Fixed and removable implant restorations: A solution for every arch

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When a patient presents with an edentulous arch or terminal dentition, implant treatment can be provided that improves not only form and function but also quality of life. For patients desiring better chewing capability, stability, esthetics and comfort than a traditional denture can offer, both removable and fixed implant restorations are superior alternatives. While the appropriate implant solution can vary depending on the patient’s oral health, anatomy, quality and quantity of bone, and financial resources, full-arch prosthetics have progressed to the point where virtually every patient can be restored.

Although fixed, implant-supported restorations offer the highest levels of stability, function and patient satisfaction, removable overdentures are a dramatic improvement over conventional complete dentures as well. Both treatment options effectively mitigate the bone resorption that occurs following the loss of teeth, helping to preserve the oral and facial structures and, by extension, the self-confidence of the fully edentulous patient. Determining which solution is appropriate requires a careful evaluation of the individual patient’s circumstances and desires. Even when an implant overdenture is delivered, the prosthesis can eventually be converted to a fixed restoration.

As evidenced by the case that follows, in which one arch is restored with an implant overdenture and the other with a BruxZir Full-Arch Implant Prosthesis, practitioners today have a great deal of clinical flexibility. Whatever prosthetic approach is adopted, immediate, life-changing relief can be provided to patients suffering from terminal dentition or an uncomfortable, poorly functioning traditional denture. Further, the dramatic overhaul of this patient’s oral health demonstrates the life-changing capabilities of implant therapy, which helped him overcome severe functional and esthetic challenges that were impacting practically every facet of his life prior to treatment.

Case presentation

A 47-year-old male presented with terminal dentition in both arches resulting from periodontal disease and severe caries (Figs. 1a–1c). The patient had already lost many of his teeth, and the dentition that remained had been rendered unstable by his periodontal condition (Fig. 2). He had saved up enough money for a fixed implant restoration for his upper arch, for which he desired the most functional, lifelike prosthesis possible. While he couldn’t afford such a restoration for both arches, he wanted a retentive appliance for his mandible, with the option of later upgrading to a fixed prosthesis.

The patient accepted a treatment plan in which his maxilla would be restored with a BruxZir Full-Arch Implant Prosthesis and his mandible with an Inclusive® Locator Implant Overdenture. Fabricating his maxillary restoration from monolithic zirconia would ensure maximum long-term durability. This was important provided the relatively young age of the patient, who would not have to worry about his upper prosthesis succumbing to fractures, chips or stains.

His lower appliance would be held in place by connecting to the implants via Locator® attachments (Zest Anchors; Escondido, Calif.), which are an economical means of improving prosthetic retention and stability. The overdenture caps that connect to the Locator attachments would be incorporated in the prosthesis chairside, though it should be noted that many clinicians elect to have the laboratory handle this step.

The surgical phase of treatment called for the ex-
traction of the patient’s remaining teeth followed by the immediate placement of eight dental implants. CBCT scans were taken to help determine the optimal placement of the implants within the available bone and away from the patient’s vital oral anatomy. Evaluation of the CBCT scan determined that there was sufficient height, width and quality of bone to place the implants in the appropriate locations and angulations via freehand surgery. Four 3.7 mm Inclusive Tapered Implants (Glidewell Direct; Irvine, Calif.) would be placed in each arch to support the fixed maxillary restoration and the removable mandibular prosthesis.

At the surgical appointment, the patient’s remaining teeth were removed, and a flap was raised to visualize the socket sites and areas of implantation. Bone leveling was performed on the patient’s maxillary arch to elevate the patient’s smile transition line above the upper lip.

The maxillary osteotomies were positioned to facilitate an All-on-4 configuration, with the posterior implants tilted to maximize the anterior-posterior (A-P) spread, avoid the sinuses and accommodate the patient’s bone limitations (Fig. 3). Osteotomies were created for the placement of four mandibular implants, as opposed to the minimum of two required for a Locator overdenture. This would enhance retention of the overdenture while affording the possibility of upgrading to a fixed restoration at a later time.

Following creation of the osteotomies, the implants were placed (Figs. 4a–4c). Inclusive Multi-Unit Abutments (Glidewell Direct) were attached to the maxillary implants, correcting for the divergent angulation of the implants. This would both position the restorative platform in a manner that would situate the screw access holes of the eventual prosthesis toward the lingual aspect and allow for a molar-to-molar restoration (Fig. 5).

Note that when patients present for treatment with terminal dentition, they are commonly anxious about losing their teeth and the effect this
For this reason, it is important to make every effort to ensure that the patient leaves with functional appliances in place.

Thus, traditional dentures were fabricated from preliminary impressions in advance of the surgical appointment for modification and delivery following placement of the implants (Fig. 6).

Having achieved sufficient primary stability, the Inclusive Tapered Implants placed in the patient’s maxilla could be immediately loaded. Thus, the upper denture was trimmed and modified chairside to connect to the multi-unit abutments through temporary cylinders (Figs. 7a, 7b).

This would satisfy the patient’s desire to leave the surgical appointment with a fixed, fully functional maxillary prosthesis in place. Note that the two distal-most molars were removed to minimize the cantilevers and the forces transmitted to the implants during osseointegration. Healing abutments were placed in the mandibular implants to begin developing the transmucosal passages. The lower immediate denture was then modified and relined to seat over the implants during healing.

This approach provided the patient with same-day temporary restorations, and he walked out of the office with properly functioning teeth for the first time in many years. The effect this had on the patient’s comfort, function and appearance was immediate and profound (Figs. 8a, 8b). The final radiograph taken after seating the temporary appliances confirmed excellent positioning of the implants (Fig. 9).

The patient returned after three and a half months of healing so the stability of the implants and health of the soft tissue could be evaluated. Removal of the temporary appliances revealed excellent tissue health around the healing abutments of the mandible and multi-unit abutments of the maxilla (Figs. 10a, 10b). Vinyl polysiloxane (VPS) impressions were taken to begin the restorative process (Figs. 11a–11c). Because multi-unit abutments and healing abutments were placed on the day of surgery, the restorative process began above the tissue level, without any need for secondary surgery or anesthetization.

The restorative protocol for both prostheses included wax rims and setups, which the lab produced on the working casts fabricated from the impressions (Figs. 12a, 12b). The maxillary wax rim incorporated temporary cylinders through which screws could connect to the dental implants. The lower wax rim was designed to seat over Locator attachments.

At the next appointment, the wax rims were seated, the jaw relationship was recorded using conventional denture technique, and a bite registration was taken (Figs. 13a, 13b). A VPS “wash” impression of the mandibular arch was also taken with the wax rims and Locator impression caps in place (Fig. 14). This would aid the lab in designing an overdenture that fully rests on the tissue instead of the implants.

The case was returned to the lab, and wax setups...
were produced (Figs. 15a–15c). During the try-in appointment, the wax setups were evaluated to confirm the vertical dimension of occlusion, interocclusal relationship, phonetics, esthetics, midline, teeth arrangement, tooth color and shape, incisal edges, and function (Figs. 16a–16c).

After final approval of the wax setups, the restorative protocols for the two prostheses diverged, as the lab moved directly to the final implant overdenture from the approved wax setup, while the process for the BruxZir Full-Arch Implant Prosthesis included an implant verification jig, custom final impression, and provisional implant prosthesis. These extra measures were taken to make absolutely certain that the definitive prosthetic design was accurate before milling the final restoration from monolithic zirconia.

The implant verification jig was attached to the implants so a precise final impression could be taken (Figs. 17a–17c). The custom tray provided by the lab was filled with VPS material and seated over the implant verification jig. As the VPS material set, the relative positions of the implants represented by the verification jig remained fixed, ensuring an extremely accurate final impression.

The approved wax setups and final maxillary impression were returned to the lab so the final mandibular implant overdenture and maxillary provisional implant prosthesis could be produced. The final lower appliance was fabricated on the master cast and included recess wells in which metal housings with overdenture caps would be cured chairside (Figs. 18a, 18b). These denture caps provide retention and stabilize the prosthesis by seating over the Locator attachments and keeping the appliance in place during function.

A new master cast of the maxilla was produced based on the custom open-tray final impression. The new master cast and final-approved wax setup were scanned. A virtual model was generated upon which the fixed monolithic prosthesis was designed using CAD software (Figs. 19a, 19b). Because this digital model was based on the final impression containing the verification jig, screw access holes were created in precise alignment with the positions of the maxillary implants.

The CAD design was used to mill a provisional implant prosthesis from poly(methyl methacrylate) (PMMA) (Figs. 20a, 20b). This appliance was tried in and worn for a trial period, thus ensuring an accurate prosthetic design. The provisional implant prosthesis is an essential element of the restorative process, as significant adjustments cannot be made to the final restoration once it has been milled from BruxZir Solid Zirconia.

At the following appointment, the Inclusive Locator Implant Overdenture was seated and checked for proper fit, function and support from the soft tissue. Then the provisional implant prosthesis was screwed into place, and its teeth positioning, function and
Figs. 12a, 12b. For the recording of jaw relations, the lower wax rim was designed to seat over the Locator attachments, while a screw-down wax rim was created for the upper.

Figs. 13a, 13b. Upper wax rim was screwed into place through the temporary cylinders while lower wax rim was seated over Locator impression caps.

Fig. 14. A VPS wash impression was made of the mandibular arch, capturing the positions of the Locator attachments as well as the gingival contours and vestibules.

Figs. 15a–15c. The lab produced wax setups for try-in. The upper included temporary cylinders so setup could be attached to the implants during evaluation. The lower setup included recess wells so it could be seated over the Locator attachments and soft tissue.

Figs. 16a–16c. The upper and lower wax setups were tried in to evaluate fit, esthetics, occlusion and function.

Figs. 17a–17c. Individual sections of the implant verification jig were seated and luted together before being picked up in the open-tray final impression, which was made using a custom tray and Capture VPS material (Glidewell Direct).

Figs. 18a, 18b. Final lower implant overdenture was designed to seat over Locator attachment analogs situated in the mandibular cast. This would allow the overdenture caps that engage the Locator attachments to be picked up chairside.

Figs. 19a, 19b. CAD software was used to design the definitive prosthesis for the patient’s maxilla based on the final impression and approved wax setup. Access holes were created in the precise positions needed for passive fit.

Figs. 20a, 20b. The provisional implant prosthesis was milled and seated on the master cast to verify a proper fit as well as the interocclusal relationship with the opposing implant overdenture.
esthetics were verified (Figs. 21a, 21b). With both appliances in place, the interocclusal relationship was checked (Figs. 22a, 22b). Minor occlusal adjustments were made directly to the maxillary provisional implant prosthesis, as PMMA is easily modified.

Slight alterations were also made to the lower implant overdenture. Then, blockout shims and the retentive overdenture caps were seated over the Locator attachments (Figs. 23a, 23b). Quick Up self-cure material (VOCO America; Indian Land, S.C.) was added to the recess wells of the overdenture before seating the appliance over the metal housings.

After letting the material set for approximately three minutes, the overdenture was removed, picking up the denture caps in the prosthesis. The minor voids surrounding the denture caps were then filled with Quick Up light-cured pink composite (Fig. 24). The appropriate retentive inserts, which are available in a variety of strengths depending on the functional capabilities of the patient and the number of implants, were swapped into the metal housings (Fig. 25). The implant overdenture was reseated, providing excellent retention, stability and function for the patient.

With the final mandibular restoration in place, the patient wore the provisional full-arch implant prosthesis for a trial period of two weeks (Fig. 26). This opportunity to wear the appliance during actual day-to-day function instilled a high degree of confidence in the prosthetic design for the patient and doctor alike. Following patient approval, the provisional implant prosthesis was returned to the lab so it could serve as the blueprint for the final restoration and the minor adjustments made to the appliance could be included in the definitive prosthetic design.
The final BruxZir Full-Arch Implant Prosthesis was digitally fabricated with precision (Fig. 27). As an exact reproduction of the test-driven provisional, the definitive prosthesis fit perfectly and offered the esthetics and function the patient had come to expect (Figs. 28a, 28b). The final restoration effectively addressed the unique circumstances of the case, providing the most durable, stable prosthesis possible for his upper and a lower restoration that greatly improves prosthetic retention and can be upgraded to a fixed prosthesis should the patient’s situation change.

**Conclusion**

Practitioners now have the clinical flexibility to offer patients a wide range of treatment options, from entry-level, economical restorations like the Inclusive Locator Implant Overdenture, to the fixed, highly durable BruxZir Full-Arch Implant Prosthesis. There is a viable means of treating nearly all patients, whatever their oral health, needs and finances. Provided the life-changing benefits of implant therapy and the straightforward restorative protocols of today, all patients should be offered this service to confront the challenges confronting the challenges presented by complete edentulism.

**References**


**About the author**

Paresh B. Patel, DDS, graduated from the University of North Carolina at Chapel Hill School of Dentistry in 1996. He graduated from the Medical College of Georgia/American Academy of Implant Dentistry MaxiCourse in 2009. He has been in private practices in Lenoir and Mooresville, N.C., from 1996 through the present. Patel is a founding member and on the editorial board of Journal of the International Academy of Mini Dental Implants. He is a clinical instructor at the Reconstructive Dentistry Institute and a diplomate of American Academy of Small Diameter Implants. Patel was president of the Iredell County Dental Society in 2012; is a member of the American Dental Association, the North Carolina Dental Society and the American Academy of Implant Dentistry; and is a clinical consultant on dental implants and prosthetics. He lectures nationally on implant and restorative dentistry, and he has published numerous articles in leading dental journals.