patients’ gingival zeniths are at different levels in nature, while in dentures many dental technicians prepare perfect zeniths in the setups. In order to mimic nature, the gingival zeniths should be altered slightly, but not so much that it provides a gummy smile.

DENTURE OCCLUSION

Posterior mold selections and occlusal setup designs include nonanatomic monoplane, nonanatomic ramp, lingualized monoplane, lingualized balanced, semi-anatomic, and anatomic. Anatomic is typically contraindicated due to the difficulty in equilibration and is not ideal for patients with compromised ridges. Nonanatomic forms are rarely used due to their unnatural appearance, difficulty in equilibration in eccentric movements, and that more vertical force is required for the patient to masticate food properly. With the lingualized monoplane molds, it is difficult to achieve a bilaterally balanced occlusion. Due to the “lingualized forces” placed over the mandibular ridges, lingualized-balanced occlusion is currently the recommended posterior setup for most implant-supported prostheses, as well as complete denture prostheses requiring stability. Due to only one cusp remaining in contact, it becomes an easier posterior setup to equilibrate. Lingualized-balanced occlusion should be the posterior setup of choice for clinicians seeking to both simplify their process and to provide a more predictable outcome. Semi-anatomic molds are ideally selected for partial dentures, complete dentures opposing natural dentitions, and complete dentures where the dentist feels confident in his or her equilibration skills and abilities in recording the proper centric bite relation. See Table 2 for a quick guide to the advantages,

<table>
<thead>
<tr>
<th>Table 1. Guide to Denture Tooth Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>PMMA</td>
</tr>
<tr>
<td>DENTSPLY</td>
</tr>
<tr>
<td>MFT</td>
</tr>
<tr>
<td>Least wear</td>
</tr>
</tbody>
</table>
disadvantages, and indications for posterior tooth selection.\textsuperscript{11}

### VERIFYING THE OCCLUSION AND APPROVAL OF THE SMILE

Once the wax setup has been completed with the requested tooth manufacturer—and material, type, shade, anterior design, posterior occlusal setup, and gingival characterizations have been requested—it is time to confirm the smile and occlusion with the patient. With all the steps taken in the previous visits, this should be a very short and easy appointment avoiding the need for resets.

The final step of the wax try-in visit is to select a processing shade and the processing type to be requested. Many dentists leave these selections to the lab team without understanding of the importance of these selections. IvoBase (Ivoclar Vivadent) (Figure 28) is the newest and most improved continuous injection processing available, and it is built upon the long-standing positive reputation of Ivocap Injection System (Ivoclar Vivadent) for denture base finishing.\textsuperscript{12-14} These are continuous-injection heat-polymerization systems that compensate for chemical shrinkage of the acrylic resin during polymerization. This laboratory processing technique eliminates any unwanted increase in the VDO, and greatly reduces any unwanted movement of the teeth, thus reducing chairside adjustments significantly. Furthermore, IvoBase processing has the ability to provide a monomer-free denture, unlike any other processing techniques and/or materials available.

### DENTURE PROCESSING

Understanding the dimensional changes that can occur from shrinkage during processing is extremely important. Throughout the years, many dentists have told me that they have had difficulty in fabricating implant-supported overdentures if the attachments were processed with the lab; this is despite working with implant level impressions and verifying the fit on the wax try-in appointment. Shrinkage of 4% is commonly seen in traditional processing.
techniques and can be blamed for poor final fit. If the lab team does not follow specific manufacturer directions with traditional processing techniques, greater than 4% shrinkage has been noted in various studies. Have you ever taken an excellent final impression and confirmed its retention, only to be left with a poor fitting and/or loose denture? Processing may be the culprit for these issues. Communication between the clinician and the dental lab team is extremely important throughout the entire process of denture fabrication; the final step of processing should not be left to guesswork! Discuss which processing is available with your lab team and find out if they offer pressed processing or traditional cold-cure processing.

With the aging population becoming more demanding in their quest for a high-quality and aesthetic denture, the understanding of materials, processing, and systems to increase predictability becomes vital to our success. With the availability of highly aesthetic nanohybrid composite teeth, and custom characterized denture base processing, dentists have the ability to offer more than just a denture...they can provide a terrific smile (Figure 29).  

References

More Than Just a Denture

POST EXAMINATION INFORMATION

To receive continuing education credit for participation in this educational activity you must complete the program post examination and receive a score of 70% or better.

Traditional Completion Option:
You may fax or mail your answers with payment to Dentistry Today (see Traditional Completion Information on following page). All information requested must be provided in order to process the program for credit. Be sure to complete your “Payment,” “Personal Certification Information,” “Answers,” and “Evaluation” forms. Your exam will be graded within 72 hours of receipt. Upon successful completion of the post-exam (70% or higher), a letter of completion will be mailed to the address provided.

Online Completion Option:
Use this page to review the questions and mark your answers. Return to dentalcetoday.com and sign in. If you have not previously purchased the program, select it from the “Online Courses” listing and complete the online purchase process. Once purchased the program will be added to your User History page where a Take Exam link will be provided directly across from the program title. Select the Take Exam link, complete all the program questions and Submit your answers. An immediate grade report will be provided. Upon receiving a passing grade, complete the online evaluation form. Upon submitting the form, your Letter of Completion will be provided immediately for printing.

General Program Information:
Online users may log in to dentalcetoday.com any time in the future to access previously purchased programs and view or print letters of completion and results.

This CE activity was not developed in accordance with AGD PACE or ADA CERP standards. CEUs for this activity will not be accepted by the AGD for MAGD/FAGD credit.

POST EXAMINATION QUESTIONS

1. It is estimated that 38 million people in the United States are either fully edentulous, or edentulous in one arch; however, this number is not expected to increase.
   a. True    b. False

2. According to the author, most dentists have enough advanced training in removable prosthodontics beyond dental school to practice very successfully.
   a. True    b. False

3. Many dentists are erroneously taught that bar design and try-in follows the impression process for fabrication of fixed/detachable prostheses.
   a. True    b. False

4. The purpose of the wax rim is to determine the desired position of the maxillary central incisors and the occlusal plane for the posterior teeth.
   a. True    b. False

5. If the horizontal position is deficient, the dentist can choose to add flowable composite to the facial surfaces of the existing denture teeth to determine the ideal position.
   a. True    b. False

6. The benefit to the design of the wax rim former over a conventional flat spatula is that the raised edge of the rim former will build in an occlusal plane nearly equal to the hamular notch/incisal plane.
   a. True    b. False

7. The vertical dimension of occlusion can be determined several ways. The patient’s previous/existing dentures should never be used for this determination of the vertical.
   a. True    b. False
More Than Just a Denture

8. Many anterior mold selections are shifting from the square/ovoid forms of the past and are now focusing on “bold versus soft” and “youthful, universal, and mature” for age depiction.
   a. True     b. False

9. Many times, we see that patients’ gingival zeniths are at different levels in nature, while in dentures, many dental technicians set up perfect zeniths in the setups.
   a. True     b. False

10. Nonanatomic forms are commonly used due to their natural appearance and ease of equilibration in eccentric movements.
    a. True     b. False

11. IvoBase processing has the ability to provide a monomer-free denture, unlike any other processing techniques and/or materials available.
    a. True     b. False

12. If the lab team does not follow specific manufacturer’s directions with traditional processing techniques, greater than 4% shrinkage has been noted in various studies.
    a. True     b. False
More Than Just a Denture

PROGRAM COMPLETION INFORMATION

If you wish to purchase and complete this activity traditionally (mail or fax) rather than online, you must provide the information requested below. Please be sure to select your answers carefully and complete the evaluation information. To receive credit you must answer at least 9 of the 12 questions correctly.

Complete online at: dentalctoday.com

TRADITIONAL COMPLETION INFORMATION:

Mail or fax this completed form with payment to:

Dentistry Today
Department of Continuing Education
100 Passaic Avenue
Fairfield, NJ 07004
Fax: 973-882-3622

PAYMENT & CREDIT INFORMATION:

Examination Fee: $60.00 Credit Hours: 3

Note: There is a $10 surcharge to process a check drawn on any bank other than a US bank. Should you have additional questions, please contact us at (973) 882-4700.

☐ I have enclosed a check or money order.

☐ I am using a credit card.

My Credit Card information is provided below.

☐ American Express ☐ Visa ☐ MC ☐ Discover

Please provide the following (please print clearly):

Exact Name on Credit Card

Credit Card # Expiration Date

PROGRAM EVALUATION FORM

Please complete the following activity evaluation questions.
Rating Scale: Excellent = 5 and Poor = 0

Course objectives were achieved.

Content was useful and benefited your clinical practice.

Review questions were clear and relevant to the editorial.

Illustrations and photographs were clear and relevant.

Written presentation was informative and concise.

How much time did you spend reading the activity and completing the test?

What aspect of this course was most helpful and why?

What topics interest you for future Dentistry Today CE courses?

PERSONAL CERTIFICATION INFORMATION:

Last Name (PLEASE PRINT CLEARLY OR TYPE)

First Name

Profession / Credentials License Number

Street Address

Suite or Apartment Number

City State Zip Code

Daytime Telephone Number With Area Code

Fax Number With Area Code

E-mail Address

ANSWER FORM: VOLUME 34 NO. 4 PAGE 116

Please check the correct box for each question below.

1. ☐ a. True ☐ b. False

2. ☐ a. True ☐ b. False

3. ☐ a. True ☐ b. False

4. ☐ a. True ☐ b. False

5. ☐ a. True ☐ b. False

6. ☐ a. True ☐ b. False

7. ☐ a. True ☐ b. False

8. ☐ a. True ☐ b. False

9. ☐ a. True ☐ b. False

10. ☐ a. True ☐ b. False

11. ☐ a. True ☐ b. False

12. ☐ a. True ☐ b. False

This CE activity was not developed in accordance with AGD PACE or ADA CERP standards. CEUs for this activity will not be accepted by the AGD for MAGD/FAGD credit.