For decades, dental implants have been used to replace failing or missing teeth, and their performance has been well documented in the literature. More recently, dental professionals have focused on approaches that improve the predictable integration of implant restorations and simplify the associated surgical and restorative protocols. This has resulted in techniques such as immediate implant placement, immediate provisionalization, and immediate loading that strive to improve the biological response to implant placement and reduce the number of steps required.

In similar fashion, CAD/CAM technology has evolved from its introduction, and certain systems can now be used not only in the fabrication of crowns and fixed partial dentures but implant abutments as well. The ability of CAD/CAM to fabricate dense, pure, and uniformly engineered materials has created a new standard that eliminates many operator-dependent variables associated with conventional laboratory procedures. Such improvements, when combined with accurate scanning and milling technology, result in more durable, precise restorations that enhance the level of care provided by today’s professionals—making CAD/CAM well suited for use in implant dentistry.

In the presentation that follows, immediate implantation and sound prosthodontic principles are demonstrated in conjunction with precision CAD/CAM technology and aesthetic ceramic layering to provide a timely, predictable restoration of a patient with internal tooth resorption.

Case Presentation
A 50-year-old female patient presented for aesthetic enhancement of her anterior maxillary dentition, which had been previously restored with porcelain-fused-to-metal crowns. Clinical and radiographic examination revealed the presence of gingival recession as well as internal resorption of tooth #9(21); the patient was in good periodontal health and bone levels were acceptable. Several treatment options (e.g., fixed partial denture, removable partial denture, implant-supported restoration) were presented for the patient’s consideration. Since the patient desired a fixed, stable restoration that would allow normal function and aesthetics, she was treatment planned for immediate implant placement and subsequent provisionalization and placement of CAD/CAM-fabricated restorations.

Figure 1A. Preoperative appearance of the failing restorations, in situ for over 15 years. Note the compromised aesthetics and marginal integrity.

Figure 1B. Postoperative facial view of the aesthetic restorations. Note the harmonious tissue integration and natural-looking result.

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Clinical Realities
Figures 2A,B,C,D,E. Once the patient was anesthetized, atraumatic extraction of tooth #9 was performed. Great care was taken to preserve the existing gingival symmetry between teeth #8(11) and #9. The extraction socket was thoroughly debrided with a curette prior to placement of an internal-connection implant (Replace Select, Nobel Biocare, Yorba Linda, CA), which was positioned by the oral surgeon approximately 3 mm apical to the free gingival margin. A healing abutment was placed, and the patient was returned to the restorative dentist. The healing abutment was replaced by a zirconia stock abutment, which was hand-tightened on the implant. Multiple implant-abutment connections were possible during the procedure due to the thick biotype of the patient. A bisacryl provisional restoration was placed, and the patient was dismissed.

Figures 3A,B. Three months postextraction, the provisional restoration was removed from tooth #9. The metal-ceramic crowns were removed from the adjacent teeth, and the underlying tooth structures were re-prepared for all-ceramic crowns. Retraction cords were placed, and tooth #9 was readied for a closed tray fixture-level impression.

Figures 4A,B. Multiple polyvinylsiloxane impressions were made in order to ensure accurate communication to the laboratory. By sending multiple impressions, any discrepancies in the model would be easily observed and addressed prior to the fabrication of the definitive restorations. A facebow (Protar 7, KaVo Dental, Lake Zurich, IL) transfer was also completed at this time to provide additional data for the laboratory technician. Provisional restorations were formed for the six anterior teeth using acrylic resin (Luxatemp, Zenith/DMG, Englewood, NJ) and seated to maintain the gingival architecture and prevent recession of the papillae while the definitive restorations were fabricated.

Figures 5A,B,C. Models were fabricated and mounted on an adjustable articulator (Protar 7, KaVo Dental, Lake Zurich, IL). From the diagnostic waxup, an abutment was formed in wax and evaluated with the tooth preparations for clearance. The implant site was adjusted and contoured for proper emergence then sealed with a hardening agent. The implant was then waxed using the matrices to evaluate shape and clearance. The interface and waxup were then placed on an analog and a bead of wax was placed at the margin and bulked out to permit scanning of the margin. Any undercuts along the interface on the analog were blocked out. Screw holes on the interface were filled, and the analog was waxed into the base.
Clinical Realities
Figures 6A,B,C. The wax abutment and interface were scanned together as one piece with the KaVo Everest ScanPro. The abutment was then removed from the interface, which was scanned as well. This information was sent to the KaVo Everest milling unit (KaVo Dental, Lake Zurich, IL) and used to precisely mill the custom implant abutment from zirconium dioxide. Its accurate reproduction required minimal manual intervention, merely slight finishing of the margin and emergence profile with a handpiece under water irrigation. The abutment was checked on the model for fit and positioned 1 mm below the gingival margin to account for the tissue response.

Figures 7A,B,C. For the copings, individual dies were cut from the diagnostic waxup, scanned, and milled using the KaVo Everest (KaVo Dental, Lake Zurich, IL) system. The copings were burned out at 25°F per minute, with a heat rate starting at 500°F to 1010°F hold for 15 minutes. After the units cooled, they were submerged in the desired stain for one minute. The copings were placed in sintering tray and fired on a sintering cycle. The copings were then seated, framed to a minimum thickness of 0.4 mm, and cut back with 360° butt margins. The copings were lined and waxed to full contour; after investing the copings were pressed with a B14-shaded ingot (eMax ZirPress, Ivoclar Vivadent, Amherst, NY) and seated on the individual dies.

Figures 8A,B,C. The occlusion and envelope of function were examined. The restorations were cut back 1 mm to 1.5 mm to instill incisal translucency. Porcelain effects were then layered into the crowns. Dentin (shade A1) and CT Orange (eMax, Ivoclar Vivadent, Amherst, NY) were used in a 2:1 mix for the gingival third and body to blend among the selected shades. An overlay of T/N was used for the enamel layer in the gingival third, after which the shape and contour were refined with diamond burs and evaluated with the matrix. Texture was added to break up the light reflections, and character stain was added.

Figures 9A,B,C. At the 60-minute seating appointment, the temporary abutment and provisional restorations were removed. The definitive zirconia abutment (torqued to 35 Ncm) was placed and accurately followed the gingival contours; all-ceramic crowns were tried in and then seated with a resin ionomer cement. As the tissue had been preserved through the extraction and provisionalization phases, the accurate CAD/CAM restorations enabled the authors to provide an aesthetic, functional result.

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