Dual CBCT Scanning Technique for Completely Edentulous Arches

Authored by Randolph Resnik, DMD, MDS

Upon successful completion of this CE activity, 2 CE credit hours may be awarded.
**Dual CBCT Scanning Technique for Completely Edentulous Arches**

Effective Date: 12/01/16 Expiration Date: 12/01/19

**About the Author**

**Dr. Resnik** is a leading educator, clinician, and researcher in the field of prosthodontics and oral implantology. He is a graduate of the University of Pittsburgh, with a specialty degree in prosthodontics, a surgical fellowship in oral implantology, and a master’s degree in radiology. He is a clinical professor of oral implantology at Temple University, a clinical professor at the University of Pittsburgh (Graduate Prosthodontics), a staff member at Allegheny General Hospital, and surgical director of the Misch International Implant Institute. He maintains a private practice in Pittsburgh limited to oral implantology. He can be reached via email at resnik@verizon.net.

Disclosure: Dr. Resnik reports no disclosures.

**INTRODUCTION**

Two of the most popular and current trends related to dental implant treatment involve the use of minimally invasive surgery and the integration of computer-guided surgery. For these techniques to be successful, the preoperative radiographic evaluation of the proposed implant recipient sites is crucial in order to obtain an aesthetic, functional, and long-term implant prosthesis. With the use of CBCT coupled with stereolithographic surgical templates, the implant clinician has access to comprehensive technology that has been shown to improve presurgical treatment planning.

With edentulous patients, drawbacks of the CBCT-generated surgical technique are the time-consuming nature of the procedures, laboratory procedures and associated costs, and the technique sensitive nature of the process. To combat these disadvantages, a new scanning template technique, referred to as the dual-scan (or double-scan) technique, has been introduced to the profession for fully edentulous patients. This technique permits fast, easy, and accurate evaluation at a decreased cost. Traditionally, to obtain a fully edentulous scanning template, the clinician would need to duplicate the existing prosthesis or fabricate a new prosthesis. This is often time consuming and expensive as the patient needs to be reappointed, and the clinician would need to fabricate a new prosthesis. With the dual-scan technique, the scan can be obtained at the initial appointment, without the need for a duplicate prosthesis or irreversible modification of the existing prosthesis.

**DUAL-SCAN TECHNIQUE**

Basically, the dual-scan technique using CBCT involves 2 parts. The first scan is obtained with the current prosthesis with added radiopaque markers along with a bite registration (centric relation). The second scan is obtained only with the current prosthesis with added radiopaque markers.

After the scans are taken, the raw data (Digital Imaging and Communications in Medicine [DICOM] datasets) are easily reformatted with any of the third-party software programs available today. By superimposing the spherical markers over each other, a 3-D bone model is fabricated along with the radiographic template. Note that the dual-scan technique may be utilized for partially edentulous patients (converting an existing prosthesis). However, it may only be used for prosthetic and aesthetic planning, not for surgical guide fabrication.

**Scan Prosthesis**

The main advantage of the dual-scan technique is that the patient’s existing prosthesis (eg, denture) may be used for the scan. Most edentulous patients seeking oral rehabilitation already have an existing prosthesis, which in most cases has adequate fit and reflects optimal tooth position. With past techniques, the clinician would be required to fabricate a duplicate prosthesis for use during the scanning process. However, this would often result in an ill-fitting prosthesis, which could lead to increased morbidity with the implant process (eg, non-ideal implant positioning, improper vertical dimension). Therefore, with the dual-scan technique, the patient’s existing prosthesis is used. This prevents the patient from being rescheduled after a duplicate prosthesis is fabricated. However, it is imperative the existing prosthesis exhibits no movement, functions ideally, and has proper aesthetics.

**Scan Prosthesis Markers**

To merge the 2 scans in a dual-scan technique, radiopaque markers are added to the existing removable prosthesis. Most importantly, the prosthesis and the radiopaque markers should consist of a material that will cause no scatter that could lead to inaccuracies in the scan. Materials commonly used in the past include gutta-percha, titanium, or Cavit (3M), which all have a high opacity without causing scatter artifacts. For the dual-scan technique, a new material is recommended: 1.0 mm Suremark Clearmarkers (Donaldson Marphil Medical). These peel-and-stick, artifact-free opaque markers are very effective and simple to use. They are affixed to the dental base with a special adhesive that is easily removed after scan completion.
Dual CBCT Scanning Technique for Completely Edentulous Arches

Ideally, 6 to 8 markers should be used, staggered throughout the buccal and lingual flange areas. With the use of these radiographic markers, no modification (ie, holes or glue spheres added to denture base) is required to the existing prosthesis, nor is there a need for duplication of the existing denture (Figure 3).

**Scanning Process**

**First Scan:** A radiolucent bite registration material may be used to slightly separate the upper and lower prosthesis. After the bite registration (centric relation) is obtained, the excess material is removed with a sharp knife. The bite registration will allow for stability of the prosthesis during the scan process. If the maxillary and mandibular teeth are not separated for the scan process, difficulty will result in distinguishing the incisal edges of the teeth.

The prosthesis should be evaluated to confirm complete seating and ideal positioning. If incomplete seating occurs, a radiolucent airspace will be seen on axial images. The scan is taken to include all areas of interest according to the CBCT manufacturer’s instructions. Ideally, specifications of the scan should include a 512 x 512 matrix, less than 1.0 mm slice thickness, high resolution reconstruction algorithm, and exported in DICOM format (Figure 4).

**Second Scan:** For the second scan, the prosthesis is removed from the patient’s mouth and placed onto a holder (such as box or foam added to a chin-up holder) that allows the prosthesis to be positioned parallel to the floor. The prosthesis should be placed in relatively the same position as the first scan. Note: It is important that the markers are not removed or repositioned prior to the second scan, as this may lead to inaccurate merging of the 2 scans (Figure 5).

**Merging of the Two Datasets**

Software programs (SimPlant [Dentsply Sirona Implants]) will allow for the joining of the radiographic scanning guide and of the patient’s anatomy. The CBCT dataset files are merged by aligning the radiopaque markers so that the prosthesis will be visible over the available bony anatomy, thus allowing the clinician to accurately evaluate available bone, vital and anatomical structures, bone density, interocclusal distance, trajectory, and implant sites of the edentulous areas (Figure 6).

**End Result**

After proper merging of the datasets, the radiographic template and patient’s anatomy may be viewed together or separately. The virtual planning is then completed on the bone and/or prosthetic model, which allows for the fabrication of the final treatment plan.

**Fabrication of the Surgical Template**

From the final interactive treatment plan, the information is converted to a stereolithographic (STL) file for the fabrication of a surgical template that incorporates the ideal location for the drilling sleeves. The drilling guides are precisely fabricated to incorporate the implant site and trajectory information that will allow for the surgical placement of the osteotomy sites (Figure 7).
Dual CBCT Scanning Technique for Completely Edentulous Arches

Prosthesis Fabrication
With the use of the dual-scan technique, an immediate or provisional prosthesis may be fabricated. The dental laboratory team is able to fabricate an accurate stone cast that incorporates the soft-tissue anatomy along with ideal implant position. From this case study, an immediate prosthesis may be fabricated to be inserted at the time of implant placement (elective). Care should be exercised with this technique, as the clinician should be aware of inherent complications and difficulties in immediate loading situations.

Surgical Appointment
The surgical template is secured in position with fixation screws. Special care should be used to verify proper seating and placement of the surgical template. With the use of specially designed surgical burs and drilling guides, which fit precisely into the sleeves of the template, the osteotomy sites are performed in a flapless technique through the soft tissue, and the implant is then placed in the exact position as per the interactive treatment plan (Figure 8).11

CLOSING COMMENTS
The advent of CBCT imaging has allowed the implant clinician to have a much clearer view of prospective patient anatomy, which has greatly assisted in treatment planning for implant surgical sites and identifying areas that may need augmented bone volume. Computer-generated guided surgery has transformed implant dentistry into a precise and predictable treatment modality.

The use of a dual-scan technique is a significant advancement over traditional methods for establishing treatment plans for the fully edentulous patient. By combining ease of use and patient convenience with a decreased cost, this planning method is of significant benefit to the implant clinician’s practice.11

References
Dual CBCT Scanning Technique for Completely Edentulous Arches


Figure 7. (a) Interactive treatment planning with implant placed into previous sinus bone graft, (b) stereolithographic mucosal surgical template retention screw hole (palate) and implant dimension specific tubes for osteotomy preparation and implant placement, and (c) final tissue-supported surgical template.

Figure 8. Surgical template placement. (a) Fixation screw placed into palate to stabilize template during osteotomy and implant placement. (b) Osteotomy sites prepared with copious amounts of irrigation. (c) Implant placement through surgical template, which is depth controlled.
Dual CBCT Scanning Technique for Completely Edentulous Arches

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 dentalctoday.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 dentalctoday.com any time in the future to access previously purchased programs and view or print letters of completion and results.

POST EXAMINATION QUESTIONS

1. With the dual-scan technique, the scan can be obtained at the initial appointment, without the need for a duplicate prosthesis or irreversible modification of the existing prosthesis.
   a. True   b. False

2. The main advantage of the dual-scan technique is that the patient’s existing prosthesis (eg, denture) may be used for the scan.
   a. True   b. False

3. The prosthesis and the radiopaque markers should consist of material that will cause no scatter that could lead to inaccuracies in the scan.
   a. True   b. False

4. Ideally, 8 to 12 markers should be used, staggered throughout the buccal and lingual flange areas.
   a. True   b. False

5. The maxillary and mandible teeth are always separated for the scan process.
   a. True   b. False

6. It is important that the markers are not removed or repositioned prior to the second scan, as this may lead to inaccurate merging of the 2 scans.
   a. True   b. False

7. With the use of the dual-scan technique, an immediate or provisional prosthesis may be fabricated.
   a. True   b. False

8. The surgical template is secured in position with fixation screws; special care should be used to verify proper seating and placement of the surgical template.
   a. True   b. False
Dual CBCT Scanning Technique for Completely Edentulous Arches

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 6 of the 8 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: $40.00  Credit Hours: 2
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
Signature

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.

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 35 NO. 12 PAGE 50
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

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?

What topics interest you for future Dentistry Today CE courses?