Dentists are often tasked with creating complex treatment protocols in order to best meet the clinical needs and desired outcomes of each individual case. There is no single solution that is easily applicable to all cases in implantology and restorative dentistry. A full knowledge and understanding of various treatment options is necessary to create a comprehensive treatment plan. Decisions must be made regarding immediate delivery, temporization, screw- versus cement-retained restorations, and whether to use guided or freehand surgery when placing implants. In many cases, bringing a case to completion requires a global understanding of treatment options and protocols along with a combination of various techniques.

In the case that follows, a patient presented to the operatory with conditions that appeared fairly standard, but eventually called for a comprehensive, multi-stepped protocol that involved various methods of implant treatment.

Case Report
A female patient presented to the operatory with a fixed dental prosthesis extending from teeth #5–9, with pontics in the area of #6 and #8 (Figs. 1a–1c). She exhibited a high smile line as well as fractured porcelain on the incisal edges and lingual occlusal surfaces of the restoration. Comprehensive extraoral and intraoral examinations were performed. A diagnosis of recurrent decay was made and a treatment plan was developed to replace the existing five-unit bridge with individual restorations.

The intraoral examination and palpation of the labiolingual ridge width initially revealed that the patient might qualify for freehand surgical implant placement for the pontic areas. However, a radiographic and cone-beam computed tomography (CBCT) examination revealed that the patient had far less bone than first anticipated, as well as large labial undercuts. To increase the accuracy and predictability of implant placement, a guided surgical approach was selected for tooth #6 and #8.¹

Figures 1a–1c: In the preoperative condition, the patient exhibited a high smile line and esthetics that would prove to be a restorative challenge.
Upon removal of the existing fixed prosthesis, there was confirmation of significant decay on abutment tooth #5 (Figs. 2a, 2b). Abutment tooth #7 and #9 were prepared to eventually receive single-unit restorations. Tooth #5 was deemed non-restorable; root canal treatment, crown lengthening, and a post and core followed by a crown would have compromised the esthetic situation due to the high smile line.

A comprehensive treatment plan involving a series of appointments was devised for the patient, including a combination of both freehand and guided surgery, temporization and immediate loading.

During a previous appointment, an impression of the patient’s existing dentition had been taken and sent to the lab for a diagnostic wax-up and fabrication of a provisional restoration spanning teeth #5–9 (Fig. 3). The diagnostic wax-up helped with garnering patient approval for the case, in conjunction with the digital models created via the treatment planning software. The BioTemps® provisional restoration (Glidewell Laboratories; Newport Beach, Calif.) was relined and temporarily cemented on the abutment teeth, with care taken to create ovate pontics in the areas of missing tooth #6 and #8 (Fig. 4).
The temporary was removed when the patient returned four weeks later. With the patient back in the operatory, it was confirmed that the ovate pontics in the areas of tooth #6 and #8 had helped to contour the implant sites during the temporary phase, promoting esthetic emergence profiles and interproximal papillae formation for the planned restorations. At this appointment, the gingival tissue around tooth #7 and #9 was retracted utilizing a two-cord method to increase the likelihood of achieving an intraoral impression scan suitable for producing a high-quality STL file.

At the same appointment, tooth #5 was atraumatically extracted and a 4.7 mm x 11.5 mm Inclusive® Tapered Implant (Glidewell Direct; Irvine, Calif.) was delivered via freehand placement in the extraction site (Figs. 5, 6). Care was taken to accomplish the necessary requirements for a favorable restorative outcome, including primary stability, proper angulation for the final restoration, and proper mesial-distal spacing. Two millimeters of space was also given between the shoulder of the implant and the facial aspect of the extraction socket to help support proper bone healing and an esthetically pleasing outcome. A healing abutment was placed along with a demineralized cortico-cancellous allograft bone graft and sutures to allow for proper healing (Fig. 7). A cantilever interim restoration was then seated with temporary cement, spanning from teeth #5–9 (Fig. 8). This design ensured that no pressure would be placed on
the implant during osseointegration and initial healing. The interim prosthesis was also designed with ovate pontics in the area of tooth #6 and #8 to continue contouring the tissue for the planned implant restorations. With the interim restoration in place, the patient was given four months to heal before moving on to the next step in the treatment plan.

The patient returned to the operatory after the allotted four-month healing period. An intraoral examination confirmed that healing had occurred without complication (Fig. 9). After the interim restoration was removed, contouring of the future implant sites was confirmed (Fig. 10). The purpose of this visit was also to load the implant in the area of tooth #5 in order to create a proper emergence profile. The healing abutment was removed and a temporary abutment was engaged into the implant. The interim restoration, which was fabricated from poly(methyl methacrylate) (PMMA) material, was then modified by creating a hole positioned over implant #5, allowing the temporary abutment to slide through unimpeded. The temporary abutment was connected to the interim restoration and adjusted to create the proper contours for tissue conditioning. After attaching the prosthesis to abutment tooth #7 and #9 with temporary cement, a suitable material was placed in the screw-access hole of the temporary abutment. Then, composite was placed over the occlusal surface in the area of tooth #5. Additional contouring of the
Implant sites occurred over six weeks of healing with the partially screw-retained provisional in place (Fig. 11).

To aid surgical placement of the implants for tooth #6 and #8, CBCT scans were utilized to provide a three-dimensional view of the underlying bone and transition the case into a digital environment by producing the DICOM file needed for digital treatment planning (Figs. 12a, 12b). The DICOM and STL files were uploaded into a digital treatment planning program, where the proper implant positions were planned and coordinated based on a digital wax-up of the final prosthesis. The appropriate implant lengths and diameters were selected and the implants were placed digitally based on anatomical limitations (Figs. 13a, 13b). A surgical guide was designed for placing the implants for tooth #6 and #8, and the file was sent to the laboratory for stereolithographic printing and finishing.

**Figure 11:** Additional tissue contouring was achieved utilizing a partially screw-retained provisional.

**Figures 12a, 12b:** A CBCT scan was taken to transfer the case into a digital setting, as well as to verify the bone state of the patient.

**Figures 13a, 13b:** The intraoral scan was merged with the CBCT scan, allowing for virtual placement of the implants.
At the next surgical appointment the temporary bridge was removed, revealing that the desired gingival contouring had been achieved (Figs. 14a, 14b). A healing cap was seated on the implant in the area of tooth #5, and the surgical guide was positioned firmly on the maxillary arch (Fig. 15). The surgical guide incorporated windows to confirm full seating and stability. A tissue punch was used before creating the osteotomies through the surgical guide in the areas of tooth #6 and #8. Both implants were then delivered into their respective positions (Fig. 16). Having a prolonged healing period prior to implantation allowed the pontics of the temporary bridge to firmly establish esthetic gingival contours, which, combined with the position of the delivered implants, formed the basis for an emergence profile appropriate for the esthetic zone.2

Measurements of both implants were taken utilizing the Osstell® ISQ stability meter (Osstell USA; Linthicum, Md.), which confirmed that each implant was stable enough to permit immediate loading. Then, titanium temporary custom abutments were seated on the implants. The abutment placed in the area of tooth #6 was cementable, due to the angulation of the placed implant, while the positioning of the implant for tooth #8 allowed for screw-retention. With all three implants placed and capable of loading, the partially screw-retained BioTemps provisional was seated over teeth #5–9. The provisional was delivered to continue the regrowth of the papillae during the period of implant osseointegration, as well as to establish esthetic margins, in order to ensure that the final restorations achieved natural emergence profiles (Figs. 17a, 17b).3,4

Figures 14a, 14b: Preoperative view prior to guided surgical placement of the implants for tooth #6 and #8.

Figure 15: The CAD/CAM-created surgical guide seated on the maxillary arch.

Figure 16: Implants placed in sites #6 and #8.

To aid surgical placement of the implants ... CBCT scans were utilized to provide a three-dimensional view of the underlying bone and transition the case into a digital environment.
After eight weeks of healing, final impressions were taken and sent to the laboratory for fabrication of the final custom abutments and restorations. For the final appointment, three Inclusive® Custom Abutments (Glidewell Laboratories) were delivered to the operatory in addition to five single-unit porcelain-fused-to-zirconia crowns. While two of the temporary abutments utilized during provisionalization attached to the temporary prosthesis via screw-retention, the final custom abutments were designed to be cementable, ensuring uniform, consistent results across all five restorations. The patient was recalled for the final appointment. Three custom abutments were seated on the implants (Fig. 18), followed by the delivery of five single-unit cement-retained restorations (Figs. 19a, 19b).
Conclusion

The restorative outcome of this case was achieved through a sequential, multifaceted protocol that focused on minimally invasive procedures. The final restorations achieved a natural state of papillary health and emergence profiles that significantly improved upon those offered by the preexisting PFM bridge. When comparing the preoperative condition to the final prostheses, the health of the tissue had improved visibly (Figs. 20a, 20b). The patient was pleased with the final esthetic outcome (Fig. 21). IM

References