The full-arch implant rehabilitation technique (FAIR) uses multiple implants to treat edentulism, avoiding the morbidity associated with bone grafting. FAIR is derived from the successful four-implant, full-arch restoration treatment concept pioneered by Malo and colleagues. Its importance to the clinician, as evidenced in this case report, is that it is one of many sister protocols developed over the past decade that attempt to duplicate the success of the full-arch restoration treatment concept via less standardized and less costly commercial products and processes.

For a rapidly aging American demographic, the need for solutions for missing teeth is growing, and so should alternative methods for addressing these solutions, especially cost-effective solutions. The FAIR option employed in this case represents a relatively simple alternative to traditional dentures or overdentures, with much more effective results for patients. The implant-fixed bridge techniques demonstrated in this case are the culmination of decades of implant-based restorations for single teeth, which have made possible the multi-implant restorations accomplished for entire arches today, with their extraordinary success rates.

This case demonstrates the many advantages of full-arch implant restoration. Not only does the case show the immediate, fixed and visually appealing result of the provisional prosthesis, but it also presages the highly functional, cost-effective and hygienically simple care the patient will enjoy for years when the final restoration is placed. FAIR and its sister protocols make these outcomes possible for edentulous patients who formerly were bound to overdentures or traditional dentures.

**Case description**

A healthy 52-year-old Caucasian male presented with a completely edentulous mandible (Class I). He wore a complete lower denture and an upper removable partial denture. His chief complaint was lower denture instability during function and a diminished social life. His primary desire was to find a solution for the lower arch via fixed prosthesis.

An extensive clinical and radiographic evaluation (including panoramic radiograph and cone beam CT scan) was performed to facilitate case planning, which resulted in the decision to provide the patient with an upper removable denture and a lower full-arch solution via full-arch implant restoration on four implants.
In preparation for mandibular surgery, the clinician ordered functional impressions, which were mounted in a semiadjustable articulator with occlusal registration and a vertical dimension of occlusion set for this patient. Next, measurements were taken to ensure enough interocclusal space (15–17 mm) for the multiunit abutments, framework, teeth, freeway space while speaking, and proper biomechanics ratio for such a FAIR case, following the color selection and wax-up. Smile and laugh lines were evaluated as well as the anterior-posterior spread of the implant design placement to minimize any cantilever.

The lower denture was duplicated in transparent acrylic and prepared for the surgery to ensure apical-to-occlusal visibility of the residual ridge. The buccal flank had the minimum 15mm distance from the incisal edge of the tooth to the apical border of the flange. To ensure buccal-to-lingual visibility of the residual ridge, a window was required to view the lingual aspect of the surgical stent to allow enough space to observe the entire ridge.

Before surgery began, the case was completely reviewed, the dentures were checked in place for a proper occlusion, the middle line and vertical dimension of occlusion were registered, and a bite registration was taken and used as a guide once the denture had been converted into a provisional fixed-screw prosthetic.

With the patient under local and infiltrative anesthesia (lidocaine 2 percent), a mid-crestal incision was performed with a 15C blade from first molar to first molar, and a flap was reflected with a midline incision, making sure that the mental foramen was identified. The lingual flap was sutured to ensure more visibility. The surgical guide was placed in position, and it was determined that 2–3mm of bone reduction was required, which was effected by a round acrylic bur at 40,000 rpm (Implant Vision Motor) with saline solution irrigation.

Four conical implants, wide-pitch and self-taping, with RBM surface and internal hex (Implant Vision) were placed through the surgical stent, with a 20:1 reduction and 1,200 rpm (Implant Vision) and external irrigation. The clinician followed the drilling protocol for wide-pitch implants, where undersizing the osteotomy is mandatory. Two straight implants (3.7 diameter by 13mm in position of laterals) were placed perpendicular to the bone ridge, and two implants tilted 30 degrees (4.2 diameter by 16mm in position) were placed between the first and second premolars, with the clinician making sure to avoid the mental loop and foramen (Fig. 1).

A countersink bur, or bone profile bur, was used to flare the distal part of the osteotomy to avoid threat exposure and to allow for a full seating of the multiunit abutments. Before the implants were placed, all the mountings were loose, and the implants were driven manually into the osteotomy site, each sunk with 45Ncm of torque. Before suturing, the clinician used a snap-in guide director/indicator to determine the angulation of the multiunit abutment to be used (Fig. 2A). Once the abutments were selected (0 degrees for the two anterior and 30 degrees for the two posterior, Fig. 2B), they were ratcheted to 25Ncm (Fig. 3, p. 68), then sutured with a 3.0 violet suture in an interrupted fashion, starting from the middle releasing incision.
Upon completion of suturing, the dentures were placed in the patient’s mouth with the bite registration, making sure that the lower denture contained a fast-set polyvinyl siloxane to make an imprint of the multiunit abutments at occlusion to facilitate transfer of the implant position to the denture (Figs. 4A and 4B); thereafter, windows were opened to pick up the provisional abutment and start the prosthetic conversion.

At this point, the provisional metal multiunit abutments were attached and properly hand-screwed into the multiunit implants, ensuring no visual gap between them. The lower denture was seated, and the provisional abutments thus stood through the windows made in the denture. The height of those abutments was adjusted until occlusion was achieved (Figs. 5A and 5B, p. 70). Once this try-in process was completed, the provisional abutments’ chimneys were filled with Gingi Mask; then, a rubber dam in a U-shape arch was placed over the provisional abutments to prevent the acrylic from moving into any undercut.

For the denture reline, pink acrylic was placed in the inner part of the denture, the MucoHard was injected around the provisional abutments, and the denture was placed in position. After the acrylic was set, the Gingi Mask was removed from the chimneys with an explorer, and the denture was unscrewed from the patient’s mouth. The length of the provisional abutments was adjusted with a carbide disk, removing the metal spurs to allow access for the final screw. Buccal and lingual denture flanges were cut and shaped for proper cleaning, and all voids were filled with MucoHard. The cantilever allowed for this particular FAIR procedure is 5mm distal to the terminal abutment. Next, the prosthesis was polished with rubber and photo-cure glazed (Fig. 6A, p. 71).

The FAIR provisional prosthesis was screwed in the patient’s mouth in a zigzag manner and torqued to 25Ncm. Teflon was engaged inside the chimney, and Cavit was used as provisional sealer. Balanced occlusion was desired and achieved in this case (Fig. 6B, p. 71). Amoxicillin and clavulanic acid (875mg) were prescribed every 12 hours for 7 days, as well as sodium diclofenac (50mg) every 8 hours for 3 days, along with a liquid-to-soft diet.

Discussion
This case history demonstrates how the full-arch implant rehabilitation approach for using multiple implants to treat edentulous or nearly edentulous patients is one of the more recent solutions to a specific dental
concern faced by millions of patients around the world.\(^{20}\) The procedure requires no bone grafting, and its success rates are outstanding, as evidenced by FAIR’s sister protocols,\(^{6-10}\) all of which are derived from the four-implant, full-arch restoration treatment concept pioneered by Malo and colleagues.\(^{1-5}\)

According to the Centers for Disease Control, the life expectancy for Americans in 2014 was nearly 79 years. As a result, more patients are seeking solutions for missing teeth, a condition often accompanying aging. These patients seek dental alternatives that are not only aesthetically pleasing but also cost-effective and highly functional. Dental clinicians clearly must act to address the growing number of edentulous patients because edentulism negatively impacts not only overall oral health but also patient longevity.\(^{11,12}\) Thankfully, FAIR and other multi-implant, full-arch restoration treatment options represented in this case offer a relatively simple treatment of edentulism instead of traditional dentures or overdentures. FAIR’s immediate-loaded, implant-supported, full-arch prosthesis is nearly equivalent (90 percent) to natural teeth in function and appearance\(^{21,22}\) and complemented by very low failure rates.\(^{23,24}\)

Conventional dentures have been the most common solution for edentulism until relatively recently. However, studies show that wearing dentures can reduce patients’ quality of life, with pain and areas of discomfort, difficulties chewing and speaking, denture slippage, a clear reduction in bite force, as well as poor oral sensation.\(^{13,14}\) Such conditions result from tridimensional alveolar bone atrophy as well as reduced musculature attachment to the edentulous ridge, the shape of the arches, and occlusal relationship between arches.\(^{25-27}\) Therefore, the development of new techniques and protocols to offer solutions to these conditions became necessary—and even urgent—to meet optimal patient satisfaction. As a result, expectations grew for an improved quality of life not only regarding patient dental function but also physical appearance and overall psychological health.\(^{28,29}\)

The success rates for immediate-load implants improved significantly in the late 1980s and early 1990s, for individual teeth rehabilitation as well as for partial-arch rehabilitation via the placement of minor bridges.\(^{30-37}\) The two-implant and four-implant removable denture represented initial treatment options for edentulous patients, reflecting dental implant technology’s evolution.\(^{38-43}\) Such implant-supported solutions approximated (60 percent) the stability and function of natural teeth and, like conventional dentures, were relatively inexpensive replacements for teeth and gingiva. Lip support and easy cleaning outside of the mouth were also accomplished by these implant-supported solutions. However, a number of disadvantages accompanied these procedures, such as sore gums, unwanted movement during chewing and speaking, and eventual relining of the device to maintain fit and comfort because of persistent reduction in alveolar bone volume and shape over time. Also, overdentures could be properly cleaned only by removing them from the patient’s mouth.

Nevertheless, evolving protocols such as the two-implant and four-implant removable denture presaged the development of full-arch replacement, complemented at first by alveolar bone enhancement and then without
it. In the mid- to late 1990s, arch restoration protocols for the bone-dense mandible attempted to meet these implant challenges via improved anatomical placement and bridge architecture redesigns.\textsuperscript{44,45} Similar implantation attempts in less accommodating maxillary bone were not as promising because of poor anchorage.\textsuperscript{46–51} As a result, the threading, size and length of implants had to undergo redesign in attempts to condense/thicken bone during placement for sinus-lift and other procedures.\textsuperscript{52–55}

In the early 2000s, important advancements were made providing realistic soft-tissue and ceramic or acrylic teeth for artificial bridges. A number of retrospective studies described the evolution of mandibular full-arch dental prostheses and zygomatic implants for the maxilla in sinus lift and other cases that contraindicated traditional implant placement and bone grafting.\textsuperscript{56–63} Additional implant design evolution took place near the end of the 2000s and during the first few years of the 2010s, including extramaxillary anchorages,\textsuperscript{64} optimal implant angulation,\textsuperscript{65} optional cantilevers,\textsuperscript{66–68} and bone reduction.\textsuperscript{69}

The FAIR techniques described in this case have leveraged the success of implant restoration for single teeth,\textsuperscript{15} making possible the success of multi-implant restoration of whole arches via placing implants throughout the edentulous region and immediately loading them with a provisional fixed prosthesis.\textsuperscript{18} Though such multi-implant protocols have minor disadvantages—surgery and necessary healing/restoration time—the implant-fixed bridges that result provide 90 percent of the functionality of natural teeth, no bone grafting, bridge temporization on surgery day, soft-food diet during healing, preservation of bone and soft tissue, a 95 percent success rate, and a patient hygiene-maintenance regimen virtually the same as natural teeth.

The FAIR surgical and restoration techniques described in this case are accomplished in a single visit, via placement of two axial implants anteriorly and two tilted implants posteriorly, supporting a provisional, fixed, immediately loaded, full-arch prosthesis with survival rates between 92 and 100 percent.\textsuperscript{16,17,19–72} Anatomical structures are preserved via the longer tilted implants, providing exemplary cortical bone anchorage and increasing the space between implants while lessening cantilever length and often eliminating any need for bone augmentation.\textsuperscript{55,73–76}

**Conclusion**

The edentulous patient described in this case report discovered the many advantages of receiving the full-arch implant restoration dental prosthesis: an immediate, fixed, visually appealing, highly functional, low-cost and hygienically simple dental device. FAIR and its sister protocols can address such patients’ surgical and restorative needs as never before—even when, as in this case, some older technologies complement the FAIR solution. By comparison, the previous generation of overdentures (which often required bone grafting, bone reconstruction, and placement of six to eight implants) left many potential patients untreatable because of age/morbidity concerns or systemic conditions such as osteoporosis, and those qualifying patients who did receive
these treatments were often unsatisfied. Additionally, FAIR helps to eliminate the range of dental and systematic drawbacks resulting from prolonged use of traditional dentures.

References

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