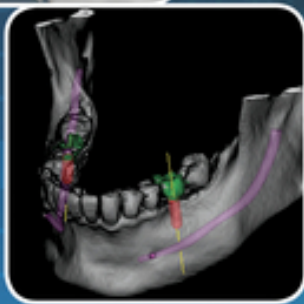
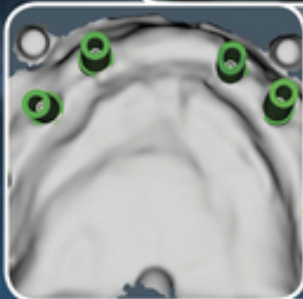
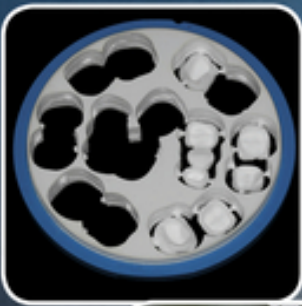


Clinical Applications of Digital Dental Technology



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piece with reference lines. (i) The final crown is delivered the same day of the implant placement. A connective tissue graft is sutured in place to compensate the horizontal defect at the level of the lateral. (j) Healing after 4 weeks shows adequate papilla fill in the interproximal areas.

Figure 7.15 Immediate placement and restoration of single implant. (a) Patient presents with chief complaint: "I want a solution for the infection that I have in my tooth, and I don't want to have a hole". His esthetic expectations are high. (b) The right first premolar needs to be extracted for restorative reasons. (c) A special plate with radiopaque landmarks is used for the radiographic guide. (d) 3D reconstruction of the patient's maxillary bone and implant. (e) SICAT surgical software planning is used for virtual implant placement. (f) Presurgical intraoral view. (g) After an atraumatic extraction, the buccal bone integrity is verified and an immediate implant placement performed with guided surgery. (h) A 4.1 × 12 mm implant (Klockner®) is fully guided through the 5 mm sleeve. (i) After implant placement, a prefabricated provisional crown is delivered. (j) Final restoration at the 2-year follow-up. (k) The soft tissue and the color of the crown are in excellent harmony with the natural dentition. (l) A 2-year postoperative CBCT shows maintenance of the buccal bone.

Figure 7.16 Guided placement and immediate loading of implants in edentulous maxilla. (a) The patient presents wearing an acrylic RPD. She wants a fixed restoration. (b) The future implant position is planned in the diagnostic and treatment planning phase. (c) The validated initial setup is used as a guide for the fabrication of the radiographic guide. A bite plate

with fiducial markers is bonded to the barium sulfate teeth. (d) After CBCTs were obtained, SICAT Planning Software was used for implant virtual placement. (e) Surgical guide fabricated by the manufacturer (SICAT GmbH & Co. KG Brunnenalle, Bonn, Germany). (f) Before surgery, the diagnostic cast is modified. Using the surgical guide, for the placement of implant analogs. (g) Eight provisional abutments were placed on top of the analogs. (h) Self-polymerizing (New Outline[®], anaxdent GmbH, Stuttgart, Germany) was used for the fabrication of a provisional full-mouth restoration. (i) Due to the limited bone availability, a full-thickness flap needed to be reflected. (j) Eight implants were placed in the maxilla and five in the mandible in the same surgery, using the computer-aided surgery guide. (k) After some adjustments, the full-mouth provisional restoration is screwed on top of the eight implants. (l) Postsurgical panoramic radiograph taken after delivery of the temporary prosthesis. Note the small implant/abutment misfit. This expected prosthetic complication was corrected by means of postoperative adjustments to the temporary provisional.

Chapter 8: Digital Design and Manufacture of Implant Abutments

Figure 8.1 A titanium prefabricated abutment designed for an implant with an external connection. Note the gold abutment screw that is used to retain the abutment and the impression coping used to make an impression from the head of the implant.

Figure 8.2 A Gold Adapt (NobelBiocare) custom abutment and retaining screw, before fabrication.

Figure 8.3 An example of a Nobel Biocare Scan Body.

Figure 8.4 (a) Occlusal view of scanned master cast and the design of CAD/CAM custom abutments. White color represents the location of implants and abutments are in green. (b) Frontal view of scanned master cast and abutments design.

Figure 8.5 (a) Scanned mandibular cast and design of custom abutment on the first molar. (b) Articulated digital casts with a superimposed scan of the provisional restoration. This will allow for the design of a custom abutment within the confines of the provisional restoration and the available space. In this figure, maxillary anterior custom abutments are shown. (c) Designed mandibular custom abutment is shown. (d) Frontal view of designed abutments with a superimposed scan of the provisional restoration.

Figure 8.6 (a) Occlusal view of milled ATLANTIS abutments fabricated by DENTSPLY Implants. The abutments are coated with TiN to give gold shading. (b) Lateral view of ATLANTIS custom abutments. (c) Try-in of abutments in the mouth.

Figure 8.7 (a) Occlusal view of metal ceramic restorations fabricated on the master cast. (b) Frontal view of restorations inserted in the mouth.

Figure 8.8 (a) Custom abutments designed using NobelProcera system. (b) Final prosthesis cemented on NobelProcera abutments.

Figure 8.9 (a) Occlusal view of free form milled bar fabricated using NobelProcera system. (b) Frontal view of the final prosthesis retained on the substructure using lateral retaining screws.

Figure 8.10 (a) Frontal view of master cast that is scanned into NobelProcera software to design an implant-retained bar. (b) Occlusal view of master cast

that is scanned into NobelProcera software to design an implant-retained bar. (c) Waxup of final prosthesis is scanned into NobelProcera software (frontal view). (d) Virtual abutments are placed on the virtual master cast (frontal view). (e) Virtual abutments are placed on the virtual master cast (occlusal view). (f) Virtual bar is designed (frontal view). (g) Virtual bar is designed (occlusal view). (h) Waxup is superimposed on top of the designed bar to evaluate space available for restorative material (frontal view). (i) Waxup is superimposed on top of the designed bar to evaluate space available for restorative material (occlusal view).

Figure 8.11 The Encode healing abutment (Biomet 3I).

Chapter 9: Digital Applications in Endodontics

Figure 9.1 Traditional (a) and CBCT (b) radiographs of maxillary left first molar with previous endodontic treatment and a separated instrument in the MB canal. Note that the CBCT image showed a large periapical lesion that the periapical radiograph did not show. Root end surgery confirmed that there was a thick cortical plate of bone and a lesion present in the medullary bone. (c) and (d): Show two angles using periapical radiography that suggest a missed MB2 canal and a periapical lesion. (e) CBCT confirms that a missed canal and a lesion existed and shows their location and extent (arrows). (f) Completed retreatment of MB1 and MB2.

Figure 9.2 (a) Typical MRI image of posterior teeth and surrounding tissues, showing contrast for different tissues but low resolution to discern dentin and pulp detail. (b) SWIFT-MRI shown in comparison with traditional radiography and CBCT. The

photograph depicts the maxillary teeth that are also imaged with a traditional two-dimensional radiograph used to detect interproximal caries. The dotted lines, represented by a, b, c, and d, correlate with the cross-sectional CBCT and SWIFT images at those levels, from more superior closer to the root tip moving inferiorly to the crown of the teeth. Note the higher resolution for SWIFT-MRI (FOV diameter of 110 mm and an isotropic voxel size of 430) and the lack of streaking artifacts associated with metallic restoration that are present in CBCT.

Figure 9.3 (a) Ultrasonic instruments of varying types and sizes for different purposes. Preoperative (b, c) and Postoperative radiographs (d) of a retreatment case that required the used of several of these ultrasonic tips in removing the composite and the post through the existing crown, without disrupting the crown. (e) Six month recall shows healing.

Figure 9.4 Wave One reciprocating motor and instruments.

Figure 9.5 Comparison of traditional (b) and small head (a) handpieces holding 25 mm Vortex files of the same size that have a small shank. Only 22.5 mm of the file on the right is available for use.

Figure 9.6 (a) Set up of the SAF instrument with the irrigation syringe. (b) Close-up of the attachment of the SAF to the handpiece and the irrigation tube. (c) The SAF lattice structure.

Chapter 10: From Traditional to Contemporary: Imaging Techniques for Orthodontic Diagnosis, Treatment Planning, and Outcome Assessment

Figure 10.1 Traditional cephalometric analysis in two dimensions.

Figure 10.2 (a) On the periapical radiograph, the first premolar appears to have a malformed root. (b) The CBCT image (coronal slice) reveals that the premolar has a significant palatal angulation.

Figure 10.3 Cone-beam CT image of a palatally impacted canine. (a) Maxillary reconstruction. (b) Axial view. (c) Sagittal view.

Figure 10.4 CBCT image revealing resorption of the lateral incisor root, caused by the erupting permanent canine. (a) Facial reconstruction. (b) Sagittal view of the affected area.

Figure 10.5 Cortical bone thickness measurements at different areas.

Figure 10.6 Interproximal placement of a temporary anchorage device (TAD).

Figure 10.7 Superimposition of CBCT images in a patient undergoing orthopedic palatal expansion.

Figure 10.8 (a) CBCT image of a patient requiring mandibular reconstruction surgery. (b) Virtual design and fabrication of acrylic model.

Figure 10.9 CBCT image of a normal TMJ. (a) Coronal view. (b) Sagittal view. (c) Axial view.

Figure 10.10 Axial and sagittal view of the airway created from a CBCT image. Contemporary software allows for digital measurements of the airway dimensions.

Figure 10.11 3D facial image of a subject. The image can be rotated in different direction (right image) and measures recorded.

Figure 10.12 Markers are secured to specific facial landmarks. Subjects are instructed to perform