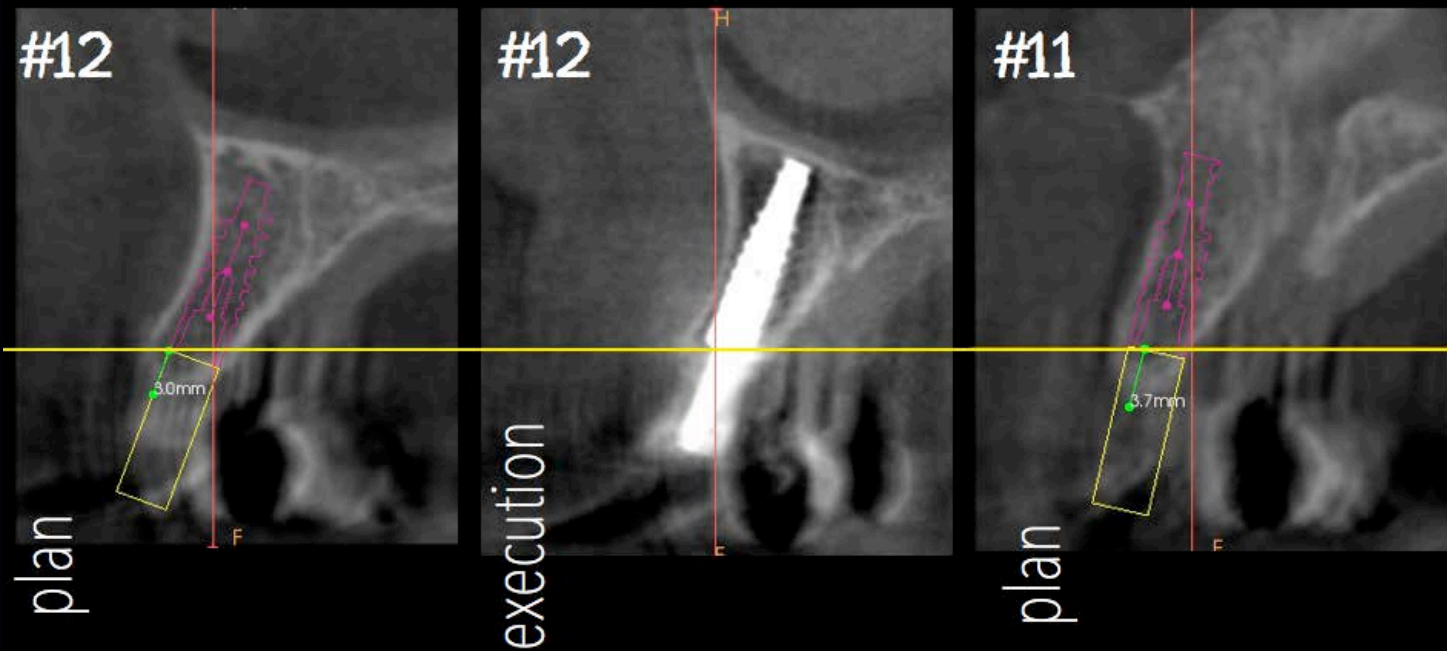


The Slim Concept—



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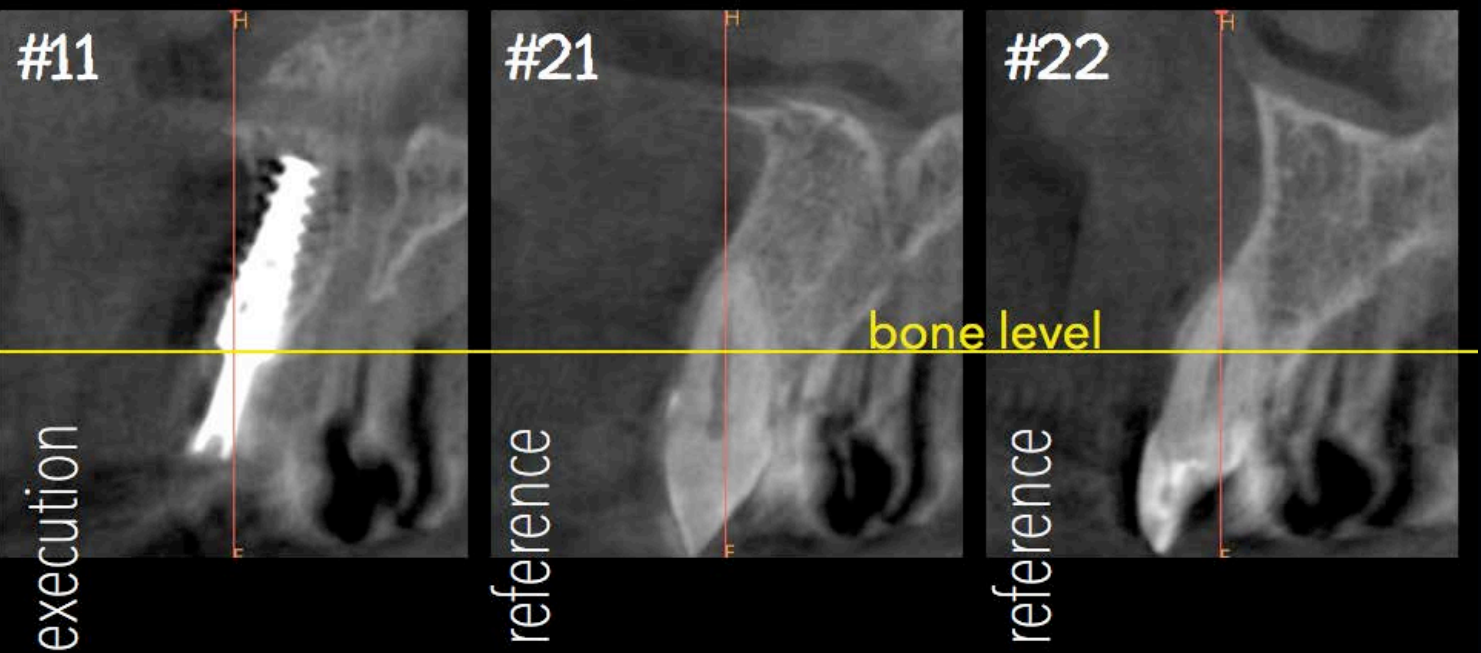
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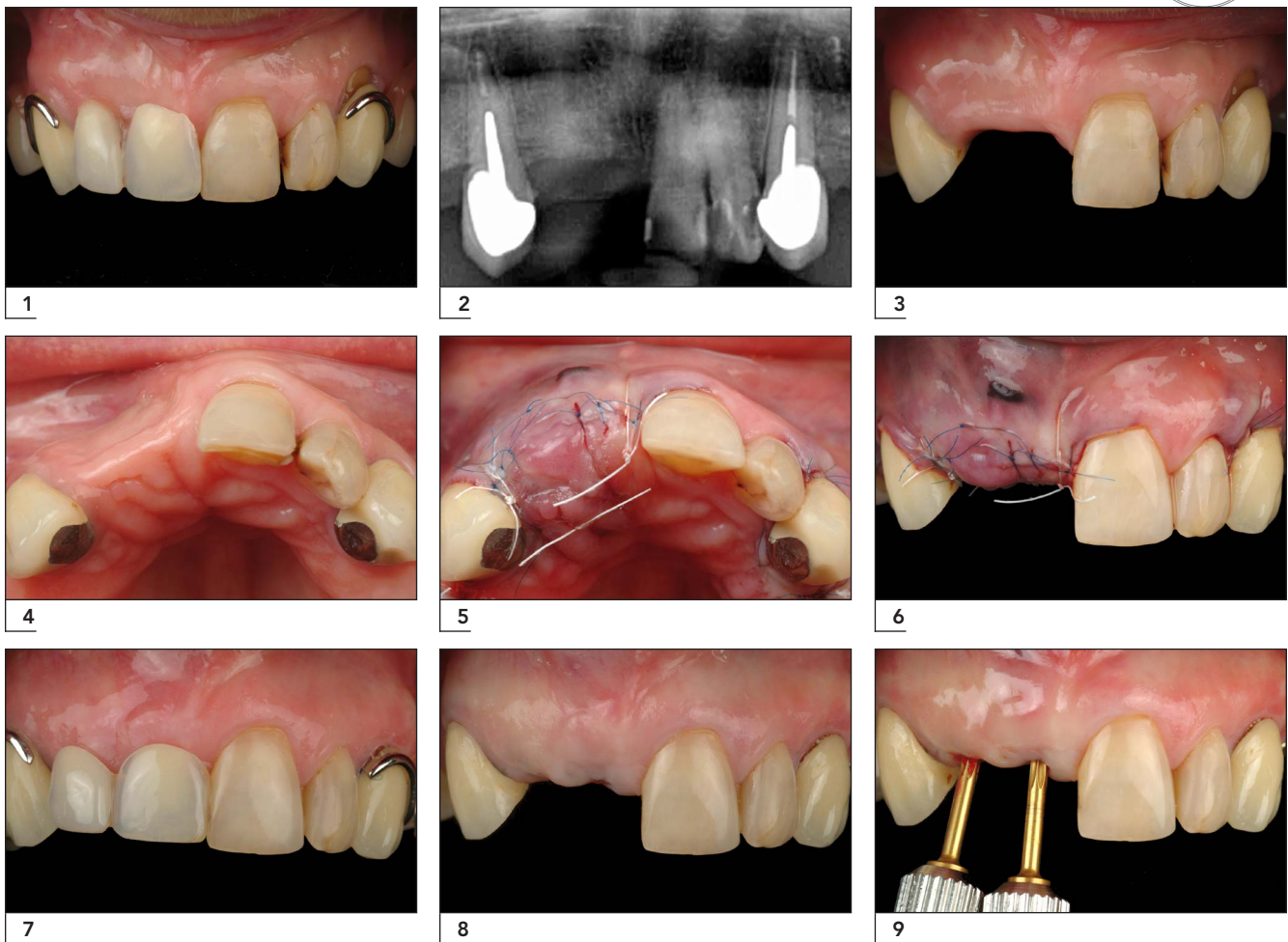
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Clinical Steps to Ultimate Success



As described in the authors' previous article published in QDT 2017, the Slim concept provides the unique ability to create an abundance of soft tissue volume in the early surgical stages of implant restoration. It involves protocols and components, the Slim heal-

ing abutment being the most important, that enable long-term esthetic and functional success. The following case details further the clinical steps of the Slim concept in a patient ideally restored with implant crown restorations along with veneers in the anterior maxilla.



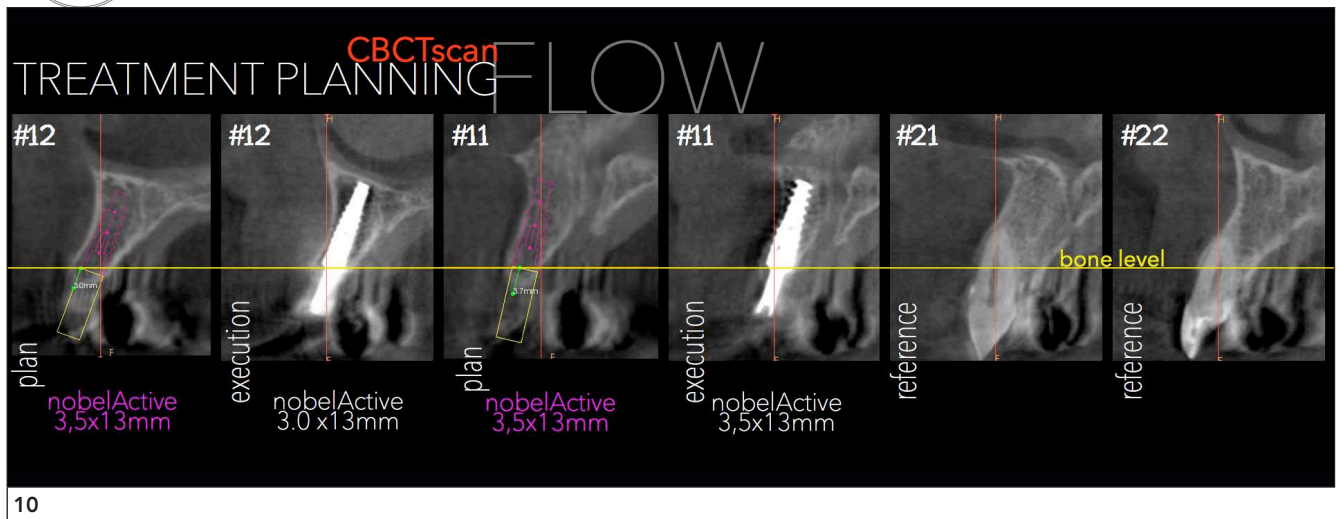
CASE PRESENTATION

A female patient presented with a removable partial denture replacing the maxillary right central and lateral incisors and first premolar as well as the maxillary left premolars (Fig 1). Her request was to have implant-supported fixed dental prostheses replace those teeth. The panoramic radiograph and cone beam computed tomography (CBCT) scan revealed the magnitude of the bone loss, especially on the buccal aspect, when compared to the adjacent central and lateral incisors (Fig 2). The heights of the papillae on the mesial and distal aspects of the defect were almost ideal, except for the volume loss on the buccal aspect (Fig 3). The large buccal and vertical defect in the edentulous area was caused by excessive pressure from the base of the removable denture, which replaced the teeth extracted about 10 years earlier.

Graft, Implant, and Slim Placement (Figs 4 to 9)

CBCT examination of maxillary tuberosities indicated sufficient soft tissue thickness to serve as preferred donor sites for subepithelial connective tissue grafts. Connective tissue from the tuber areas is more dense and provides better long-term stability than palatal tissue; however, it requires complete coverage to ensure adequate vascularization and avoid necrotizing.

Since bone augmentation procedures add another level of complexity and unpredictability, it was decided to augment the deficient sites solely with a connective tissue graft. A buccal and crestal incision was made on the edentulous ridge, and a partial-thickness flap was elevated to increase the volume and tissue height, especially between the implants and buccolingually. A sulcular incision was



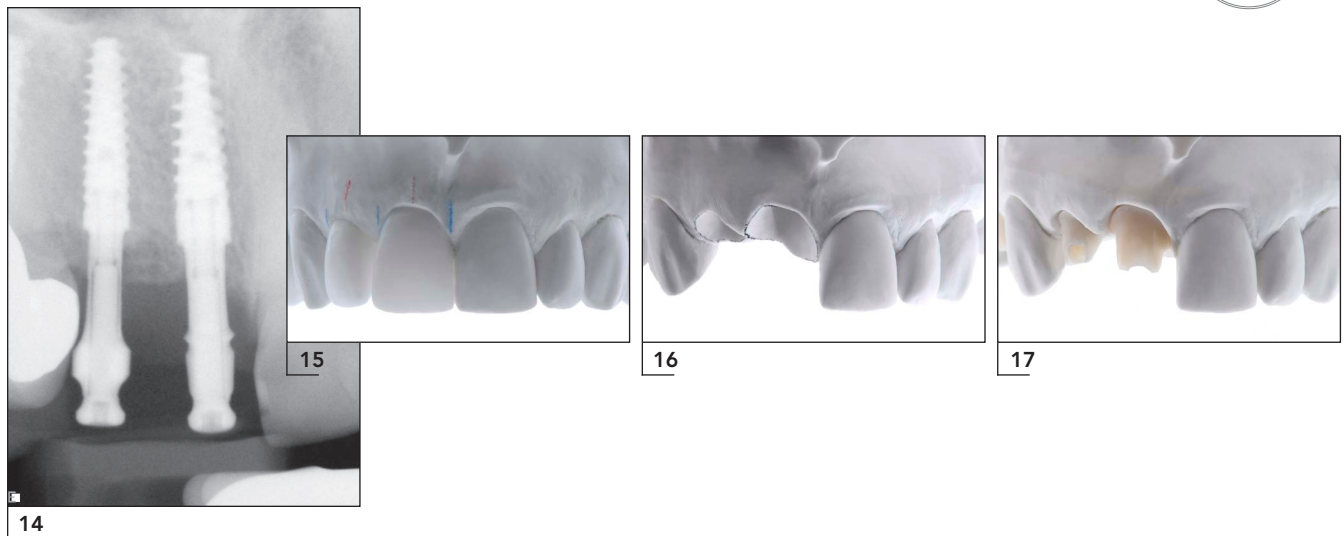
made around the mesial and distal aspects of the teeth, and the papillae adjacent to the defect were elevated. Finally, the partial-thickness flap was prepared and raised above the mucogingival junction (MGJ) until it reached the desired coronal position. No vertical releasing incisions were made and the periosteum was left on the bone. A NobelActive NP 3.3 [Au: 3.5?] × 13-mm implant (Nobel-Biocare) was placed in the area of the maxillary right central incisor and a NobelActive 3.0 × 13-mm implant in the area of the lateral incisor. Slim healing abutments with 7-mm heights were selected to maximize crestal tissue grafting and enable primary flap closure. A large free tissue graft was harvested from the maxillary tuberosity and carefully de-epithelialized. The connective tissue graft was sutured in position to the palatal aspect of the flap. The buccal flap was then sutured exactly to the initial incision to close the wound. Monofilament suture material (6-0 PTFE) was used to secure the tissues in place, and a 6-0 monpropylene suture was used for precise flap closure. This type of surgery should always be performed in one stage together with implant placement.

Implant Planning and Execution (Fig 10)

Bone morphology, implant selection, and surgical placement were assessed and determined with digital implant planning software. Virtual implant selection and placement suggested two NobelActive NP implants (3.5 × 13 mm). The yellow line indicates the bone level on the adjacent teeth and assists in the determination if bone or soft tissue augmentation is needed. About 3.7 mm of tissue depth for the central and 3 mm for the lateral incisor would be necessary to control tissue scallop and volume to mimic the adjacent site. Due to the thin buccal plate, the implant for the lateral incisor was selected to have a 3.0-mm diameter.

Healing Phase (Figs 11 to 13)

The removable partial denture served as a provisional restoration and was adjusted to avoid any contact with the augmented site. The 3-month follow-up showed that the



original goal of creating a soft tissue contour similar to the adjacent site was achieved. The Slim healing abutments were initially completely covered with soft tissue, indicating the great volume gained.

Provisional Impression/Slim Management (Figs 14 to 17)

Three months after surgery, an impression of the implants was made under local anesthesia. Removal of the healing abutments and connection of the impression copings were done carefully due to the large amount of tissue to displace, the bone depth, and the diameter of the impression copings—the smaller the better [Au: meaning of this unclear]. Due to their wider base, Slim healing abutments must be removed with pliers. The impression coping was inserted with vertical pressure, and seating was verified radiographically. A diagnostic full-contour wax-up was made to replicate the natural tooth and duplicate its diameter, especially in the gingival third. A line was drawn on the master cast following the ideal scallop of the wax-up, and the desired emergence profile was carved from that line to the abutment head. Polyvinyl siloxane (PVS) matrices were made to visualize the full-contour wax-up and fabricate the composite abutment. The stone was carved with hand instruments until a divergent cone was created from the implant head. Composite abutments were then scanned and transformed in zirconia.

Provisional Restoration/Adaptation (Figs 18 to 20)

After the Slim abutments were removed with the patient under anesthesia, the final zirconia (Zr) abutments were connected and verified radiographically. Some interproximal bone had to be trimmed with diamond burs until final adaptation. No flap was deflected and all bone recontouring was done through the tissue hole created by the Zr abutments. The abutment screw of the 3.0 NobelActive implant should not be torqued beyond 5 Ncm. Ischemia is related to pressure and blanching of the tissues, which reduces blood supply and may cause necrosis of the surrounding tissues. The provisional crowns were then relined chairside to establish ideal fit and proper interproximal contact areas. The abutments were disconnected to adapt the margins and polish the provisional crown restorations extraorally.

Papilla Loss/Second Graft (Figs 21 to 25)

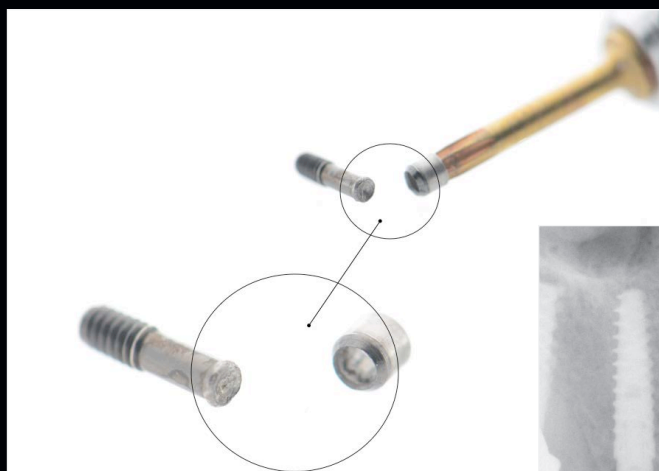
During the healing process (3 months), papilla between the two implants was lost, which was likely caused by a loosening of the provisional and trauma due to incorrect occlusion. Buccal tissue volume was adequate. A second connective tissue graft was placed in the papilla area to improve the volume and density of the lost papilla. Zr abut-



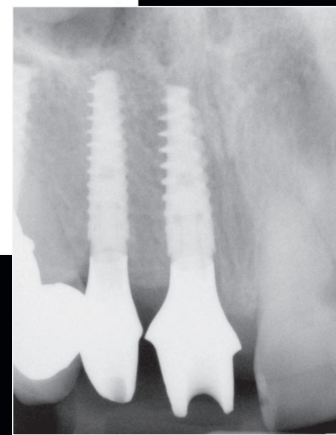
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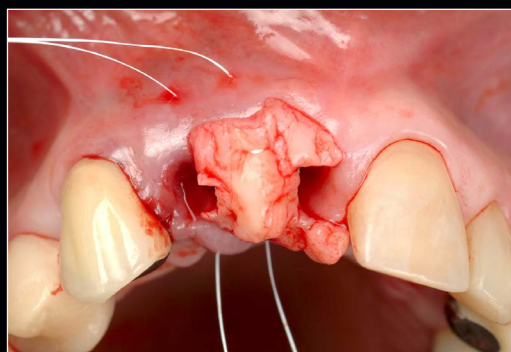
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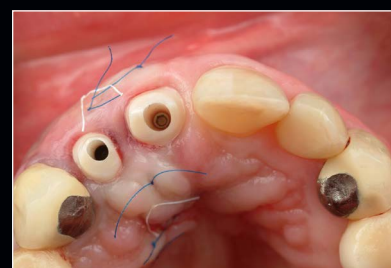
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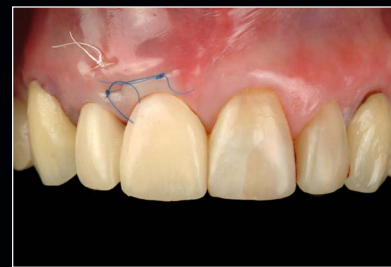
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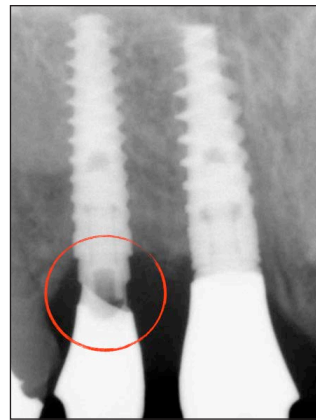
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ments were modified to allow more space for grafting. A tunnel incision on the papilla and adjacent implants was prepared to attach the second connective tissue graft buc-

copalately. A 6-0 PTFE monofilament suture material was used for that, while 6-0 monpropylene suture was used for exact flap closure adaptation and positioning.



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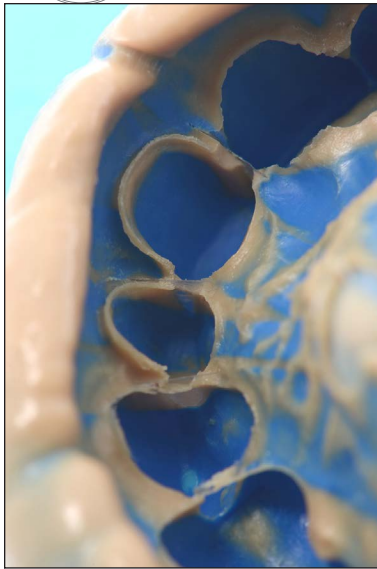
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Prosthetic Phase Healing (Figs 26 to 28)

After 9 months, the healing process of the grafted site around the Zr abutments and provisional restorations was reevaluated. The soft tissue situation in respect to volume, interproximal height, and buccal/palatal support was almost ideal. Some additional pressure was needed on the buccal aspect to control and blend the scallop of the implant restoration with the adjacent central incisor. The original Zr abutments were replaced by an ASC (angulated screw channel) Zr abutment on the central and a new titanium/Zr abutment on the lateral incisor, due to fracture of the Zr abutment as seen on the periapical radiograph. A pick-up impression of the provisional restorations was made and poured in stone while the patient was waiting. This impression is helpful to transfer the emergence profiles but lacks accuracy in the interproximal contact areas.

Veneers: Preparation/Final Impression (Figs 29 to 31)

The maxillary left central and lateral incisors were prepared for porcelain laminate veneers to improve the overall esthetic outcome. The veneers were completed first and the veneered teeth would be used to match the implant crowns to their exact shade, value, and translucency. The preparation was approximately 1.4 mm in depth at the middle third of the tooth to create sufficient space for the ceramist to mask the dark shade of the natural abutment teeth. Since the interproximal contact areas were not completely opened, clear matrices were placed to facilitate sectioning of the individual dies in the laboratory during master cast fabrication. A two-cord technique was applied for the definitive impression, with a #000 retraction cord carefully placed into the sulcus first for margin location and to con-

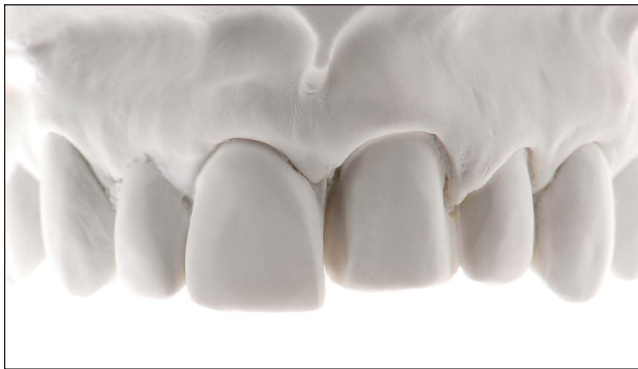


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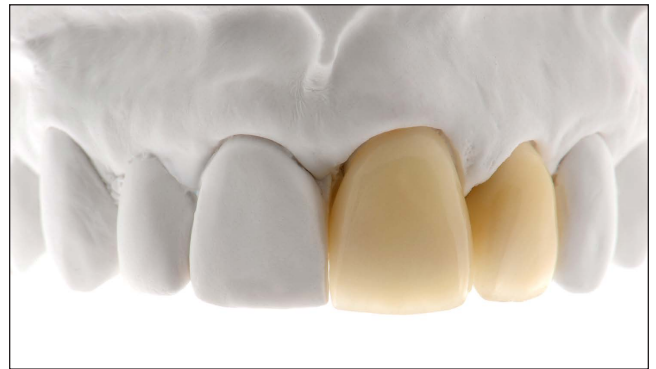
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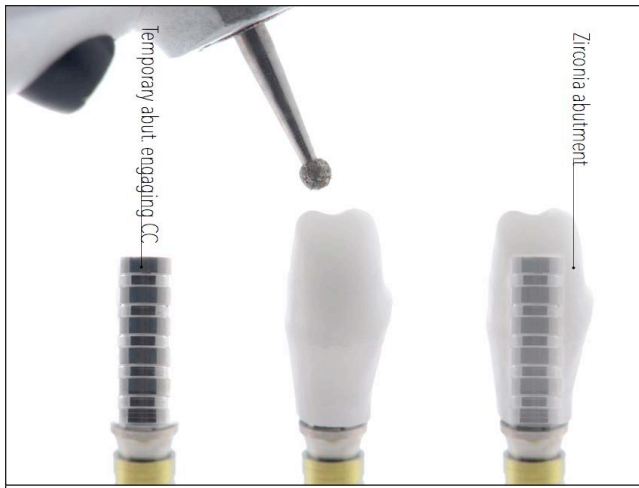
control intracrevicular fluids and bleeding, and a #00 cord placed on top to further deflect the soft tissue and capture the finishing line. The top cord was removed immediately before the impression material was applied while the first cord stayed in the sulcus.

Customized dies were fabricated for the prepared teeth with flowable composite. These dies were then stained chairside to replicate the shade of the natural abutment teeth as closely as possible. These customized dies allow dental technicians to adapt their porcelain layering technique individually and simulate the esthetic outcome in the laboratory.

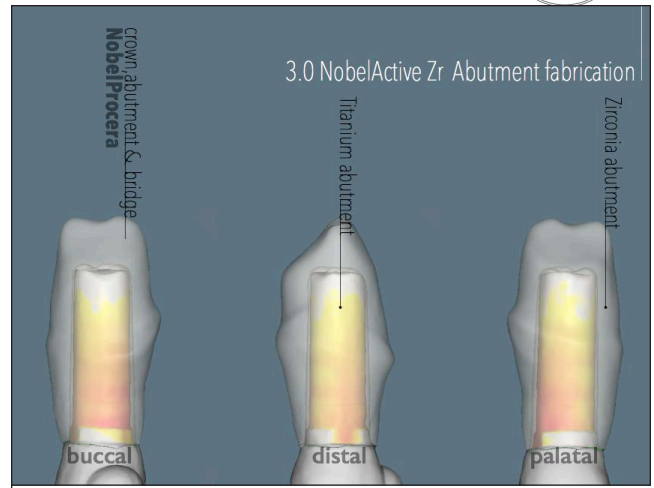
Veneers: Model Work, Porcelain Buildup (Figs 32 to 35)

A “Geller model” was made from the definitive impression to fabricate the two porcelain laminate veneers. The clear matrices in the interproximal areas allow the technician to trim the dies more efficiently and delicately without damaging the interproximal finish lines. The trimmed dies are placed back in the impression and secured into position to then pour the rest of the impression with stone, creating a master cast that allows the prepared dies to be removed while keeping the soft tissue contour of the model intact.

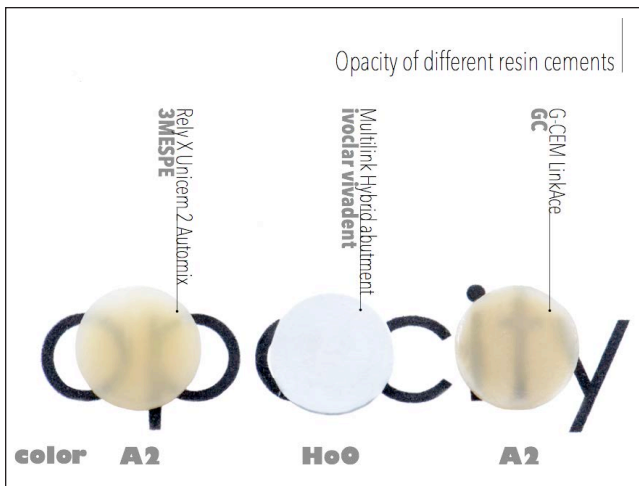
During layering of the porcelain, the dental technician can simulate and verify the expected outcome on the customized composite dies in terms of final shade, value, chroma, and translucency.



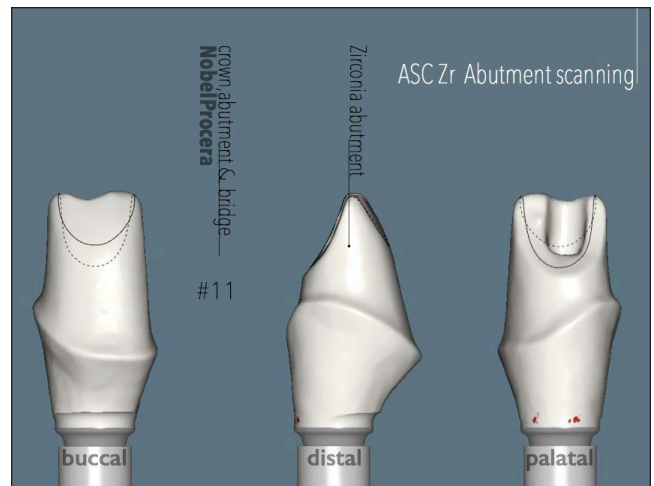
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Zr Abutment Fabrication (Figs 36 and 37)

The new Zr abutments were fabricated to provide better support of the soft tissues after the second connective tissue graft. Modifications were also necessary to meet the goal of having the soft tissues supported 90% by the abutment and 10% by the crown. A two-piece Zr abutment was fabricated for the lateral incisor since there was no metal connection available for the specific implant (3.0 mm NobelActive). The Zr abutment part was bonded to a titanium abutment to maximize the esthetic outcome. It was first built in composite to the ideal contour. The composite and supporting titanium abutments were then scanned to design and fabricate the Zr component. The Zr abutment was perforated to facilitate the bonding process and limit voids in the resin cement.

To block out the dark color of the titanium, three different resin cements were selected and tested with respect to their level of opacity. Of those, the high-opacity (Ho0) Multilink Hybrid abutment cement (Ivoclar Vivadent) seemed to provide the best ability to mask the titanium.

Abutment Scanning (Fig 38)

The plastic ASC wax-up sleeve engaging abutment was connected to the laboratory analog, and composite resin was placed between the conically carved stone and the plastic sleeve until the ideal contour was achieved. The composite abutment was light cured and prepared to create a 1-mm subgingival margin on the buccal aspect of the ideally carved scallop and a slightly supragingival margin on the palatal aspect. The composite abutment was



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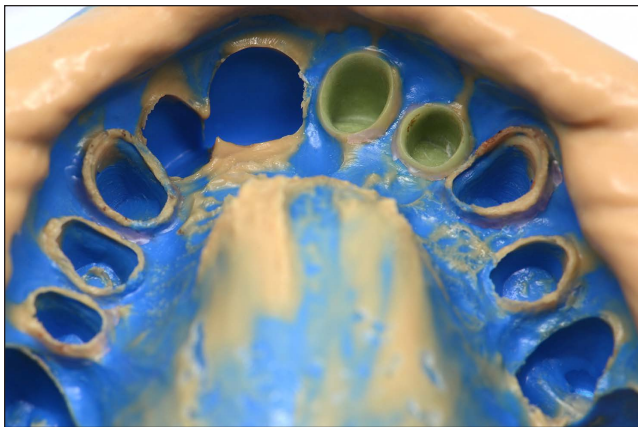
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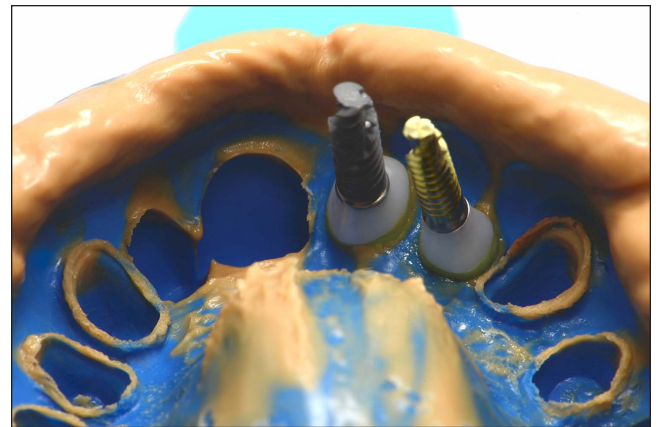
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scanned (Nobel Biocare 2G scanner), allowing the technician to order a duplicate zirconia abutment of the provisional abutment from the milling center.

Veneer Cementation and Final Impression (Figs 39 to 44)

Impression copings were fabricated with an acrylic resin material on top of the final Zr abutments to ensure preci-

sion when pouring the impression in stone, to not disturb the soft tissues, and to speed up the process during the final impression of the maxilla after final cementation of the two porcelain laminate veneers. A double-cord technique was used for the two canines (first cord #3 and second cord #1) and multilayered single #1 cord around the Zr abutments on the premolar implants.

The final Zr abutments were placed into the acrylic copings under the microscope before the impression was poured in stone.



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Bisque Bake Try-in (Figs 45 to 47)

To assess the final value and shade, glycerin gel was painted on the intaglio surfaces of the crowns during bisque bake try-in. The shapes of the crowns were modified by adding composite; this would also give the dental technician some guidance for the finalization of the restorations. All functional and esthetic parameters were assessed and adjusted as needed. All crowns were cemented with provisional cement, and a pick-up impression was made to communicate the present soft tissue topography.

Delivery of Zr Crowns (Figs 48 and 49)

The soft tissue support was carefully evaluated on the pick-up model in terms of scallop, volume, interproximal contour, embrasure spaces, and contact areas. Additional pressure was exerted by the semi-pontic design on the buccal aspect of the implant crowns to blend the conventional with the implant-supported restorations.



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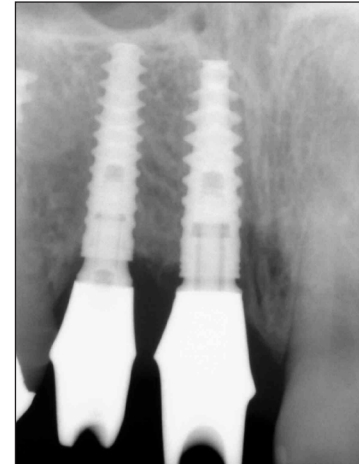
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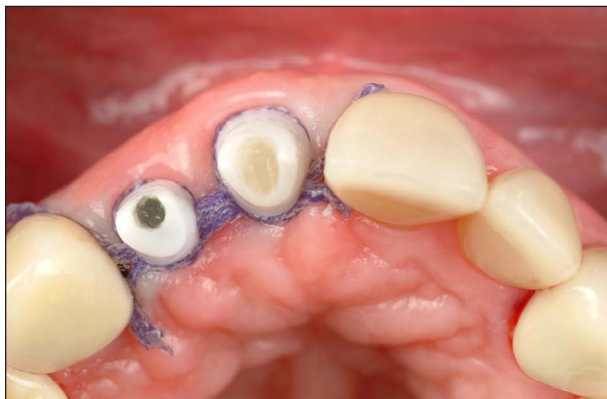
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Try-in of Zr Crowns (Figs 50 to 55)

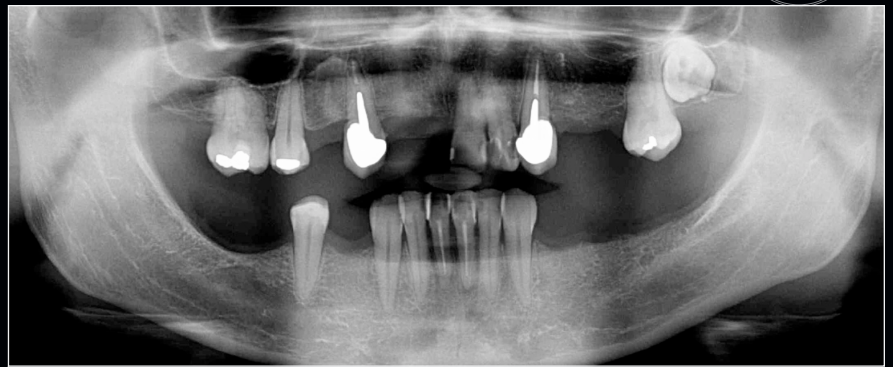
The implant abutments were disinfected in 2% glutaraldehyde for 10 minutes and rinsed thoroughly before connecting them to the implants. The tissues were carefully inspected and any cement remnants from prior interventions were removed. The abutments were torqued to 35 Ncm as recommended by the manufacturer. Periapical radiographs were taken to verify fit and proper seating of the components. All esthetic and function parameters were verified during the final try-in.

Cementation of Zr Crowns (Figs 56 and 57)

For final cementation of the implant crowns, two retraction cords were placed independently: one on the buccal and the other on the palatal aspect of each abutment. The cords were extended into the sulcus of the adjacent teeth, which allows for easy retrieval of the cords and control of cement removal from both sides, buccally and palatally, in an independent manner. Self-adhesive cement (Rely X Unicem, 3M Espe) was used for final cementation. A periapical radiograph was taken after cleaning of the cementation site with dental floss.



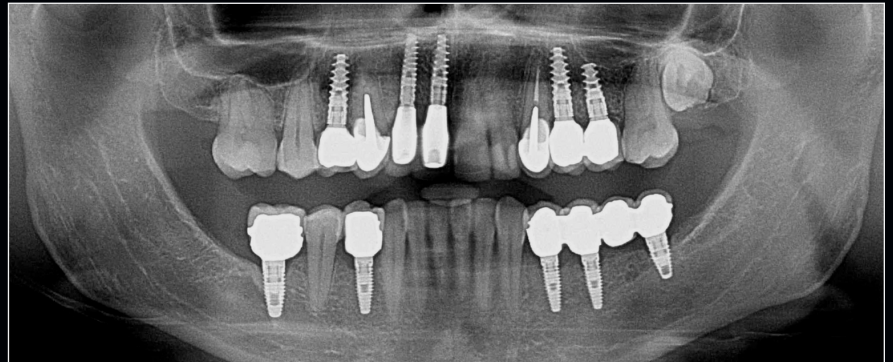
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Final Result

The preoperative compared to postoperative results (Figs 58 to 63) and 1-year postcementation situation (Figs 64 to 68) indicates a favorable blend of the various treatments performed in this patient—from conservative internal bleaching and direct composite restorations on the

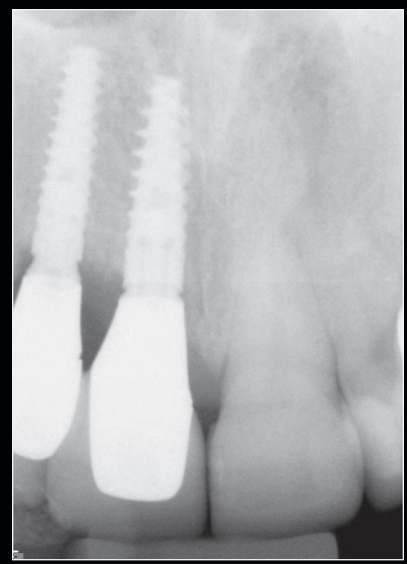
mandibular central incisors, to single-tooth implants with crestal connective tissue grafts to improve the soft tissue volumes, to porcelain laminate veneers, conventional crowns, and zirconia fixed dental prostheses. The high smile line demanded a carefully planned and executed approach to provide the patient with optimal and long-term stable prosthetic and soft tissue outcomes.



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