Use of Modular Transitional Implants in the Partially Edentulous Patient

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Transitional implants that are used to support partially and/or fully edentulous restorations have been widely discussed and documented in the dental literature.[1-4] Their encompassing utility and function cannot be overestimated; consequently, we have in-corporated them as a staple component in our treatment planning and restorative implant procedures. We consider modular transitional implants (MTIs) to be the most significant reason that patients are choosing implant-supported restorations.[1-3]

Previously, we gave our patients the choice of implants, but we now give them the choice of immediate teeth that will later be supported by the implant fixtures. Reflecting on our earliest use of MTIs, we have made a good investment by taking the time to learn how the MTIs and prosthetic components should be used.

Because we have acquired the necessary skills and are more confident of their safety, we now routinely include MTIs in the development of a treatment plan for our patients.[1-4] We use MTIs in diverse applications, according to where they are most productive, and we discontinue their use in areas where they fail to meet our expectations. We routinely use the MTIs in the following procedures and for the support of all types of restorations: edentulous, intermediate, small and temporary single-tooth replacements, for anchorage of bone grafts and membranes, and for attaching chin-grafted and other bone blocks horizontally to the ridge.

This article describes the development of a treatment plan to stabilize the unilateral ridge and provide immediate support for the temporary fixed restoration. Unilateral restorations may require the placement of a greater number of MTIs in an altered, lattice-type spacing and position to withstand occlusal and lateral masticatory forces and to allow access for home care and oral hygiene.

Developing a Comprehensive Treatment Plan

The treatment plan is comprised of a thorough medical/dental diagnosis and history with periodontal evaluation, radiographic, panoramic, or tomographic analysis, and the patient's most current articulated models (Figure 1).[5,6] These models should reflect the anticipated results of the temporary prosthesis. The detailed plan coordinates the surgical, operative, and technical procedures and is formalized as an operative action plan.

Corrected Articulated Model

The corrected models are used to make a clear, vacuum-formed shell, which is used to:

- check the best position for the MTIs.
- check the height and angulation of the implants that can be corrected.
- make a chairside, immediate restoration with self-curing, tooth-colored resin.

Subsequently, after suture removal, a more elegant, laboratory-crafted restoration can be made using the MDM™ technique (Valley Dental Arts, MN) via impression techniques. The MDM™ process consists of re-creating in wax the hard and soft tissues that need to be replaced on the articulator-mounted casts. This precisely indexes the implant positions with transfer copings for exact transfer to the master cast (Figure 2).

Surgical Procedure

Before beginning the surgical procedure, the number and length of MTIs are selected, as well as the MTI profile drills and ancillary items, which must be sterilized before they are used.

After removing the teeth, the extraction site must be carefully debrided of the remnants of the periodontal tissue before creating osteotomies for placing implant fixtures.[7] The osteotomies are drilled in a planned position and angulation and to a predetermined depth. In the edentulous spaces, osteoplasty or reshaping of the ridge may be necessary to achieve the best results. Conversely, it may be necessary to augment the ridges for adequate implant support and to shape their form for an esthetic tooth emergence profile of the planned restoration.[8,9]

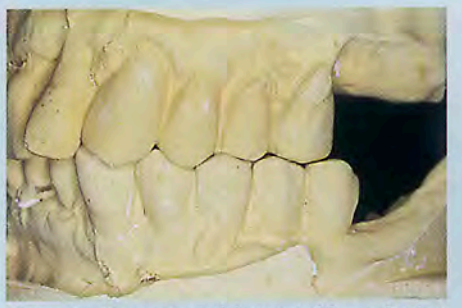

Figure 1—Diagnostic models mounted from a facebow transfer.

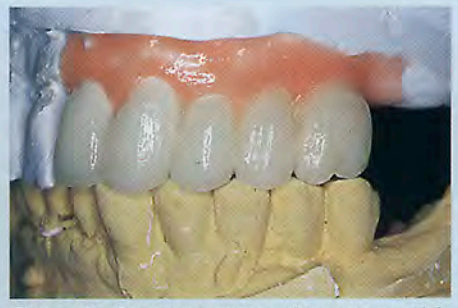

Figure 2—Completed master diagnostic models mounted on the articulator.

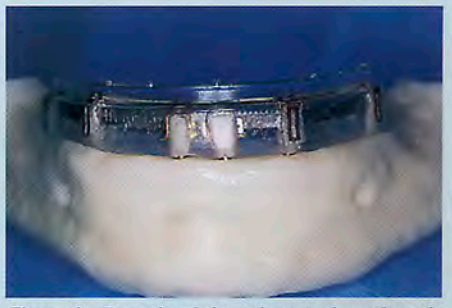

Figure 3—Example of the polymerized acrylic substructure.

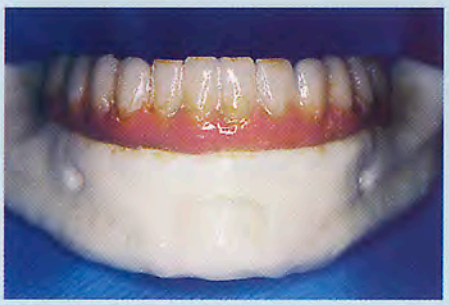

***Figure 4**—Example of the chairside immediate prosthesis.*

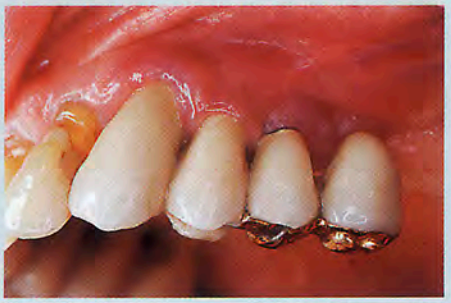

***Figure 5**—Pretreatment clinical view of the maxillary left posterior sextant.*

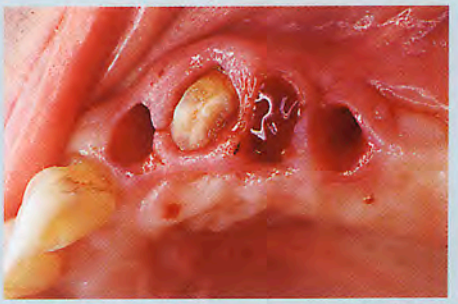

***Figure 6**—Clinical appearance after teeth Nos.10 through 13 were extracted. The root for tooth No.11 was removed after the flaps were elevated.*

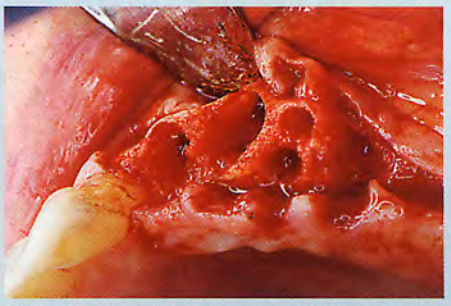

***Figure 7**—Crestal incision with full thickness flaps elevated and degranulation of the extraction sockets.*

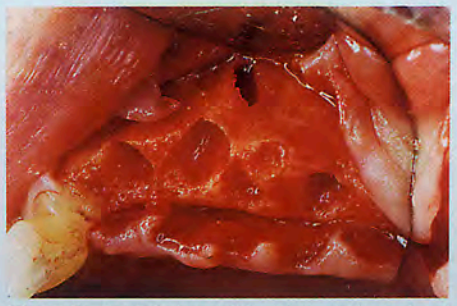

***Figure 8**—Lateral views of the plasty performed and the degranulation completed. Note the fenestration at the apical area of tooth No.11.*

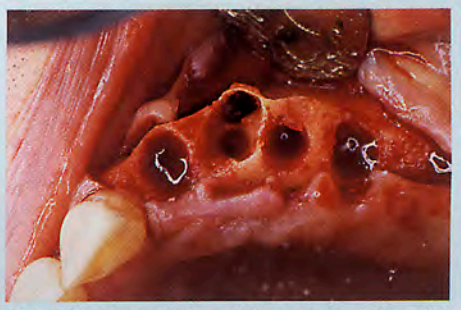

***Figure 9**—Occlusal view of the extraction sites after the degranulation process is completed.*

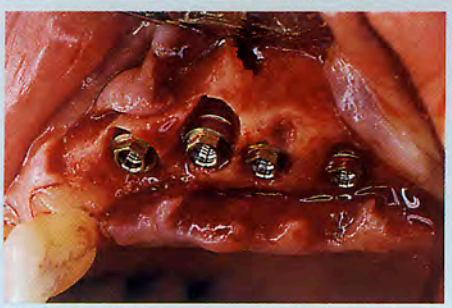

***Figure 10**—The placement of four implants within the housing of the extraction sockets.*

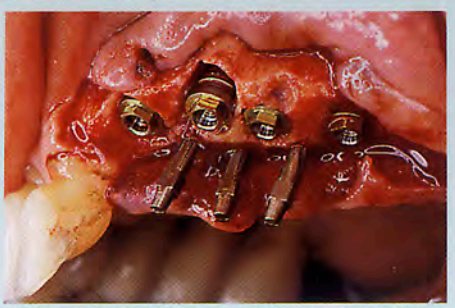

***Figure 11**—The placement of three implants slightly palatal and with a mesial inclination.*

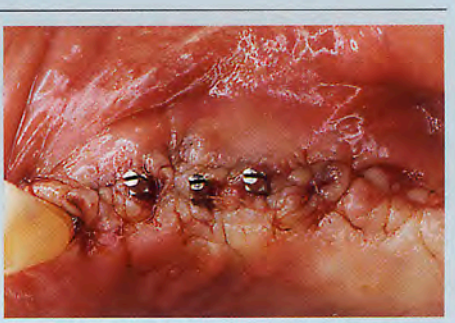

***Figure 12**—After the bone grafting and barriers are seated, continuous sling suturing is completed.*

Technical Procedures

The technical procedures begin with preparing one or a number of vacuum-formed shells copied from the corrected model. After assembling the modular components on the MTIs, the shell is filled with tooth-colored, self-curing resin and placed over the MTI modular assembly, leaving it in place until it is fully polymerized.

The same procedure applies when a laboratory, prefabricated bridge is used. The prosthesis should have a wide and deep hollowed-out space for its unimpeded placement over the MTIs. The shell is similarly filled with self-curing resin, attaching it firmly to the modular components and creating an immediate splinted restoration. The manufacturer's **(Dentatus USA, Ltd.)** recommended technique is to construct a splinted frame with its universal flexible splint frame, which adjusts to most ridge sizes and configurations. The splint frame is filled with clear, self-curing acrylic, which is placed in a doughy form over the assembled components and is allowed to polymerize. The smaller volume of acrylic reduces the heat potential, and the clear acrylic, when cured, facilitates reseating.

The polymerized splint is removed and smooth finished; under extreme conditions, it can be cemented and left in place for 1 to 2 weeks (Figure 3). To complete the restoration, the filled dentate vacuum shell is placed over the splint. The technique is neat and easy to control, and it is reported to be most effective when attaining immediate splinting over the MTIs.

Implant Installation

After the implant fixtures are installed, the MTIs are placed in the available spaces, no closer than 2 mm adjacent to the fixtures. They may be placed lingually or palatally with a slight mesial angulation for resistance to possible posterior drift. After installation, grafting and barrier are performed. When sutured in place, the implants are firmly stabilized to prevent micromovement of the graft and membrane. Suturing is performed by various techniques, keeping a very taut pressure on the sutures. For proper maturation of the tissue, keep a zone of keratinized tissue on each side of the transitional implant extensions.

After Closure

After primary closure, a thin elastic surgical tape/rubber dam is slipped over the MTIs. To provide a safety zone against contamination and to prevent soft acrylic from becoming entangled with the suture tags in the soft acrylic, the tape or dam is firmly pressed to the tissue level.

While the clear vacuum splint form is used to check the implant position and height, it is most

Figure 13—Lateral view showing the titanium bar and modular coping assembly.

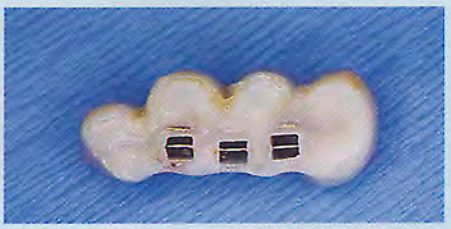

Figure 14—Undersuture of the chairside temporary.

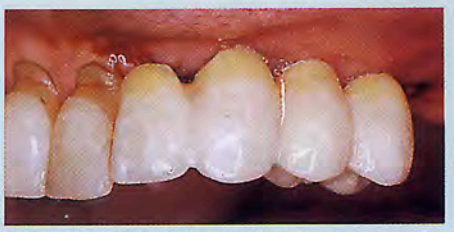

Figure 15—Clinical view of the chairside temporary.

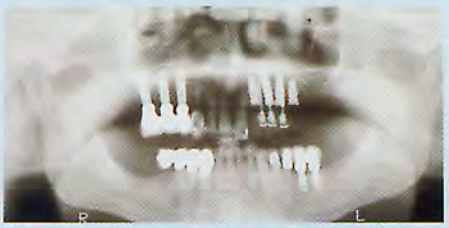

Figure 16—Postoperative Panorex showing the placement of the permanent and transitional implants in the maxillary left posterior sextant.

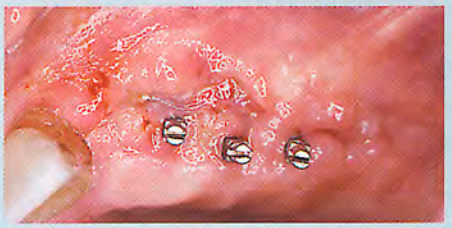

Figure 17—Six-month clinical view of the transitional implants and gingival tissue.

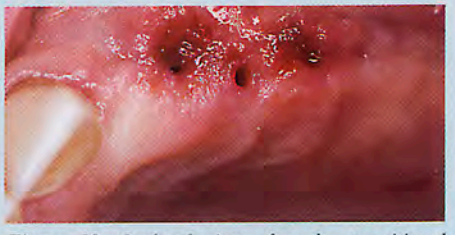

Figure 18—Occlusal view after the transitional implants are removed by counterclockwise rotation.

Figure 19—Panorex after removal of the transitional implants and the placement of the temporary abutments.

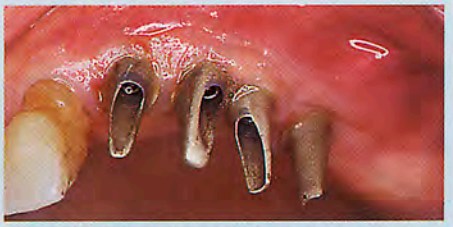

Figure 20—Clinical view of the precision-milled custom abutments.

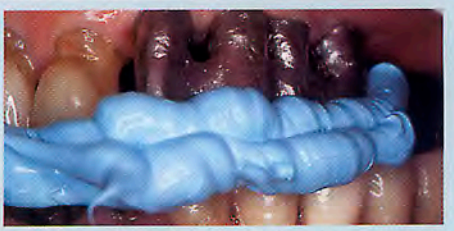

Figure 21—Corrected bite registration confirming vertical dimension.

effective for the chairside fabrication of an immediate prosthesis (Figure 4). The manufacturer's recommended splinting method described earlier makes it possible to provide the patient with a functional prosthesis shortly after surgery.

Case Study

A healthy, 83-year-old, nonsmoking man presented for implant reconstruction in the maxillary left posterior sextant. The patient had undergone implant therapy in the past and when the maxillary left began to fail periodontally and functionally, implant reconstruction was again instituted.

Stage I: Clinical Procedures

Local anesthesia was used in the maxillary left anterior and posterior sextant (Figure 5). Then, teeth Nos. 10 through 13 were extracted (Figure 6), followed by a crestal incision with full thickness flap elevation (Figure 7). All extraction sites were thoroughly debrided, and remnants of periodontal ligament fibers were removed (Figure 8). For better flap adaptation and closure, a small amount of osteoplasty and reshaping was performed (Figures 8 and 9).

Four **SteriOss implants (Nobel Biocare, USA, Inc.)** were installed in the maxillary left posterior sextant (Figure 10). Three **MTIs (Dentatus USA, Ltd.)** were placed with a mesial inclination and somewhat palatally for better access and space for seating the cover screws on the implanted fixtures (Figure 11).

Autogenous bone particles harvested from the osteotomy sites were mixed with **BioMend™ absorbable collagen membrane (Sulzer Calcitek, Inc.)**, filling the small natural defects around the implant. Primary closure was performed using a continuous sling-type and horizontal mattress technique with **5.0 Monocryl (Ethicon, Inc.)**. Special attention was given to suturing the zone of keratinized tissue on both the buccal and palatal aspects of the MTIs (Figure 12).

After primary closure, protective spacers were placed over the implant extension, insulating its slimmer neck from interlocking with the soft flowing resin and preventing stressful removal and reinsertion of the restoration. The **titanium grooved bar (Dentatus USA, Ltd.)** was seated into the implant slots, which were aligned with the crest of the ridge (Figure 13). Modular copings were seated over the implant and the bar, and the gold-plated metal clips were pushed downward, locking the coping assembly firmly in place (Figure 13).

The dentate, clear vacuum form copied from the corrected diagnostic models was filled with tooth-colored, self-curing resin and placed over the titanium bar and modular assembly. The restoration must be fully polymerized before it is removed (Figure 14). After removal, the restoration is finished smooth and occlusal interferences are corrected (Figures 14 and 15). It is then cemented into place.

A postoperative Panorex shows the placement of the permanent implants in the left quadrant and the MTIs with the modular assembly (Figure 16). The sutures were removed 2 weeks after surgery, and the patient was observed periodically during the 6-month maturation period.

Stage II: Removal of MTIs and Placement of Abutments

Stage II surgery was performed 6 months after fixture installation. The MTIs were removed with a slight apical pressure and firm counterclockwise rotation (Figures 17 and 18). After their removal, a crestal incision was made and temporary abutments were seated into the implanted fixtures. Suturing was again performed with a 5.0 Monocryl suture in a continuous sling fashion.

The provisional restoration was hollowed out, adapted, and placed over the temporary abutment cylinders. The postoperative Panorex shows the temporary abutment cylinders mounted into the fixtures with no collateral

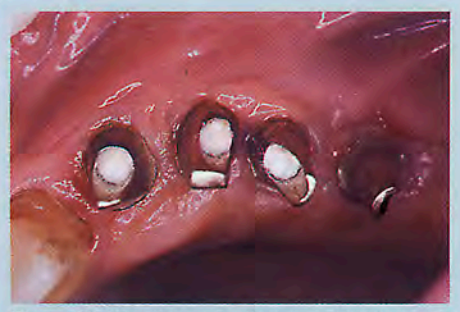

Figure 22—The placement of cotton pellets to protect the access opening of the abutment skews.

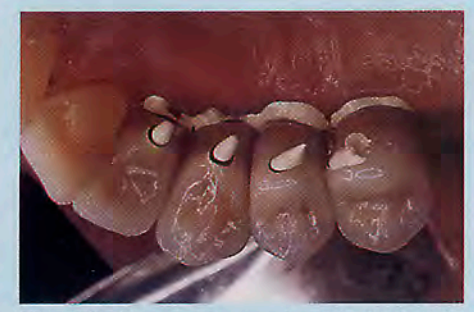

Figure 23—Cement access openings allowing for adequate displacement of cement.

Figure 24—Final postoperative Panorex.

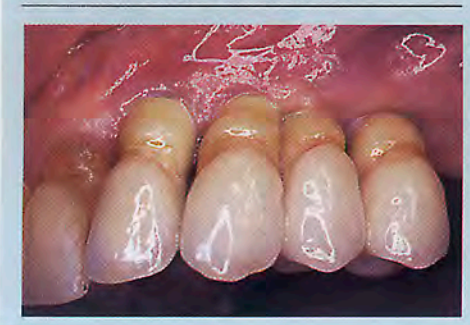

Figure 25—Completed implant-supported restoration.

damage to the maxillae adjacent to the fixtures (Figure 19).

Stage III: Completion of the Implant-Supported Restoration

Following standard implant impression techniques, custom-milled abutments were fabricated (Figure 20). A seating jig was made for abutment alignment and seating as well as to verify the vertical dimension (Figure 21). Before cementing the restoration, the center screw assembly was kept open by placing cotton pellets into the openings of the abutments (Figure 22). The completed porcelain restorations were cemented in place, allowing the excess cement to be displaced by the palatally placed openings in the restoration (Figure 23).

The Panorex showed close adaptation of the implant-supported crowns (Figure 24). The completed implant-supported restoration showed excellent form and position with a healthy level of maturated tissue with accessibility for home care hygiene (Figure 25).

The substantial collateral benefits of using transitional implants are that the temporary restorations can be modified with the patient's consultation and approval as to size, shape, and color of the ultimate restoration. Likewise, the completion of the restoration can be scheduled to the benefit of the practice as well as to the patient's availability.

Conclusion

We have presented a unilateral restoration illustrating an important application for MTIs. Although smaller restorations tend to draw less of our attention, we caution practitioners to apply the same critical and exacting procedures that are normally used for larger restorations. The concept of transitional support allows us to safeguard our delicate surgical installation and placement of fixtures, and also offers the patient an immediate, functional, fixed restoration. While this is a great advantage in itself, the other important benefit is the economical use of time for both the patient and the dentist.

The overall treatment of our patients has vastly improved, and they can participate in the selection of color and size of their teeth, which may be easily modeled from the temporary restoration. We complete restorations on a fixed schedule, but there is no urgency for completion because throughout treatment patients are maintained in a comfortable dentate state with the transitional implant-supported prosthesis.

Anticipating future opportunities, we began to use the MTI on a controlled group of patients to support existing retrofitted dentures, converting them to a fixed or removable stable restoration. We are selecting older patients with spindly, nonretentive ridges and physically impaired and/or economically disadvantaged patients who cannot undergo the more invasive, costlier implant restorative procedures. We are testing the usefulness of the MTIs with the knowledge that they are safe and retrievable without any ill effects or bone loss after their removal. We will report the results in the future.

We are convinced that many of the reported 36 million edentulous patients can benefit from such treatment, and we hope that dentistry will be ready to offer these services to impaired and disadvantaged patients.

Acknowledgments

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9. Nevins M, Mellonig JT: The advantages of localized ridge augmentation prior to implant placement: a staged event. *Int J Periodontics Restorative Dent* 14(2):96-111, 1994.

Product References

Product:	SteriOss Implants
Manufacturer:	Nobel BioCare USA, Inc.
Address:	777 Oakmont Lane Suite 100 Westmont, IL 60559 Suite 901
Phone:	800.891.9191
Fax:	630.654.1833
Product:	Modular Transitional Implants titanium grooved bar
Manufacturer:	Dentatus USA, Ltd.
Address:	192 Lexington Avenue Suite 901 New York, NY 10016
Phone:	800.323.3136
Fax:	212.532.9026
Product:	BioMend™ absorbable collagen membrane
Manufacturer:	Sulzer Calcitek, Inc.
Address:	2320 Faraday Avenue Carlsbad, CA 92008-7216
Phone:	800.854.7019
Fax:	760.431.9753
Product:	5.0 Monocryl sutures
Manufacturer:	ETHICON, INC. (A subsidiary of Johnson & Johnson)
Address:	US Route 22 West Somerville, NJ 08876
Phone:	800.255.2500
Fax:	732.562.2212