Fixed and removable implant restorations:
A solution for every arch

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Introduction

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, aesthetics 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 have their teeth restored. Although fixed, implant-supported restorations offer the highest levels of stability, function and patient satisfaction, removable overdentures are also a dramatic improvement over conventional complete dentures. 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 aesthetic 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–c). 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 Dental Solutions), which are an economical means of improving prosthetic retention and stability. The overdenture caps that connect to the Locator

![Fig. 4a: Inclusive Tapered Implants by Glidewell Direct.](image-url)

**Fig. 4a:** Inclusive Tapered Implants by Glidewell Direct.

**Figs. 4b & c:** The Inclusive Tapered Implants were threaded into place, achieving excellent initial stability.

**Fig. 5:** Multi-unit abutment with carrier in place illustrates correction of the implant’s angulation to establish a uniform prosthetic platform around the arch.

**Fig. 6:** Traditional dentures were fabricated in advance of the surgical appointment so they could be immediately converted to serve as temporary appliances during the healing phase.

**Figs. 7a & b:** Same day conversion of the maxillary denture to an immediate fixed prosthesis was achieved by adding multi-unit temporary cylinders using cold cure acrylic and trimming the appliance into a horseshoe shape.

**Figs. 8a & b:** Note the dramatic change in the appearance of the patient, who left with chairside-converted dentures in place on the same day as surgery, including a screw-retained, fixed provisional for his upper arch.

**Fig. 9:** Postoperative panoramic radiograph illustrates All-on-4 configuration of maxillary implants and axial placement of the mandibular implants, which would facilitate a passive fit of the lower overdenture.
The surgical phase of treatment called for the extraction 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) 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 visualise the socket sites and areas of implantation. Bone levelling 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 maximise the anterior-posterior (AP) 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 the creation of the osteotomies, the implants were placed (Figs. 4a–c). 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 will have on their speech and chewing capabilities. 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 & b).

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 most distal molars were removed to minimise 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 & b). 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 & b). Vinyl polysiloxane (VPS) impressions were taken to begin the restorative process (Figs. 11a–c). 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 anaesthetisation.

The restorative protocol for both prostheses included wax rims and set-ups, which the lab produced on the working casts fabricated from the impressions (Figs. 12a & b). 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 & b). 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 set-ups were produced (Figs. 15a–c). During the try-in appointment, the wax set-ups were evaluated to confirm the vertical dimension of occlusion, interocclusal relationship, phonetics, aesthetics, midline, teeth arrangement, tooth colour and shape, incisal edges, and function (Figs. 16a–c).

After final approval of the wax set-ups, the restorative protocols for the two prostheses diverged, as the lab moved directly to the final implant overdenture from the approved wax set-up, 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–c). 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 set-ups 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 & b). These denture caps provide retention and stabilise 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 set-up were scanned. A virtual model was generated, upon which the fixed monolithic prosthesis was designed using CAD software (Figs. 19a & b). 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 & b). 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 aesthetics were verified (Figs. 21a & b). With both appliances in place, the interocclusal relationship was checked (Figs. 22a & b). 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, block out shims and the retentive overdenture caps were seated over the Locator attachments (Figs. 23a & b). Quick Up self-cure material (VOCO America) was added to the recess wells of the overdenture before seating the appliance over the metal housings.

After letting the material set for approximately 3 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 aesthetics and function the patient had come to expect (Figs. 28a & b). The final restoration effectively addressed the unique circumstances of the case, providing the most durable, stable prosthesis possible for his upper and 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. Given 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 presented by complete edentulism.

References