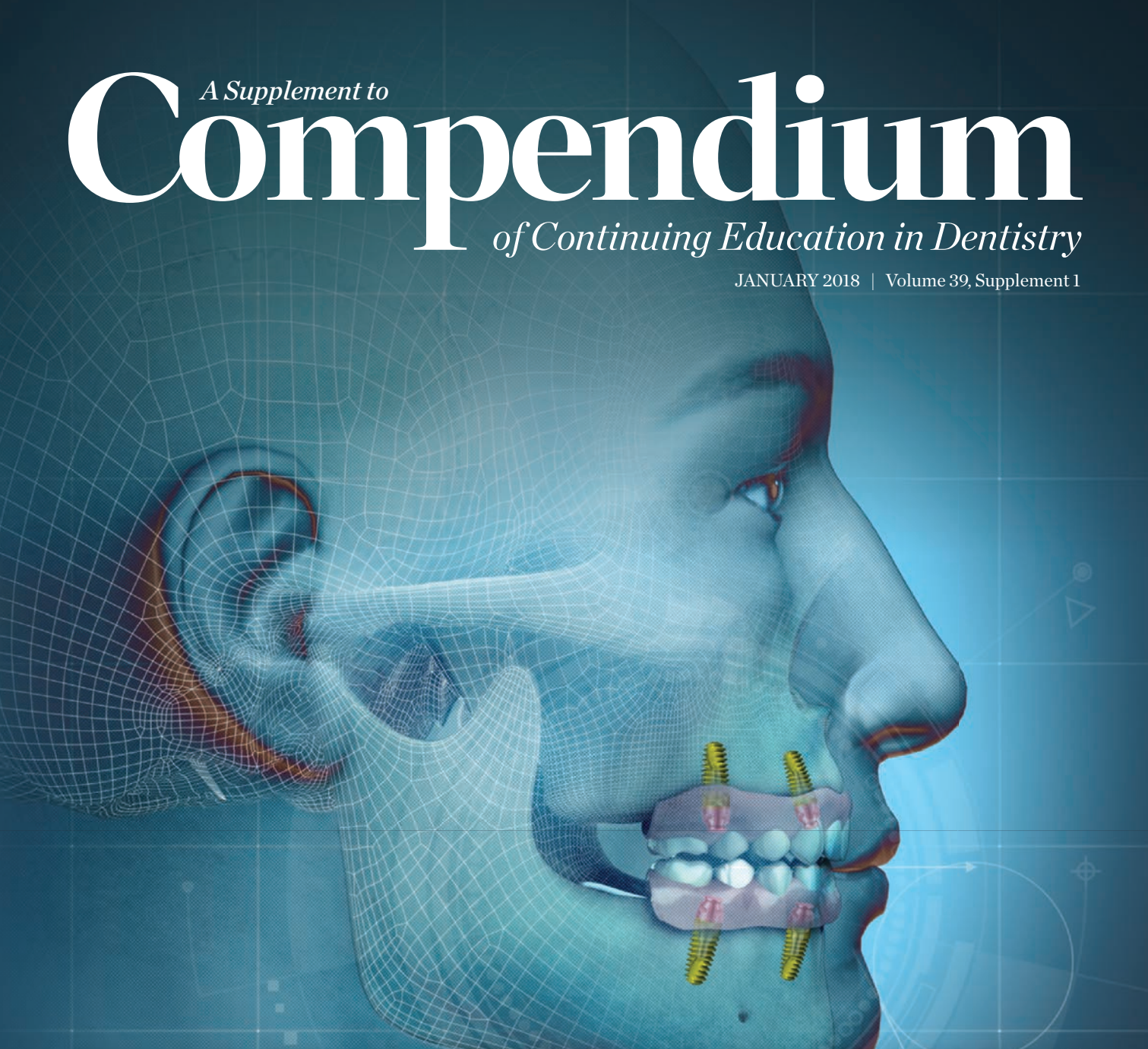
A Supplement to
Compendium
of Continuing Education in Dentistry
JANUARY 2018 | Volume 39, Supplement 1



FIXED FULL-ARCH RESTORATIONS
A NOVEL APPROACH

COMMERCIALLY SUPPORTED BY ZEST DENTAL SOLUTIONS

Compendium
of Continuing Education in Dentistry

PUBLISHER
AEGIS Publications, LLC

SENIOR MANAGER, SPECIAL PROJECTS
Justin Romano

BRAND DIRECTOR
Matthew T. Ingram

BRAND MANAGER
Amelia Falcone

MANAGING EDITOR
Bill Noone

PROJECT EDITOR
Cindy Spielvogel

CREATIVE/DESIGN
Jennifer Barlow, Claire Novo

COVER
© AEGIS Publications, LLC

Compendium of Continuing Education in Dentistry® and *Fixed Full-Arch Restorations: A Novel Approach* are published by AEGIS Publications, LLC.

Subscription and CE information
Hilary Noden
877-423-4471, ext. 207
hnoden@aegiscomm.com

AEGIS

AEGIS Publications, LLC
104 Pheasant Run, Suite 105
Newtown, PA 18940

JANUARY 2018 | VOLUME 39, SUPPLEMENT 1

Fixed Full-Arch Restorations

A NOVEL APPROACH

ARTICLES

CONTINUING EDUCATION

CASE REPORTS

A Novel Attachment System

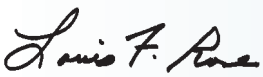
"IMPLANT-SUPPORTED PROSTHESES CAN BRING MANY QUALITY-OF-LIFE BENEFITS TO EDENTULOUS PATIENTS.

Edentulism has long been a debilitating problem for many dental patients. Indeed, it can be a source of not only physical and functional problems that result directly from tooth loss, but psychological and emotional ones as well, such as embarrassment, low self-esteem, and limited social interaction. Solutions to this all-too-common problem are highly sought after.

That's what this special supplement to *Compendium* is all about—an innovative solution for implant-supported fixed full-arch restorations. Use of a novel fixed attachment system for such restorations helps alleviate many of the clinical complications and challenges these options typically present. As you will read throughout this publication, which features research, continuing education, and a variety of case studies, use of the LOCATOR F-Tx® Fixed Attachment System eliminates the need for cement, screw-access channels, retention screws, and composite filling materials. The system is indicated for the rigid connection of full-arch restorations onto endosseous dental implants, and, as the authors collectively affirm, it involves a protocol that is simple to place, easy to maintain, and both cost-effective and convenient for dentists and patients alike.

Implant-supported prostheses can bring many quality-of-life benefits to edentulous patients. The fixed attachment system highlighted herein is aimed at making these benefits a reality, particularly in cases where the adverse effects of edentulism and the wearing of conventional removable dentures may present anatomical challenges that could otherwise compromise prosthetic integrity. As you'll see, LOCATOR F-Tx fixed attachments are efficient, esthetically pleasing, and less technique-sensitive.

Sincerely,



Louis F. Rose, DDS, MD
Editor-In-Chief, *Compendium*
lrose@aegiscomm.com

Emerging Technologies for Implant Treatment of Edentulism

Lyndon F. Cooper, DDS, PhD

OVER THREE DECADES, TECHNOLOGICAL ADVANCES HAVE PROVIDED NEW CONCEPTS AND TOOLS FOR TREATING EDENTULISM USING DENTAL IMPLANTS.

The provision of implant-supported or -retained prostheses is now broadly recognized as an accepted modality for the management of edentulism. Over three decades, technological advances have provided new concepts and tools for treating edentulism using dental implants. While challenges to successful osseointegration still remain, the impact of surface topographic enhancement on implant success and survival has been demonstrated for the edentulous maxilla and for low-density bone. Many of the challenges in creating complex and large prostheses retained by multiple implants have been circumvented by computer numeric control manufacture that eliminates the dimensional inaccuracies that accumulated in traditional lost-wax casting of metallic frameworks.

However, clinicians face yet another challenge when treating edentulism using implants. The biologic implications of placing a foreign body (ie, the implant and abutment) through oral mucosa and attaching a prosthesis—a biofilm-accumulating and non-shedding surface—into the oral cavity remain largely unexplored. Successful treatment of edentulism requires the effective and lifelong management of osseointegration, mucosal integration, and prosthetic integrity. An important added consideration is the individual patient, including his or her functional, social, and financial expectations and the systemic health factors he or she presents in individual management. The challenge of treating the edentulous patient is far from unidimensional.

Past investigators and scholars have broadly divided the treatment of the edentulous patient into two technical therapeutic categories. One is treatment using a fixed prosthesis, retained on implants (or abutments) using screws or retained on abutments using cement. The other is treatment using a removable prosthesis or overdenture retained by unsplinted implants with attachments or by splinted implants with a superstructure bearing attachments.

Previously reported factors that guided the selection of fixed versus removable prosthetic solutions for implant-related treatment of edentulism included anatomic restrictions that encompassed bone and soft-tissue deficiencies, relative or absolute prognathism, and phonetic complications. Recent evidence indicates that neither the implant location, the number of implants, nor the type of restoration influences implant loss rates.[1] Further, while there is some data demonstrating that implant-retained or -supported prostheses provide a high level of measured satisfaction,[2] fixed prostheses are often discussed as

"superior" or "advantageous" in terms of function and satisfaction. The patient's expectations are, thus, central to the decision-making process when selecting treatment using fixed versus removable prostheses.

More recently, the lifelong management of implant prostheses has come into focus among clinicians. Regarding implant prostheses, the wear, chipping, and fracture of acrylic-wrapped metal framework prostheses ("hybrid") is commonly reported and progressive over time. PFM and layered zirconia prostheses demonstrate chipping and fracture that is costly to repair. Monolithic zirconia prostheses are relatively new and the published limited experience is favorable, but not without complications and rare catastrophic failures. The long-term biological impact of implant prostheses in the edentulous patient is also of growing concern, and it is peri-implantitis that challenges successful management of a significant percentage of treated patients.[3] The prevention and management of peri-implant mucositis and peri-implantitis requires long-term supportive care that involves careful oral hygiene, detailed clinical examination, and mechanical biofilm disruption. Together, these growing data sets regarding the long-term management of edentulous individuals with dental implants (irrespective of prosthesis type) can be facilitated by, or may require more frequent removal of the prosthesis for, prosthetic repair, implant hygiene, or intervention.

The advantages of removable prostheses for hygiene access, implant assessment, and intervention and repair or replacement are clearly aligned with the goals of long-term management of the edentulous implant patient. However, patient perceptions and clinical prejudices regarding removable prostheses may present substantial barriers to more widespread adoption. The visual similarity of removable implant prostheses with dentures relates to the presence of flanges and palatal coverage and these visual cues are reinforced by oral sensations of mucosal contact and motion. While bar overdenture constructions can sometimes remove the mucosal contact, they are associated with important dimensional limitations to their usage and also are reported to retain biofilm that contributes to mucositis and peri-implantitis. Alternatives to fixed and implant-supported or -retained removable prostheses may be valuable in dentistry's efforts to improve the long-term management of the edentulous implant patient.

One early approach investigated is the use of double crown prosthesis construction.[4] A prefabricated unsplinted rigid Syncone attachment system (ANKYLOS® Syncone®, Dentsply Implants, dentsplyimplants.com) also provided a removable solution for implant-retained prostheses with the key advantage of providing improved oral hygiene capability compared to bar-retained prostheses.[5] A customized Conus abutment solution (ATLANTIS™ Conus abutments, Dentsply Implants) to support removable prostheses on unsplinted implants was recently introduced and offers individualized CAD/CAM control of the mutual parallelism needed for therapeutic success. These solutions involving four or more implants provide both support and retention of the prosthesis without the requirement of mucosal support. They are all removable by the patient to enable hygiene, and because they are freely removable, they are readily repaired. Most recently, another innovative abutment solution has emerged that also enables the removal of a full-arch prosthesis from the abutment, with removal and replacement facilitated by the clinician. The LOCATOR F-Tx® Fixed Attachment System (Zest Dental Solutions, zestdent.com) introduces another means of connecting a prosthesis to an abutment that is free of cement and requires no screws.

These innovations each differ in their relative advantages and disadvantages, but all of them may be used to support a restoration that is divested of flanges (not denture-like), may be removed for hygiene access, and enable direct repair or revision.

In this supplement to *Compendium*, clinical contributors share early experiences in the initial management of edentulous patients using this new class of implant prosthesis that is perceived as fixed by the patient, but is removable as needed by the practitioner. This special issue begins to explore our ability to provide individual patients with the perceived or recognized benefits of a fixed prosthesis and the desired advantages of a removable prosthesis that may enhance long-term management of the edentulous implant patient.

ABOUT THE AUTHOR

Lyndon F. Cooper, DDS, PhD

Associate Dean for Research and Head of the Department of Oral Biology, University of Illinois at Chicago College of Dentistry, Chicago, Illinois

REFERENCES

1. Kern JS, Kern T, Wolfart S, Heussen N. A systematic review and meta-analysis of removable and fixed implant-supported prostheses in edentulous jaws: post-loading implant loss. *Clin Oral Implants Res*. 2016;27(2):174-195.

2. De Bruyn H, Raes S, Matthys C, Cosyn J. The current use of patient-centered/reported outcomes in implant dentistry: a systematic review. *Clin Oral Implants Res.* 2015;26(suppl 11):45-56.

3. Meijer HJ, Raghoebar GM, de Waal YC, Vissink A. Incidence of peri-implant mucositis and peri-implantitis in edentulous patients with an implant-retained mandibular overdenture during a 10-year follow-up period. *J Clin Periodontol*. 2014;41(12):1178-1783.

4. Frisch E, Ziebolz D, Rinke S. Long-term results of implant-supported over-dentures retained by double crowns: a practice-based retrospective study after minimally 10 years follow-up. *Clin Oral Implants Res.* 2013;24(12):1281-1287.

5. Cepa S, Koller B, Spies BC, et al. Implant-retained prostheses: ball vs. conus attachments - A randomized controlled clinical trial. *Clin Oral Implants Res.* 2017;28(2):177-185.

3-Year Follow-up of Immediately Loaded Full-Arch Implant Restorations Using a Novel Fixed Attachment System

Pär-Olov Östman, DDS, PhD

ABSTRACT

Treatment of the edentulous patient with a fixed solution can be a challenging oral rehabilitation. Converting an existing removable denture to a fixed prosthesis using temporary cylinders and grinding holes in the denture is, in most full-arch treatments, a time-consuming procedure. Locator fixed attachments (LOCATOR F-Tx®, Zest Dental Solutions) represent a simple, predictable, and cost-effective approach to convert a patient's existing denture or install a provisional denture for immediate loading onto implants. This article reviews a study evaluating and demonstrating the ease-of-use and time-saving aspects involved in the process of using Locator fixed attachments for immediately loaded implant provisional full-arch prostheses in 13 patients. The objective was to evaluate long-term follow-up of the abutment system as well as the treatment time for fabrication of the provisional and definitive prostheses.

Individuals with completely edentulous arches are prone to several negative psychological, emotional, physical, and functional effects as direct results of their tooth loss.[1,2] Although removable dentures have historically been used to replace missing teeth in an entire arch, inherent problems (eg, movement, instability, deformation) often leave patients feeling insecure, uncomfortable, and in pain due to chronic sore spots.[1,2]

Not surprisingly, implant-retained or -supported prostheses have gained in popularity based on their ability to stabilize the full-arch prosthesis and restore a patient to more natural function (eg, occlusal force, enhanced chewing and speaking) and esthetics (orofacial, lip, and cheek support).[3] Unfortunately, traditional implant treatments often require a healing period of at least 3 months before loading the definitive overdenture or prosthesis, which may be unacceptable to many completely edentulous patients.[4,5]

However, research examining immediately loaded implant-supported prostheses in completely edentulous patients indicates that this approach demonstrates high success rates comparable with delayed-loaded implants.[5-8] Considering the comparable success rates, among the most important advantages of immediately versus delayed-loaded implants in edentulous arches is high patient satisfaction, which has been most notable during the healing period.[6] High patient satisfaction may result from the reduction in treatment time realized through immediate loading, which may explain the increasing popularity of this procedure, particularly in patients with fully edentulous arches.

From a patient perspective, there is growing interest in shortening the time frame between implant placement and installation of a functional prosthesis. The latter contributes to intraoral comfort, orofacial support, and esthetics, which can be particularly appealing and significant to patients who are professionally or socially active.[3] In addition to less discomfort for patients, the fewer appointments inherent with abbreviated healing, procedures, and treatment time represents a financial and economic benefit. Likewise, from the dentist's perspective, when proper case selection and treatment planning have been completed, providing an immediately loaded prosthesis to patients with fully edentulous arches presents economic benefits. These may include less chair time for such cases and more available appointment times for other patients, each of which may help to increase profitability.

An immediately loaded implant prosthesis for the fully edentulous arch can be provided by retrofitting the patient's existing denture or installing a new provisional denture. Converting a denture to a fixed solution can be accomplished chairside by bonding temporary screw-retained cylinders into the denture base, which requires grinding holes in the denture and is often a more time-consuming process than the surgical procedure itself. It is usually performed

immediately after the patient has already endured a potentially stressful surgical event.

Alternatively, a provisional prosthesis can be created in the dental laboratory after taking an implant impression during surgery, as described by many authors.[9-11] Although the laboratory procedure is well controlled and demonstrates several advantages over chairside provisional constructions (eg, better finishing, enhanced fit, inclusion of metal or glass fiber reinforcement, superior esthetics), extended logistics and planning are required. These provisionals involve a longer production time and tend to be more expensive. Additionally, while they typically can be delivered between 6 and 8 hours after surgery, if reinforcements are required, an extra technical working day is often necessary.

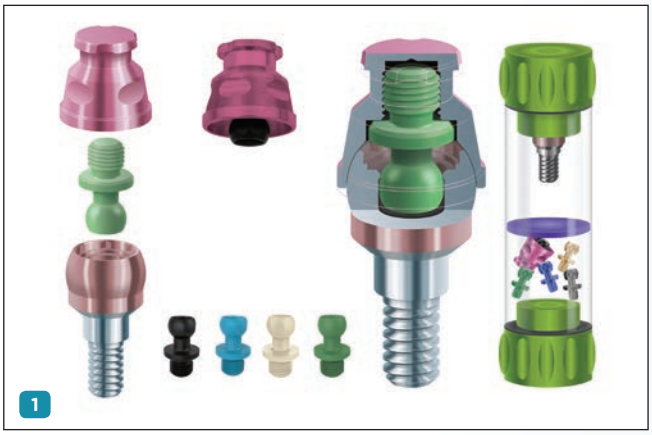
Additionally, researchers evaluating the incidence of technical complications in implants supporting a provisional bridge found that 7.4% of the restorations fractured, of which more than half occurred during the first 4 weeks.[12] With an opposing implant-supported prosthesis, the fracture risk was 4.7 times higher. Bridges in the mandible, bridges without cantilevers, and those opposing natural teeth were less likely to demonstrate technical failures. The investigators studied 242 consecutive patients who were treated with 1,011 implants supporting provisional bridges during a 2- to 3-month period after surgery.

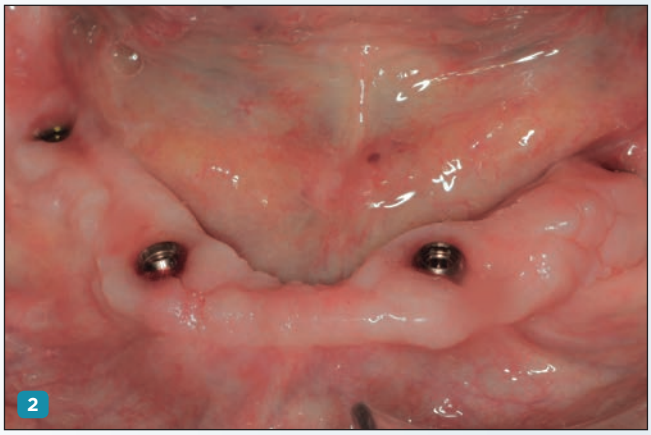
It has been this author's experience that many patients decline the option of immediate loading with a laboratory-fabricated provisional bridge due to the costs and time involved. In those cases, a chairside-made temporary construction can be a good alternative, as it provides the advantages of an immediate-loaded splinted fixed provisional that is cost-effective. However, simplifying the procedural steps involved with delivering this prosthetic option has been of interest to dentists for many years, along with availability of an easy-to-use prosthetic system that can benefit both the dentist and patient.

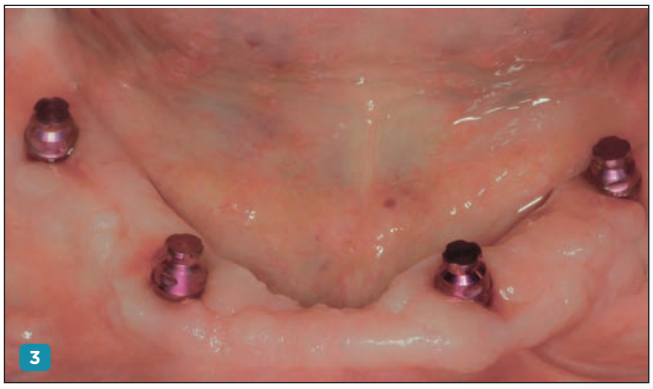
TECHNIQUE AND 3-YEAR STUDY FOLLOW-UP

The author has worked with the LOCATOR F-Tx® Fixed Attachment System (Zest Dental Solutions, zestdent.com) throughout the past 4 years. During that time, 46 patients have been treated successfully. In the first year of development, small adjustments were made to the design of the denture attachment housing and polyether ether ketone (PEEK) retentive balls. Follow-up of all the patients has shown no adverse events, and up to 4 years' follow-up has shown results comparable to traditional screw- or cement-retained full-arch rehabilitations.

A more focused study involving 13 patients was conducted to evaluate and demonstrate the ease-of-use and







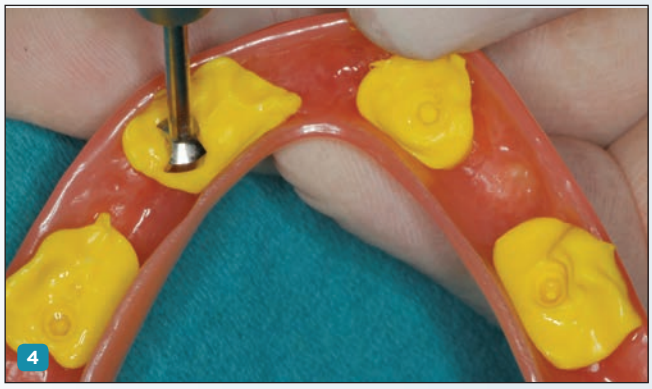
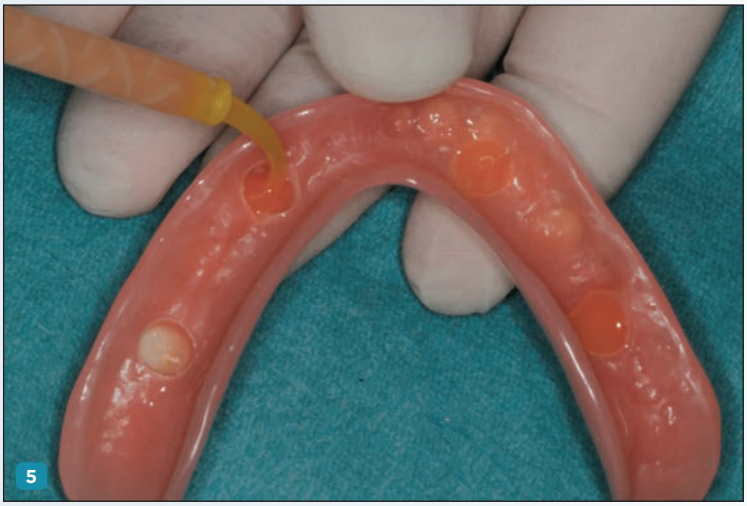


FIG 1. Illustration of the components comprising the LOCATOR F-Tx Fixed Attachment System. FIG 2. The definitive LOCATOR F-Tx abutments were mounted onto the implants at the time of surgery. FIG 3. After abutment placement, the denture attachment housing with black retention processing ball was snapped onto the abutment and aligned to be parallel. FIG 4. An indexing material was used to pick up the location/position of the denture attachment housing in the denture.



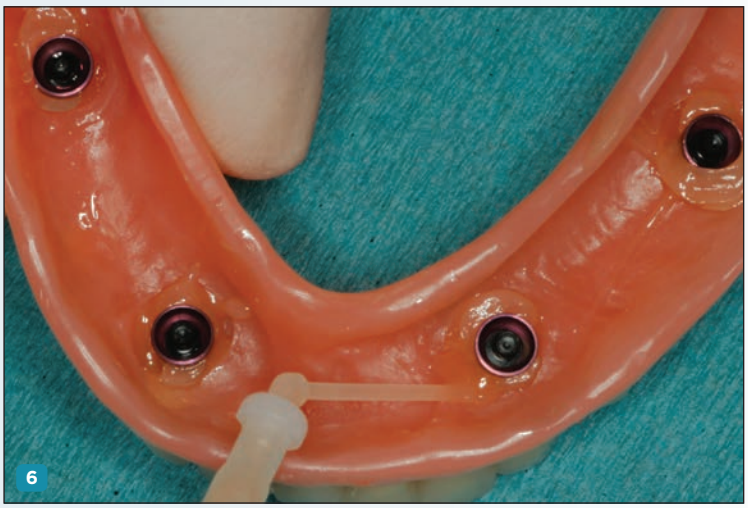


FIG 5. Recesses to accommodate the denture attachment housings were filled with a flowable, light-activated composite. FIG 6. On removal, the provisional denture had picked up the attachment housings and black retention processing balls.

time-saving aspects involved in the process of using LOCATOR F-Tx attachments for immediately loaded implant provisional full-arch prostheses. The objective was to evaluate long-term follow-up of the attachment system as well as the treatment time for fabrication of the provisional and definitive prostheses.

Material and Methods

Thirteen patients (7 female and 6 male; mean age, 57 years; range, 46-89 years) who were planned for treatment with implant-supported bridges in the edentulous maxilla and mandible participated in the study. Presurgical evaluation included clinical and radiographic examinations. Patients were selected from consecutive referrals and were considered candidates for immediate loading based on the following criteria: no general contraindications for oral surgery; 8 weeks of healing after extraction; presence of sufficient residual bone to accommodate four to six implants of at least 10 mm in length; and meeting the inclusion criteria of primary stability (ie, final torque of 30 Ncm and an implant stability quotient [ISQ] of 60 or more). All patients were thoroughly informed of the procedure and gave written consent to participate in the study. Two patients were diagnosed with diabetes mellitus type 2. Four patients were smokers.

Radiographs were taken at baseline, 3-, 6-, and 12-month follow-ups, and annually thereafter. Patients were recalled every 6 months for checkups, at which time the definitive fixed prosthesis was removed for maintenance.

Surgery

Six full-arch mandibles and seven maxillae were included. Bone quality and quantity were determined according to Lekholm and Zarb's criteria.[13]

All mandibular cases were treated with four implants. Three edentulous maxillae cases were treated with four implants, and four edentulous maxillae cases were treated with six implants. A total of 60 implants were installed (either T3®, Zimmer Biomet [zimmerbiometdental.com], 50 implants; or TriNex 12d Co-Axis®, Southern Implants [southernimplants.com], 10 implants).

A small fenestration was opened into the sinus to identify the anterior border of the sinus wall. After reflection of the flap, the optimal implant position was determined based on both esthetic and biomechanical considerations. Tilting the most posterior implants distally enabled placement in the most posterior position possible, reducing the need for cantilevers. Implants were placed in undersized sites to enhance primary stability.

Resonance frequency analysis (RFA) measurements were performed using an Osstell™ instrument (osstell.com). All 13 patients met the inclusion criteria of primary stability. Conversion of the patients' dentures to a fixed full-arch bridge was undertaken at the same appointment.

Temporalization

The novel spherical abutment being tested from the LOCATOR F-Tx Fixed Attachment System (Figure 1) was torqued into place on the implant using a dedicated abutment driver (Figure 2). The use of an abutment with a spherical geometry allowed the sterile denture attachment housing to pivot up to 20°, which would be significant to ensuring a stress-free, passive fit and proper alignment of the immediately loaded provisional prosthesis, as well as the definitive prosthesis.

Primary wound closure was achieved with resorbable sutures, after which the denture attachment housing was connected to the abutment and pivoted to the correct angulation alignment. The denture attachment housing is internally threaded to accept PEEK balls of various levels of retention force, in addition to a black processing ball. These balls snap into the abutment for fixation, thereby eliminating the need for extensive and time-consuming chairside procedures for retaining the prosthesis. During the procedure, the denture attachment housing (with the

black ball) was snapped into the abutment and aligned to be parallel (Figure 3).

The location/position of the denture attachment housing was picked up in the denture with an index material (Figure 4). Acrylic was then removed from the denture base to accommodate the denture attachment housing, and the recesses were filled with a light-activated flowable composite (CHAIRSIDE® Attachment Processing Material, Zest Dental Solutions) (Figure 5). The denture was aligned over the denture attachment housings intraorally, with the patient closing into light occlusion, after which the flowable composite was light-cured for 3 minutes. The now-fixed denture was then removed by dislodging the black processing ball attachment that was picked up in the denture attachment housing (Figure 6). Cantilevers of 10 mm were allowed.

The black processing ball was removed and replaced with a protective polishing cap, and the denture was trimmed and polished (Figure 7). The polishing cap was removed and, depending on the number of implants, different combinations of retention balls were placed in the denture attachment housing.[14] The fixed provisional prosthesis was then snapped into place intraorally, and the patient's occlusion was checked (Figure 8).

All patients were placed on mouth rinsing with chlorhexidine 2%, three times a day for 10 days, and a soft diet. After 7 to 10 days, sutures were removed, and a new combination of retention balls was selected. In three of the 13 cases, a time comparison between the LOCATOR F-Tx protocol and the classic protocol (ie, abutments and temporary cylinders) was performed.

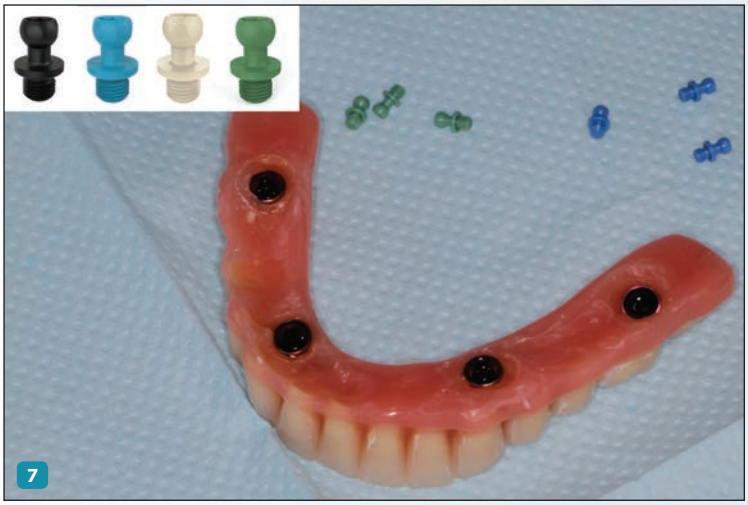
Definitive Prosthetics

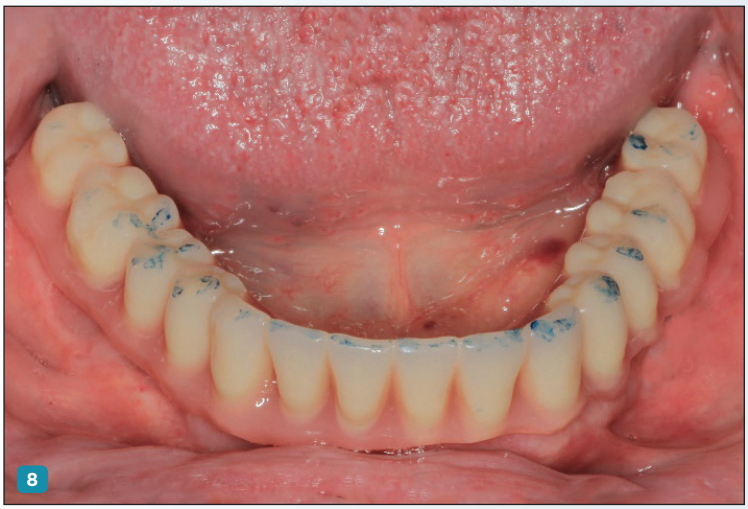
After a healing period from 8 to 10 weeks (Figure 9), an abutment-level impression was taken using the LOCATOR F-Tx impression copings and a definitive computer numerical control (CNC)-milled titanium (Ti)/acrylic or full-arch zirconia prosthesis was fabricated (Figure 10). Depending on the case, the denture attachment housing was fixated to the prosthetic framework intraorally for a completely passive fit (Ti/acrylic cases) or on the master model (zirconia), using the CHAIRSIDE attachment processing material. The manufacturer (Zest Dental Solutions) does not recommend laboratory pick-up procedures. Pick-up of housings should be done chairside if possible. High-retention balls, alone or in a combination with medium, were selected for retention of the final fixed prosthesis (Figure 11).[14]

RESULTS

No implants were lost during the follow-up period. Mean final torque was 47 Ncm. Mean bone loss after 1 year of follow-up (48 out of the 60 implants) was 0.3 mm. No temporary prostheses fractured during healing time.

One temporary prosthesis dislodged during the healing period. Low-retention balls were replaced with medium-retention balls, and no further dislodgement occurred.





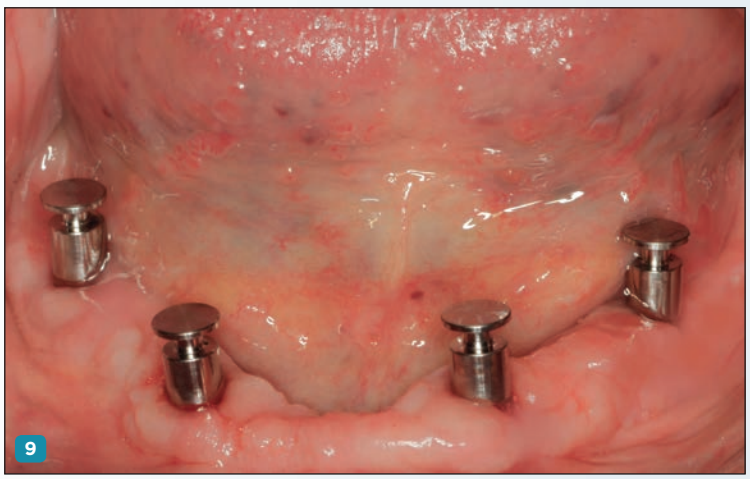
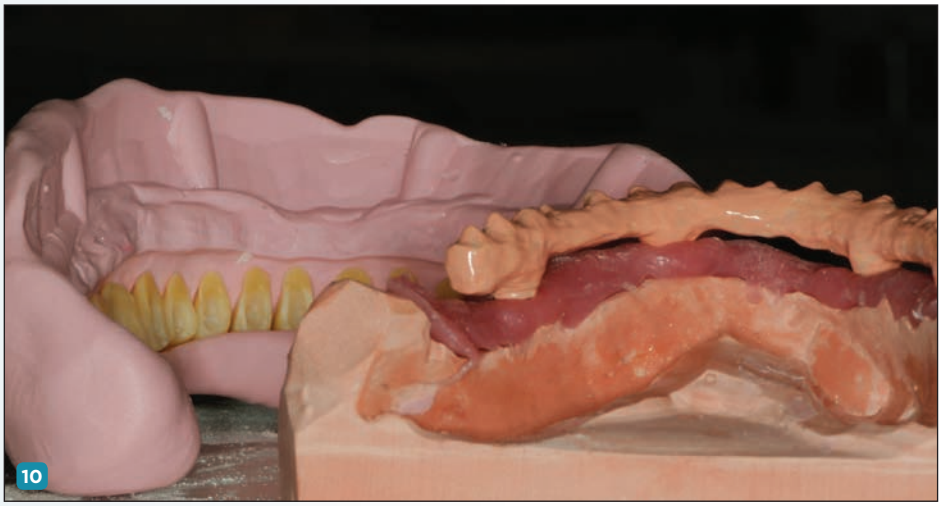
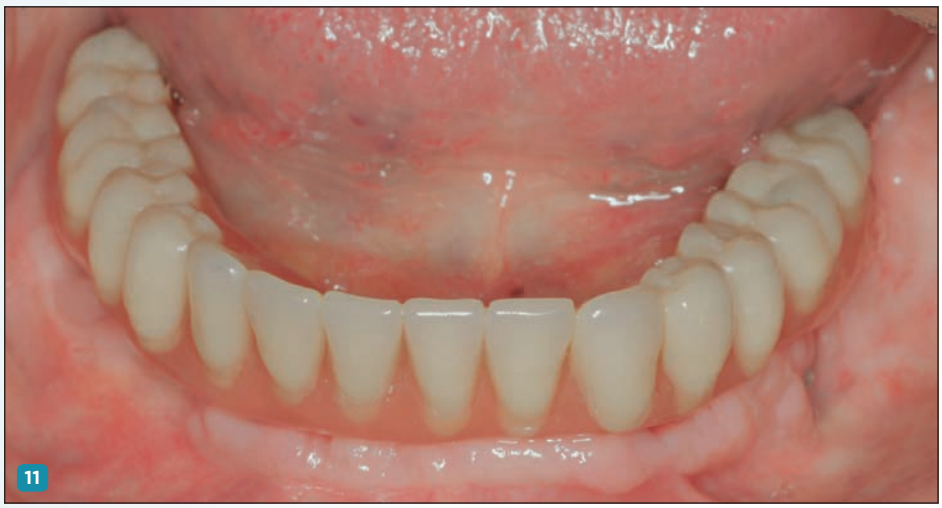


FIG 7. The provisional denture was trimmed and polished. FIG 8. The provisional prosthesis was snapped into place, after which the occlusion was checked. FIG 9. Impressions were taken after a healing time of 8 to 10 weeks.





TREATMENT TIME FOR FABRICATION OF PROVISIONAL AND DEFINITIVE PROSTHESES WAS REDUCED VERSUS CHAIRSIDE TRADITIONAL SCREW-RETAINED TECHNIQUES.

FIG 10. After the CNC-milled Ti/acrylic or full zirconia prosthesis was fabricated, the denture attachment housing was fixed to the prosthetic framework either intraorally or on the master model (not recommended by the manufacturer) using a chairside attachment processing material. FIG 11. View of the definitive fixed prosthesis.

One definitive prosthesis (four implants, 12 teeth) dislodged after final seating. Medium-retention balls were replaced with high-retention balls and, after an additional 13 months of follow-up, no dislodgement had occurred. Two denture attachment housings detached from the Ti framework during removal of the definitive prostheses at yearly checkups. Both denture attachment housings had high-retention balls attached. These findings are consistent with other evaluations in which LOCATOR F-Tx fixed attachments demonstrated few attachment-dislodgement complications.[15] One of the high-retention balls fractured during removal of the fixed definitive denture. Comparatively, fracture of a screw-retained provisional prosthesis is a common finding, affecting 17% of the patients in a previous study.[16].

As measured in three cases (one maxilla with six implants and two mandibles with four implants), the time required to construct a fixed temporary prosthesis from an existing denture using the LOCATOR F-Tx protocol totaled 65 minutes. Additional time saved during the remainder of treatment (ie, removing sutures, impression taking, teeth try-in, and delivery) totaled 45 minutes versus screw-retained procedures.

DISCUSSION

As in conventional implant procedures, the outcome of treatments involving LOCATOR F-Tx fixed attachments for immediately loaded implant provisional full-arch prostheses largely depends on case selection, presurgical planning, surgical skills, and prosthetic quality. The immediate loading implant surgical procedure is comparable to conventional implant placement procedures.

However, fixation of the provisional prosthesis may, for some restorative dentists, be unfamiliar. Placement of the provisional prosthesis, which is most often performed in the presence of bleeding tissues, may require some prosthetic skills for the procedure to be efficient timewise and comfortable for the patient.

Possible drawbacks of chairside conversion of an existing prosthesis into an immediately loaded implant fixed

restoration include risk of contamination of the surgical site from temporary prosthetic materials, as well as occasionally a lower esthetic outcome. These considerations must be weighed against the cost-effectiveness, time efficiency, and ease of the procedure.

Additionally, postoperative sessions for suture removal, plaque control measures, and prosthetic follow-up and modifications should be anticipated.[17] The provisional prosthesis requires evaluation and, often, adaptation of occlusion and articulation.

The LOCATOR F-Tx Fixed Attachment System demonstrates advantages when modifications must be performed. Compared with a screw-retained provisional, removing LOCATOR F-Tx provisionals for corrections is less complicated and time-consuming. Although it has been suggested that early manipulation of the restoration may hamper osseointegration, removal of the provisional prosthesis on the 10th day after surgery did not jeopardize implant survival, as shown in a separate cohort study involving 71 patients.[18]

The LOCATOR F-Tx Fixed Attachment System also presents advantages over the classic screw-retained temporary solution in production time and risk of fractures. In the present study group, no fractures were seen. In addition, before this study, 40 additional cases were completed during the development phase of the LOCATOR F-Tx abutment system, when the product looked slightly different and the retention balls were configured differently. No fractures were seen in those 40 prestudy cases, either.

CONCLUSION

Within the limitations of this study, the use of a no-screw/no-cement attachment system is a viable option for immediately loaded implant-supported fixed full-arch rehabilitation. Treatment time for fabrication of provisional and definitive prostheses was reduced versus chairside traditional screw-retained techniques. Prostheses with no coping screws and no access channels to fill contributed to the lack of complications, and no fractures of the provisional or final restorations were reported. Also, the attachment system provided more pleasing esthetic results to the patients. The 3-year follow-up data show good long-term results.

.

ABOUT THE AUTHOR

Pär-Olov Östman, DDS, PhD

Professor, Department of Periodontology and Oral Implantology, University of Ghent, University Hospital Dental School, Ghent, Belgium

REFERENCES

1. DiMatteo A. Dentures and implants: bringing them together for a winning combination. *Inside Dentistry*. 2009;5(1):97-104.

2. Rossein KD. Alternative treatment plans: implant-supported mandibular dentures. *Inside Dentistry*. 2006;2(6):42-43.

3. Vogel RC. Implant overdentures: a new standard of care for edentulous patients—current concepts and techniques. *Compend Contin Educ Dent.* 2008;29(5):270-276.

4. Ho CC, Jovanovic SA. The "All-on-4" concept for implant rehabilitation of an edentulous jaw. *Compend Contin Educ Dent*. 2014;35(4):255-259.

5. Lozada JL, Ardah AJ, Rungcharassaeng K, et al. Immediate functional load of mandibular implant overdentures: a surgical and prosthodontic rationale of 2 implant modalities. *J Oral Implantol*. 2004;30(5):297-306.

6. De Bruyn H, Raes S, Ostman PO, Cosyn J. Immediate loading in partially and completely edentulous jaws: a review of the literature with clinical guidelines. *Periodontol 2000*. 2014;66(1):153-187.

7. Chiapasco M, Gatti C. Implant-retained mandibular overdentures with immediate loading: a 3- to 8-year prospective study on 328 implants. *Clin Implant Dent Relat Res*. 2003;5(1):29-38.

8. Tealdo T, Menini M, Bevilacqua M, et al. Immediate versus delayed loading of dental implants in edentulous patients' maxillae: a 6-year prospective study. *Int J Prosthodont*. 2014;27(3):207-214.

9. Aalam AA, Nowzari H, Krivitsky A. Functional restoration of implants on the day of surgical placement in the fully edentulous mandible: a case series. *Clin Implant Dent Relat Res*. 2005;7(1):10-16.

10. Östman PO. Immediate/early loading of dental implants. Clinical documentation and presentation of a treatment concept. *Periodontol 2000*. 2008;47:90-112.

11. De Bruyn H, Van de Velde T, Collaert B. Immediate functional loading of TiOblast dental implants in full-arch edentulous mandibles: a 3-year prospective study. *Clin Oral Implants Res*. 2008;ww19(7):717-723.

12. Suarez-Feito JM, Sicilia A, Angulo J, et al. Clinical performance of provisional screw-retained metal-free acrylic restorations in an immediate loading implant protocol: a 242 consecutive patients' report. *Clin Oral Implants Res*. 2010;21:1360-1369.

13. Lekholm U, Zarb GA. Patient selection and preparation. In: Brånemark PI, Zarb GA, Albrektsson T, eds. *Tissue-integrated Prostheses: Osseointegration in Clinical Dentistry*. Chicago, IL: Quintessence; 1985:199-209.

14. ELsyad MA, Agha NN, Habib AA. Retention and stability of implant-retained mandibular overdentures using different types of resilient attachments: an in vitro study. *Int J Oral Maxillofac Implants.* 2016;31(5):1040-1048.

15. Cakarer S, Can T, Yaltirik M, Keskin C. Complications associated with the ball, bar and locator attachments for implant-supported overdentures. *Med Oral Patol Oral Cir Bucal*. 2011;16(7):e953-e959.

16. Cercadillo-Ibarguren I, Sánchez-Torres A, Figueiredo R, Valmaseda-Castellón E. Early complications of immediate loading in edentulous full-arch restorations: a retrospective analysis of 88 cases. *Int J Oral Maxillofac Implants*. 2017;32(5):1116–1122.

17. Kappel S, Giannakopoulos NN, Eberhard L, et al. Immediate loading of dental implants in rdentulous mandibles by use of Locator® attachments or Dolder® bars: two-year results from a prospective randomized clinical study. *Clin Implant Dent Relat Res*. 2016;18(4):752-761.

18. Borges AF, Dias Pereira LA, Thome G, et al. Prostheses removal for suture removal after immediate load: success of implants. *Clin Implant Dent Relat Res*. 2010;12(3):244-248.

DISCLOSURE: *The author is a consultant for Zest Dental Solutions.*

Clinical Application of the New LOCATOR F-Tx Fixed Attachment System for Immediate Rehabilitation of Complete Edentulous Cases: 1-Year Prospective Clinical Study

Francesco Amato, MD, DDS, PhD; and Giorgio Polara, DDS

ABSTRACT

The aim of this study was to investigate the performance and success rate of immediately loaded implants placed to retain fixed prostheses anchored by a novel fixed attachment system (LOCATOR F-Tx® Fixed Attachment System, Zest Dental Solutions) only removable by the clinician. Seventeen consecutive fully or partially edentulous patients were recruited to participate. Six or four implants were placed, attachments were connected, and existing dentures were immediately processed into a fixed hybrid prosthesis. No complications occurred among the 66 implants that were placed to support 17 maxillary and mandibular fixed prostheses; only one fixture failed, and all patients reported being highly satisfied. Within the limitations of this study, the use of immediately loaded implants to support prostheses that are fixed using the aforementioned attachment system appears to be a viable option for treating partially and completely edentulous patients.

Patients with edentulous arches experience numerous adverse physical and psychological effects as consequences of losing their natural teeth. Among them are difficulty speaking, eating, chewing, and otherwise ensuring proper nutrient intake; lack of self-esteem; social isolation; and dissatisfaction with their facial appearance.[1,2] Although conventional removable dentures help to alleviate these problems, their instability may lead to other negative sequelae, including but not limited to stomatitis, traumatic ulcers, burning mouth syndrome, alteration of taste perception, and temporomandibular joint disorders.[3,4]

Additionally, the pain, discomfort, and need for unnatural lip, tongue, and cheek muscle movements to keep the prostheses in place associated with conventional removable dentures negatively interfere with patients' quality of life.[1,2] Overall, in many cases the use of conventional dentures falls short of restoring patient function comfortably or satisfying patient expectations.[3]

Contributing to the instability of conventional dentures are residual ridge resorption and other adverse effects on the tissues supporting the dentures that occur when patients wear them.[5,6] Patients who have worn conventional complete dentures for several years frequently develop severe alveolar ridge atrophy that drastically reduces the stability of the dentures.[5] Ultimately, jawbone volumes are modified to the extent that patients with full-arch dentures frequently exhibit severe vertical posterior ridge resorption and horizontal anterior ridge resorption.[7,8]

Alternatively, the use of osseointegrated dental implants in clinical practice, which has been well documented, has become a preferred tooth-replacement option for improving the quality of life of fully edentulous patients.[9,10] Osseointegration creates a firm and lasting connection between dental implants and the vital bone into which they

TABLE 1.
Implant Sizes Used in This Study

Implant Size	Ø4 mm	Ø5 mm
6 mm	-	1
6.5 mm	-	1
10 mm	6	12
11.5 mm	25	8
13 mm	13	-
TOTAL	**44**	**22**

A total of 66 implants were placed in 17 study subjects.

are placed, resulting in more stable prosthetic retention and support (eg, removable bridges, overdentures) compared to conventional dentures.[9,10] The use of dental implants to support overdentures increases denture stability and patient function, making the prosthesis highly stable, functionally efficient, and more comfortable.[4,11] Implant-retained overdentures also help to eliminate many social, psychological, and lifestyle issues that patients may experience with traditional removable dentures.

While many patients with fully edentulous arches are candidates for implant-retained overdentures, the adverse effects of edentulism and wearing conventional removable dentures may present clinical challenges to dentists when treatment planning cases. For example, the combination of vertical posterior and horizontal anterior ridge resorptions, jawbone volume modifications, and the proximity of vital structures (eg, alveolar canal or maxillary sinus) may necessitate implant placement at different insertion axes. This could influence the correct final prosthetic outcome and mechanical force distribution.[12,13] In fact, when severe atrophy is present, extreme implant angulation may be required to avoid these structures and multiple invasive regenerative procedures.[14]

Although placing implants at a less-than-ideal angulation helps to circumvent the issues related to implant placement in areas without adequate bone quality or quantity (eg, poor osseointegration), doing so may create other potential problems. These include a misfit between the overdenture and the implants that could lead to detrimental stress throughout the prosthesis, implant, and trabecular bone[15]; aggravated peri-implant bone loss and/or changes in peri-implantitis direction[16]; and, ultimately, implant failure. To address the challenges associated with implant angulation and non-passively fitting overdentures, several approaches have been developed to compensate for deviations from ideal positioning.

One method has been the use of cementable abutments, to include pre-angled and custom milled components, that correct for implant angulation. This abutment solution, however, requires consideration of the potential for subgingival cement, which has been associated with peri-implant diseases and subsequent implant failure.[17,18] Another approach for fixed, full-arch restorations incorporates the use of straight and pre-angled screw-retained abutments. Referred to as a hybrid option, this approach has been popular because it enables clinicians to achieve the ideal angulation for connecting a prosthesis to the supporting implant; however, careful planning is required to determine the appropriate location of the screw-access hole.[19] Because the exit point of screw-access holes for screw-retained components should not be on the facial aspect, the implant fixture must be positioned such that the screw-access hole emerges from either the occlusal or lingual aspect of the teeth.

These techniques can be time-consuming and in more advanced procedures, such as immediate provisionalization, may be beyond the comfort zone of some

TABLE 2.
Implant Types Used in This Study

Implant Type	No. of Implants Placed
BNST (T3 implant internal connection)	62
BNET (T3 implant external connection)	4
	66 Total

TABLE 3.
Bone Quality of Implant Sites

Bone Quality	No. of Implants Placed in Each Bone Quality Type
Post-extraction	6
Type 1	14
Type 2	**11**
Type 3	**16**
Type 4	**19**

TABLE 4.
Insertion Torque

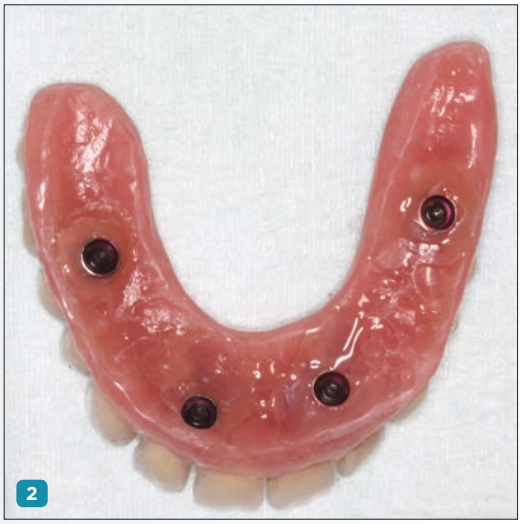
Insertion Torque	No. of Implants at This Insertion Torque
A (≥90 Ncm)	24
B (70 to 89 Ncm)	17
C (50 to <70 Ncm)	**7**
D (30 to <50 Ncm)	**15**
E (<30 Ncm)	**3**

Final seating was achieved using a calibrated torque hand ratchet to the final insertion torque.

TABLE 5.
Patient Assessments of Implant-Retained Prostheses

Question	No. of Patients Neutral	No. of Patients Satisfied	No. of Patients Very Satisfied
Express the degree of improvement in stability	-	-	17
Express the degree of improvement in chewing forces	-	-	17
Which grade of improvement did you experience in your social life?	-	6	11
Express the degree of improvement in chewing food	-	1	16
How would you define the surgical procedure?	1	5	11
Which grade of general satisfaction did you have after 1 month of denture wearing?	7	2	8

No patients responded that they were "Dissatisfied" or "Very Dissatisfied."



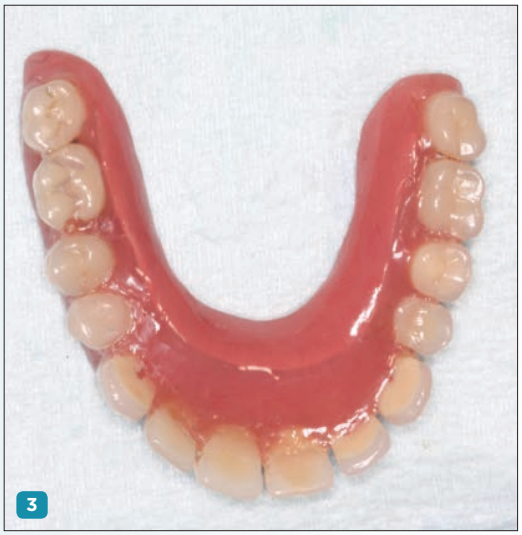


FIG 1. The attachment system in this study is delivered in an all-inclusive package that contains an abutment, a denture attachment housing with a pre-assembled black processing ball, an extra black processing ball, and low (blue), medium (tan), and high (green) retention balls and block-out spacers.
FIG 2. A direct technique for pick-up of denture attachment housings allows existing dentures to be converted into an implant-supported fixed prosthesis.
FIG 3. After occlusion is adjusted and the patient's function with the converted prosthesis is assessed, it can be trimmed, adjusted, and polished prior to insertion.

practitioners. This, combined with the risks associated with placing non-parallel implants, underscores the value of an attachment system for implant-supported prostheses that can accommodate and correct convergence/divergence between implants, eliminate the need for angled abutments, and contribute to overall survival of the final fixed prosthesis.

RESEARCH OBJECTIVE

The aim of this study was to evaluate the survival rate of immediate-loaded dental implants placed in combination with a recently introduced fixed, clinician removable attachment system. (LOCATOR F-Tx® Fixed Attachment System, Zest Dental Solutions, www.zestdent.com) for the rehabilitation of edentulous patients. Using this new attachment system, the discrepancy between implant insertion axis and a patient's existing denture prosthesis would be reduced by easily modifying the angulation of the denture attachment housings given their ability to pivot on the abutment.

MATERIAL AND METHODS

Between March 2014 and December 2016, 15 completely edentulous patients and two partially edentulous patients who were experiencing significant discomfort due to unstable maxillary or mandibular removable dentures were enrolled in the study. The main inclusion criteria were adequate bone height (ie, >5 mm) and adequate ridge thickness (ie, >5 mm) in the edentulous area. Neither smoking nor severe systemic disorders were exclusion criteria.

Each patient underwent a complete intraoral examination and cone-beam computed tomographic (CBCT) scans. Bone quality was categorized as one of four types according to Lekholm and Zarb.[20] Impressions were taken and interarch relationships recorded to mount study casts on an articulator. If possible, the existing complete removable dentures were to be utilized by processing and converting them to a fixed bridge and connecting it to the LOCATOR F-Tx abutments.

Each patient was instructed to begin systemic antibiotic prophylaxis (ie, amoxicillin 1g twice a day for 6 days) and rinse with mouthwash (ie, 0.20% chlorhexidine) 24 hours before implant placement surgery. During the surgical appointment, local anesthesia was induced using articaine 4% with adrenaline (1:100,000 Ubistesin™, 3M, 3m.com) in the vestibular and lingual areas and with adrenaline (1:50,000) in the incision line.

When the crest was wider than 7 mm and an adequate band of keratinized tissue was present, a flapless approach was preferred and undertaken. In all but one case (ie, the first), four implants (Zimmer Biomet, zimmerbiometdental.com) were inserted in the edentulous area (Table 1 and Table 2).

All osteotomies were first prepared using a piezo-surgical unit, then according to the drilling protocol suggested by the implant manufacturer, with care taken to underprepare the final diameter by at least 0.5 mm in presence of poor bone quality (Table 3). The implants were inserted using the surgical handpiece. Final seating was achieved using a calibrated torque hand ratchet to a final insertion torque, as per Table 4.

The proper abutment cuff sizes (LOCATOR F-Tx Fixed Attachment System) that had been selected during treatment planning were seated onto the implants using a dedicated LOCATOR F-Tx abutment driver included with the system (Figure 1). The abutment cuff sizes are available in different

heights (ie, from 1.5 mm to 6 mm). Each abutment was then torqued to the appropriate Ncm according to the implant manufacturer's protocol.

The existing dentures were then relined. Marking paste was applied to the intaglio surface of the dentures, which were then inserted into the mouth in position over the abutments to mark the areas where the prosthesis would need to be relieved. This would allow space for the denture attachment housings to be picked up. The minimum attachment height requirement is 5.6 mm, as measured from the implant interface. The denture attachment housing is 4.1 mm in height, and this is the portion of the attachment that is processed in the prosthesis (Figure 2).

Patients were asked to close and were guided into centric occlusion, holding the position until complete setting of the resin. Occlusion was adjusted, and the patients' function with the prosthesis was assessed. The prosthesis was then removed, trimmed, adjusted, and polished (Figure 3) before being returned to the patient's mouth.

Patients were instructed to consume a liquid diet for the first 8 weeks. After that, no dietary limitations or restrictions were required.

Patients were checked once a month for the first 3 months, and then once every 6 months. At all follow-up visits, periodontal health conditions were checked for bleeding on probing and any signs of inflammation. Radiographs also were taken to evaluate bone loss. Implants were determined to be successful if they were stable, with no signs of mucositis, and if the bone levels were stable.

One month after delivery of the prosthesis, patients were asked to complete a standardized evaluation form assessing the efficacy of the implant-supported prosthesis from their perspective. Questions assessed such areas as eating, speaking ability, facial appearance, and satisfaction during daily social life (Table 5). All 17 patients responded that they were "very satisfied" with the degree of improvement in their denture's stability and chewing force.

RESULTS

This study comprised 17 patients (ie, five males and 12 females) ranging in age from 60 to 88. Because of the investigators' initial lack of experience with the implant system, the first patient received six standard-diameter implants to minimize the risk of failure due to overloading. Thereafter, only four standard or wide-diameter implants were placed in each patient. A total of 66 implants were inserted.

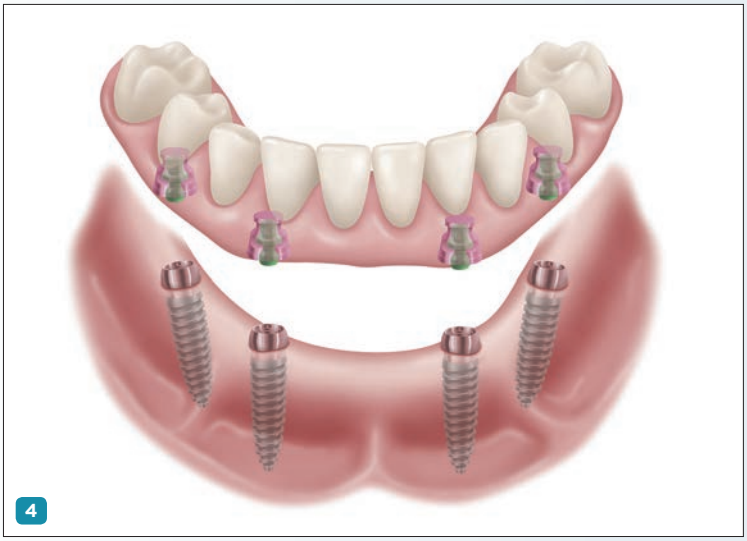
The bone quality in 14 implant sites was judged to be Type 1; in 11 sites it was Type 2; in 16 sites it was Type 3; in 19 sites it was Type 4; and six sites were immediate extraction sites (Table 3). Insertion torque for the implants ranged from <30 Ncm to >90 Ncm (Table 4). For 16 patients, it was possible to use the existing dentures; for one patient, a new prosthesis was fabricated. No signs or symptoms of postoperative complications were observed.

One implant failed after 1 month; it was removed and a new fixture inserted 3 months later. After an average follow-up period of 18 months (range: 5 to 24 months) the implant success rate was 98.5%, and the prosthetic success rate was 100%.

DISCUSSION

The LOCATOR F-Tx is a fixed attachment system that is clinician removable for rigid connection of partial (with cross-arch stabilization) and full-arch restorations on endosseous dental implants in the maxilla or mandible (Figure 4). Fixation is accomplished by a snap-in attachment that eliminates the need for subgingival cement, prosthetic screws, and screw-access channels (Figure 5). The system can be used to stabilize newly fabricated full-arch restorations (eg, all-ceramic, CAD/CAM-milled bars/bridges) or a conversion of a patient's existing full denture if the final position of the denture attachment housings within the prosthesis is acceptable. A metal frame wrapped with acrylic, PBNA, or porcelain can also be used.

Unique to the LOCATOR F-Tx Fixed Attachment System is its spherical coronal geometry, which allows the denture attachment housing to rotate in



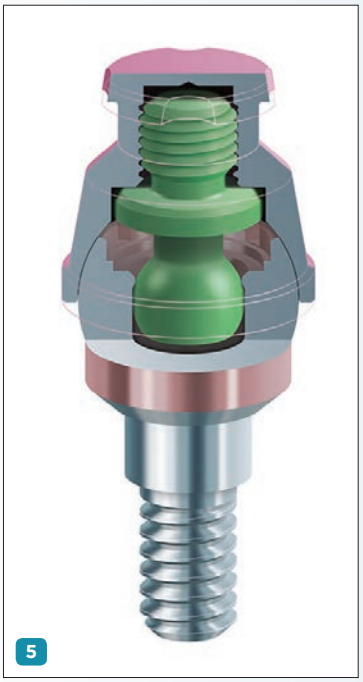


FIG 4. The unique design of the fixed attachment system in this study accommodates divergent/convergent scenarios up to 40° between implants, without the need for angled abutments.
FIG 5. The fixed attachment system in this study works similar to a ball and socket, allowing the denture attachment housing to securely snap into place and then pivot to the desired position.

any direction and correct up to 20° from the vertical and 360° in circumference, thus allowing the attachment housing to be positioned in the ideal location for the prosthesis. This eliminates the need for angled abutments while simultaneously helping to ensure a stress-free, passive fit of the prosthesis.

Considering the clinical challenges that can result from having to place implants at different insertion axes (eg, mechanical force distribution, misfit between prosthesis and implants) that can negatively affect implant survival rates,[12,13,15,16] the fact that the fixed attachment system includes a spherical coronal geometry is significant. It eliminates the need to use angled abutments or cement-retained options, thereby removing a significant known risk factor for peri-implant diseases and subsequent implant failure.[17,18]

CONCLUSION

Although many patients with fully edentulous arches are candidates for implant-supported or -retained overdentures, the adverse effects of edentulism and wearing conventional removable dentures may present clinical challenges to dentists when treatment planning cases. After having used the LOCATOR F-Tx Fixed Attachment System successfully in all applications, and based on the results of this study, the authors conclude that the adoption of this attachment system helps to resolve the issues associated with supporting fixed prostheses with implants placed at divergent insertion axes. An alternative to angled abutments, use of this fixed attachment system is time-efficient, achieves esthetically pleasing results, and is less technically complex due to the elimination of the need for cement, screw-access channels, and prosthetic screws. As with any new product, limitations and complications may occur. Therefore, clinicians must treatment plan their cases after thoroughly learning the system.

ABOUT THE AUTHORS

Francesco Amato, MD, DDS, PhD
Private Practice, Catania, Italy

Giorgio Polara, DDS
Private Practice, Modica, Italy

REFERENCES

1. Bilhan H, Geckili O, Ergin S, et al. Evaluation of satisfaction and complications in patients with existing complete dentures. *J Oral Sci*. 2013;55(1):29-37.

2. Hogenius S, Berggren U, Blomberg S, et al. Demographical, odontological, and psychological variables in individuals referred for osseointegrated dental implants. *Community Dent Oral Epidemiol*. 1992;20(4):224-228.

3. Feine JS, Maskawi K, de Grandmont P, et al. Within-subject comparisons of implant-supported mandibular prostheses: evaluation of masticatory function. *J Dent Res*. 1994;73(10):1646-1656.

4. Müller F, Hasse-Sander I, Hupfauf L. Studies on adaptation to complete dentures. Part I: oral and manual motor ability. *J Oral Rehabil*. 1995;22(7):501-507.

5. Feine JS, Carlsson GE, Awad MA, et al. The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. Montreal, Quebec, May 24-25, 2002. *Int J Oral Maxillofac Implants*. 2002; 17(4):601-602.

6. Pietrokovsky J, Enlow DH, Bianco HJ, Eklund S. The remodeling of the edentulous mandible. *J Prosthet Dent*. 1976;36(6):685-693.

7. Ueda C, Markarian RA, Sendyk CL, Lagana DC. Photoelastic analysis of stress distribution on parallel and angled implants after installation of fixed prostheses. *Braz Oral Res*. 2004;18(5):646-654.

8. Cawood JI, Howell RA. A classification of the edentulous jaws. *Int J Oral Maxillofac Surg*. 1988;17(4):232-236.

9. Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg*. 1981;10(6):387-416.

10. Thomason JM, Lund JP, Chehade A, Feine JS. Patient satisfaction with mandibular implant overdentures and conventional dentures 6 months after delivery. *Int J Prosthodont*. 2003;16(5): 467-473.

11. Melilli D, Rallo A, Cassaro A. Implant overdentures: recommendations and analysis of the clinical benefits. *Minerva Stomatol*. 2011;60(5):251-269.

12. Misch CE. *Contemporary Implant Dentistry*. 2nd ed. St. Louis, MO: Mosby; 1999.

13. Barbier L, Schepers E. Adaptive bone remodeling around oral implants under axial and nonaxial loading conditions in the dog mandible. *J Oral Maxillofac Implants*. 1997;12(2):215-223.

14. Malo P, Nobre MA, Lopes A. Immediate rehabilitation of completely edentulous arches with a four-implant prosthesis concept in difficult conditions: an open cohort study with mean follow-up of 2 years. *Int J Oral Maxillofac Implants*. 2012;27(5):1177-1190.

15. Gomes EA, Assuncao WG, Tabata LF, et al. Effect of passive fit absence in the prosthesis/implant/retaining screw system: a two-dimensional finite element analysis. *J Craniofac Surg*. 2009; 20(6):2000-2005.

16. Arun Kumar G, Mahesh B, George D. Three dimensional finite element analysis of stress distribution around implant with straight and angled abutments in different bone qualities. *J Indian Prosthodont Soc*. 2013;13(4):466-472.

17. Wilson TG Jr. The positive relationship between excess cement and peri-implant disease: a prospective clinical endoscopic study. *J Periodontol*. 2009;80(9):1388-1392.

18. Linkevicius T, Puisys A, Vindasiute E, et al. Does residual cement around implant-supported restorations cause peri-implant disease? A retrospective case analysis. *Clin Oral Implants Res*. 2013;24(11):1179-1184**.**

19. Wadhwani C, Piñeyro A, Avots J. An esthetic solution to the screw-retained implant restoration: introduction to the implant crown adhesive plug: clinical report. *J Esthet Restor Dent*. 2011;23 (3):138-143.

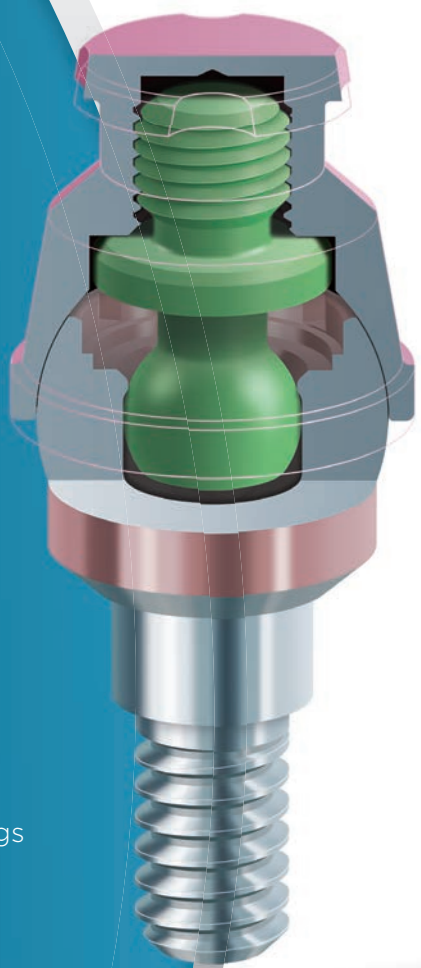
20. Hao Y, Zhao W, Wang Y, et al. Assessments of jaw bone density at implant sites using 3D cone-beam computed tomography. *Eur Rev Med Pharmacol Sci*. 2014;18(9):1398-1403.

LOCATOR F-Tx®
FIXED ATTACHMENT SYSTEM

LOCATOR F-Tx®
FIXED ATTACHMENT SYSTEM

NO SCREWS. NO CEMENT. NO COMPROMISES.

LOCATOR F-Tx is an entirely new way to think about fixed full-arch restorations. Fixed for the patient, yet easily removed by the clinician, LOCATOR F-Tx is a simplified, time saving solution for fixed full-arch restorations with no compromise to prosthesis strength or esthetics.



SIMPLICITY:
Novel "snap-in" Attachment works like a ball and socket allowing the Denture Attachment Housing to securely snap into place.

ANGLE CORRECTION:
Allows for angle correction up to 20° in any required direction (360°).

STRENGTH AND ESTHETICS:
No screws or screw access channels maintain prosthesis integrity and esthetics.

TIME SAVINGS:
Significant chair time savings due to expedited patient visits with quick and easy removal of the prosthesis.

PASSIVE FIT:
Chairside processing ensures a stress free passive fit.

PATIENT COMFORT/SAFETY:
Replacement of Retention Balls are quickly performed extra-orally.

To learn more about how the LOCATOR F-Tx Fixed Attachment System can help you simplify your fixed full-arch restorations, please visit **www.zestdent.com/ftx.**

ZD ZEST DENTAL SOLUTIONS®
ZEST | DANVILLE MATERIALS | PERIOSCOPY

A Minimally Invasive Implant-Supported Fixed Bridge Using a Screwless Restorative System

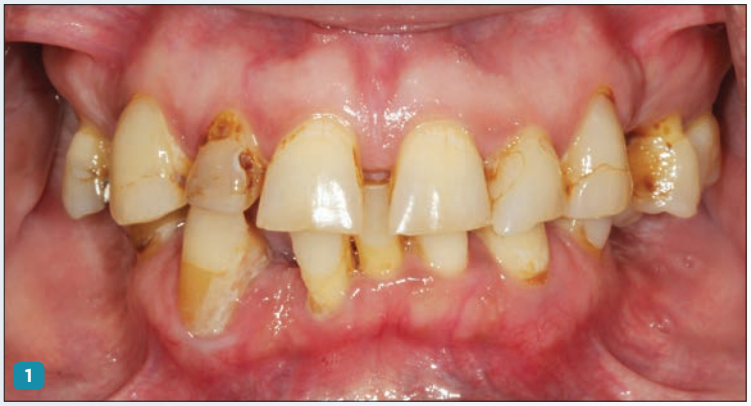
Michael D. Scherer, DMD, MS

A healthy 45-year-old partially edentulous woman presented with a failing dentition (Figure 1 and Figure 2). After seeing many other dentists who offered extensive surgical options, she presented to the author's dental office with a desire for a minimally invasive implant-supported fixed bridge.

A cone-beam computed tomography (CBCT) scan of the patient was performed (PaX-i3D, Vatech® America, vatech america.com), and an intraoral scan (3M™ True Definition Scanner, 3M, 3m.com) was generated of the mandibular arch for diagnostic planning purposes. Using a computerized implant planning software (Blue Sky Plan®, Blue Sky Bio, blueskybio.com), the digital files were merged into a single planning file. Five implants (Tapered Plus, Biohorizons®, biohorizons.com) were planned, and a pilot surgical guide was designed. The guide design file was exported and printed using a 3D printer (Form 2®, Formlabs, formlabs.com) and biocompatible surgical guide material (Dental SG, Formlabs). After printing, the guide was cleaned and metal sleeves (Guide Tubes, Blue Sky Bio) were placed.

After anesthesia, all teeth were extracted, leaving two teeth (Nos. 22 and 27) to help support the surgical guide (Figure 3). The guide was placed onto the mandibular arch, and pilot osteotomies were performed. The guide was then removed, and complete osteotomy preparation was completed using minimally invasive methods. The implants were all inserted with adequate primary stability in the ideal bone volume position (Figure 4). Abutments were placed (LOCATOR F-Tx® Fixed Attachment System, Zest Dental Solutions, zestdent.com). A radiograph was made to confirm complete seating of the abutments to the implants, and each abutment was torqued according to the manufacturer's recommendations (Figure 5).

Housings (Denture Attachment Housings, Zest Dental Solutions) and block-out spacers (White Block-Out Spacer, Zest Dental Solutions) were applied onto each abutment (Figure 6). The housings were tilted and rotated until all were parallel to compensate for any areas of needed implant angulation due to the patient's bone anatomy. Light-body polyvinyl impression material (CHAIRSIDE® Light Body, Zest Dental Solutions) was injected onto the intaglio of the denture and seated onto the edentulous ridge to mark the position of the denture attachment housings (Figure 7). Adjustments were made inside the intaglio of the denture using a denture attachment adjustment kit (Denture Prep & Polish Kit, Zest Dental Solutions), preparing recesses and vent holes for picking up the housings in the prosthesis.The housings were thoroughly dried; then composite resin (CHAIRSIDE Attachment Processing Material, Zest Dental Solutions) was injected into the prepared recesses, and the prosthesis was seated onto the edentulous ridge. After complete polymerization, the denture and housings were removed from the mouth.



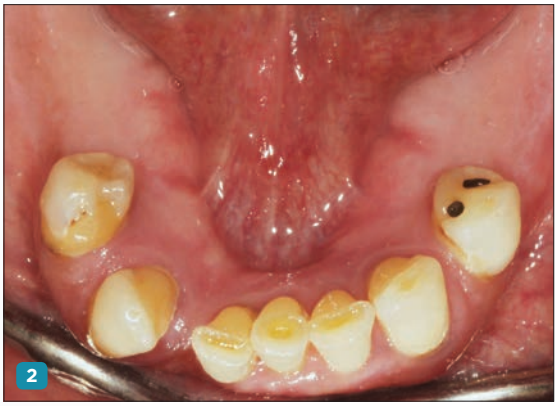


FIG 1. A patient presented with a failing dentition and requested a fixed dental implant prosthesis using minimally invasive surgical procedures.
FIG 2. The patient's mandibular arch was missing posterior teeth, and remaining teeth were compromised. A CBCT scan was completed to evaluate bone quantity and quality.

With a series of acrylic adjustment and polishing burs (Denture Prep & Polish Kit), the prosthesis was modified to resemble the shape of a well-contoured fixed partial denture. The black processing balls (Processing Balls, Zest Dental Solutions) were removed and medium PEEK retention balls placed into each of the housings. The prosthesis was seated onto the abutments using a posterior to anterior insertion procedure with firm pressure (Figure 8).

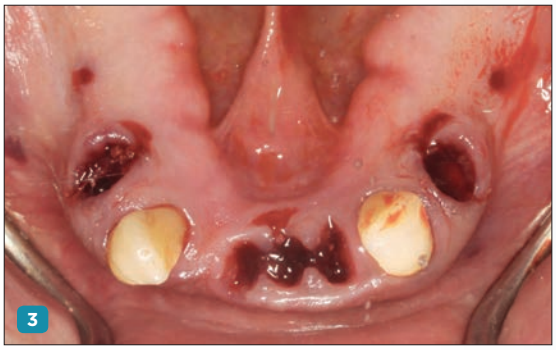
The patient received instructions on how to care for the new prosthesis and was very satisfied with the esthetics, stability, and minimally invasive surgical procedure.

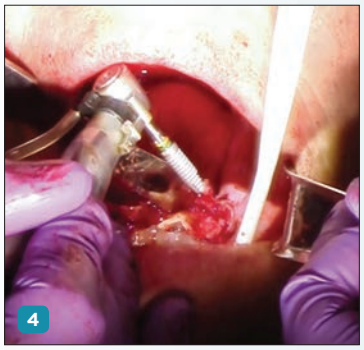
ABOUT THE AUTHOR

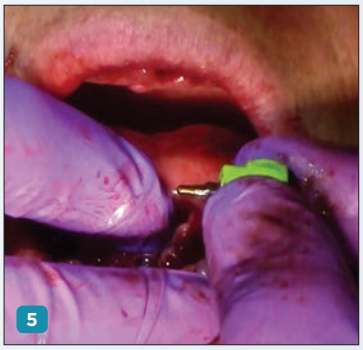
Michael D. Scherer, DMD, MS

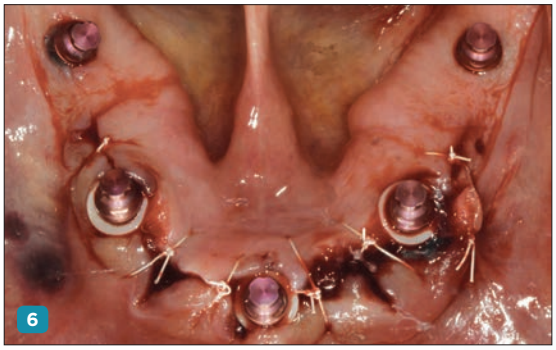
Assistant Clinical Professor, Loma Linda University, Loma Linda, California; Clinical Instructor, University of Nevada, Las Vegas, Las Vegas, Nevada; Private Practice limited to prosthodontics and implant dentistry, Sonora, California; Fellow, American College of Prosthodontists

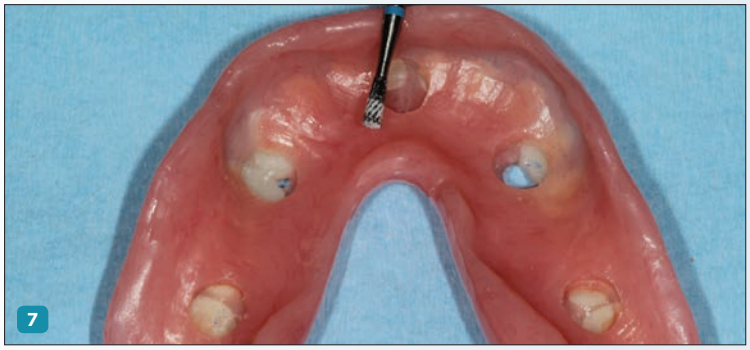
DISCLOSURE: *The author is a consultant for Zest Dental Solutions.*











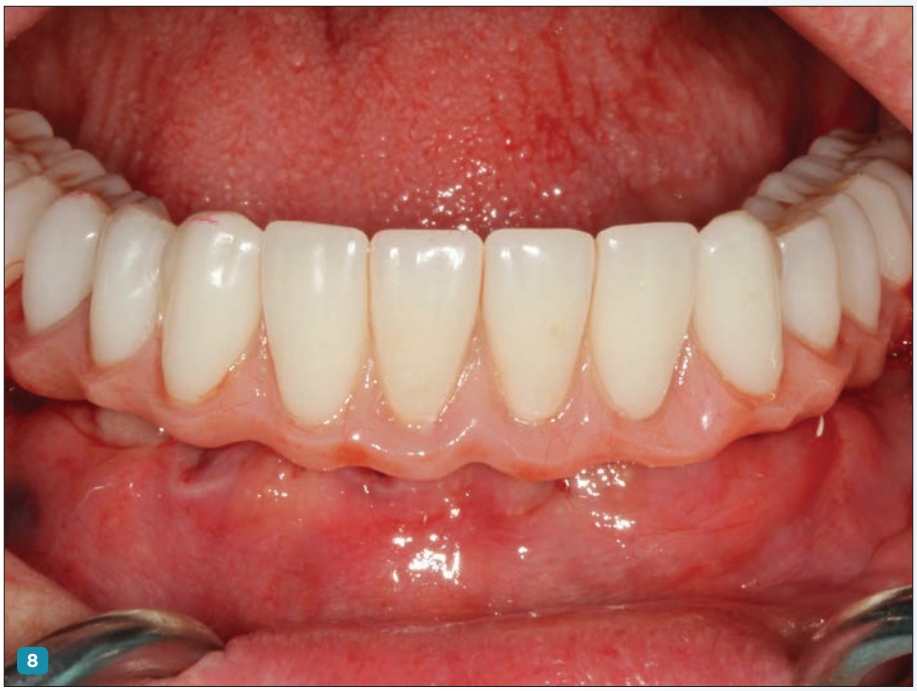


FIG 3. The teeth were extracted and a surgical guide was placed to allow minimally invasive osteotomy preparation through the surgical guide. The canine teeth were retained to assist the support of the surgical guide during osteotomy preparation procedures. FIG 4. Implants were placed into the prepared osteotomies, ensuring primary stability of the implants. FIG 5. LOCATOR F-Tx abutments were placed onto each implant and torqued. FIG 6. Block-out spacers and denture attachment housings were placed onto each abutment, allowing for angulation correction of the implants at the level of the abutment. FIG 7. CHAIRSIDE Light Body PVS material was placed into the intaglio of the denture and seated onto the edentulous ridge. Any areas of show-through were adjusted, preparing recesses within the intaglio of the prosthesis. The housings were picked up in the prosthesis using CHAIRSIDE Attachment Processing Material. FIG 8. Processing balls were removed and medium PEEK retention balls placed. The prosthesis was placed back onto each implant, ensuring firm seating of the abutments to the housings.

Rehabilitation of Failing Implant-Retained Overdentures Using a Novel Attachment System for Fixed Prostheses

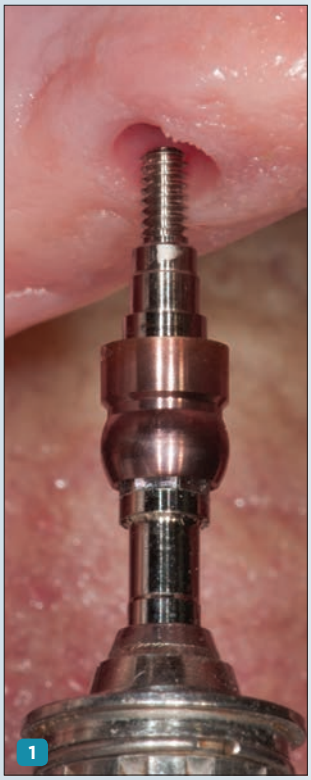
Nadim Z. Baba, DMD, MSD

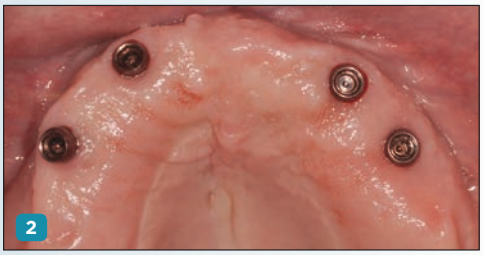
Repair of implant-retained overdentures can be time-consuming and costly, even in the hands of experienced clinicians. Patients frequently present requesting that their prosthesis be transformed from a removable prosthesis to a fixed one. This article will present a technique for the fabrication of an implant-supported fixed prosthesis that can be accomplished with minimal expense to both the patient and clinician.

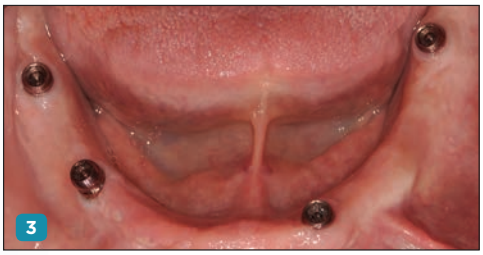
A 65-year-old male patient presented for a specialist consultation regarding his existing maxillary and mandibular implant-retained overdentures, complaining that his mandibular overdenture broke and "I cannot eat." The overdentures had been placed 11 years ago; both were retained with LOCATOR (Zest Dental Solutions, zestdent.com) from both arches. The patient's health questionnaire and medical history revealed no significant findings. He presented with no medical contraindications to prosthodontic treatment.

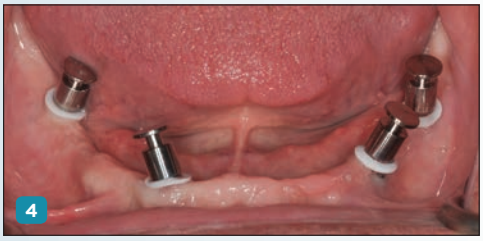
His main concern was to determine if it was possible for him to get a fixed prosthesis. Until the mandibular overdenture broke, the patient was very satisfied with the LOCATOR abutments. His vertical dimension of occlusion (VDO) and interarch space were evaluated and found to be acceptable. After the presentation of different treatment options, the patient consented to a treatment modality that consisted of an implant-supported, fixed full-arch prosthesis using the existing implants present in his jaws.

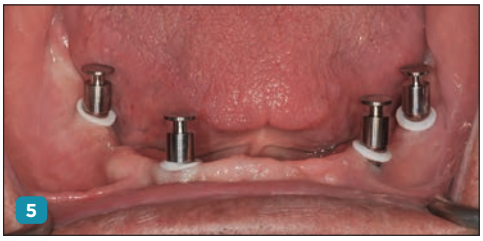
After removal of the LOCATOR abutments, the tissue height for each implant was measured with a periodontal probe, and LOCATOR F-Tx® abutments (Zest Dental Solutions) with the appropriate cuff height were

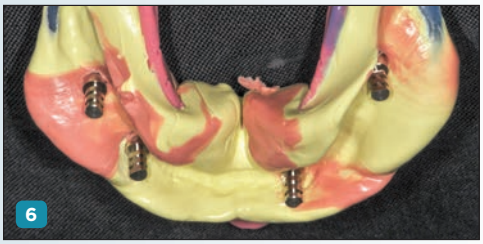


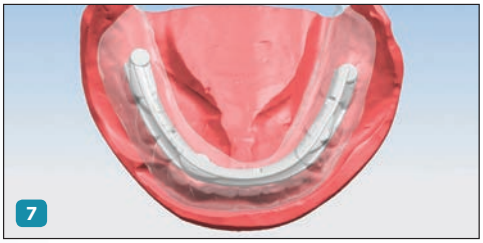












then ordered. The selected abutments were screwed in place using the abutment driver, and a calibrated torque wrench was used to torque each abutment according to the implant manufacturer's recommended torque value (Figure 1 through Figure 3). White block-out spacers were placed around the LOCATOR F-Tx abutments, and impression copings were seated on each abutment and aligned to be as parallel to each other as possible (Figure 4 and Figure 5). Due to the spherical coronal geometry of the abutments, it is possible to snap the impression copings in place and correct angulation up to 20 degrees from a common vertical.

Duplicates of the patient's maxillary and mandibular dentures were poured in cold-cure clear acrylic and adjusted, and a border molding impression and then a definitive impression were made using fast-set polyvinylsiloxane impression material. Care must be taken to ensure that the impression trays do not hit the impression copings causing them to tilt and lose their alignment. Because the impression trays were duplicate copies of the existing dentures and because the patient was satisfied with the current esthetics and phonetics, and considering that the VDO and interarch space were adequate, the trays were used to record centric relation with the use of a registration material. Subsequent to the final impression, the LOCATOR F-Tx abutment analogues were snapped onto each impression coping (Figure 6) and stone was poured to prepare a definitive cast.

The definitive maxillary and mandibular casts along with duplicates of the patient's existing dentures were sent to a dental device manufacturer (Cagenix, cagenix.com) for the design and milling of the metal frameworks for the final prostheses. After approval of the CAD designs, the milled frameworks were sent back to the laboratory for denture teeth set-up (Figure 7 through Figure 9).

Wax trial dentures were appraised to assess lip support, esthetics, and phonetics. Once patient consent was obtained, the trial dentures were sent to the laboratory for conventional processing. At the placement appointment, the block-out spacers were inserted on the LOCATOR F-Tx abutments and the denture attachment housings with new black processing balls were seated in place (Figure 10). Prior to seating the denture attachment housings, the black processing balls should be screwed in place with light finger pressure to avoid stripping and cross-threading. The milled recess in the intaglio surface of the metal framework of the definitive prosthesis will aid in the alignment of the prosthesis in the appropriate path of insertion onto the denture attachment housings. After patient consent of the esthetics and phonetics, the housings were dried, CHAIRSIDE® Attachment Processing Material (Zest Dental Solutions) was injected around the housings, and the prosthesis was seated in place.

Once the attachment processing material set, the prostheses were removed, the black processing balls were replaced with the appropriate PEEK retention balls, and the prostheses were delivered (Figure 11 and Figure 12).

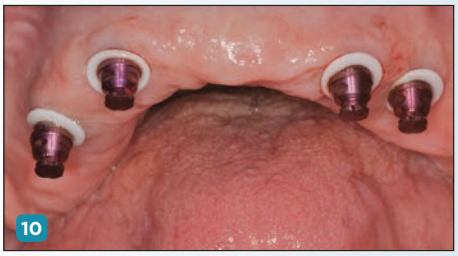
ABOUT THE AUTHOR

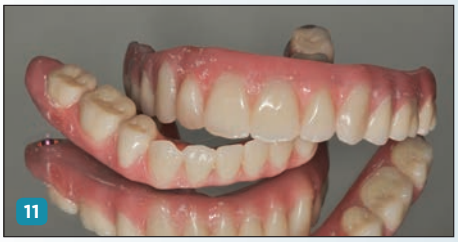
Nadim Z. Baba, DMD, MSD

Professor, Advanced Education Program in Prosthodontics, Loma Linda University, Loma Linda, California

DISCLOSURE:

The author is a consultant for Zest Dental Solutions.





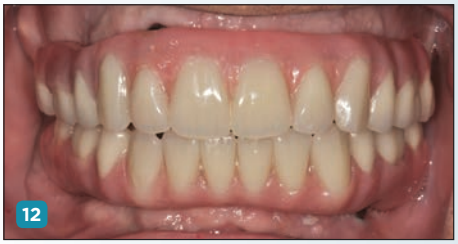


FIG 1. The LOCATOR F-Tx abutment driver was used to seat the abutments onto the implants. FIG 2. The abutments torqued onto the implants of the maxillary arch. FIG 3. The abutments torqued onto the implants of the mandibular arch. FIG 4. Impression copings with the black processing balls were seated on each abutment. FIG 5. Impression copings were aligned to each other as much as possible prior to the definitive impression of the edentulous jaw. FIG 6. Occlusal view of the analogues snapped into the impression copings of the mandibular definitive impression. FIG 7. CAD virtual design of the proposed mandibular framework for the prosthesis. FIG 8. Milled titanium framework for mandibular prosthesis. FIG 9. Milled recesses in the intaglio surface of the milled titanium framework for mandibular prosthesis. FIG 10. Seated denture attachment housings with new black processing balls on each of the maxillary abutments. FIG 11. Prostheses flasked and processed conventionally, polished, and ready for insertion. FIG 12. Frontal view of the definitive prostheses after insertion.

A Temporary Bridge to Develop a Patient's Smile for Fixed Maxillary Implant Restorations

Marius Steigmann, DDS

Developing an ideal implant-prosthetic therapy for an edentulous maxilla can be difficult when phonetic, functional, and esthetic deficits are present. Despite precise planning, after insertion of the definitive maxillary full-arch fixed restoration, the outcome is often less than optimal. This problem can be alleviated and a predictable result obtained by prototyping the patient's final smile, function, and phonetics using a temporary bridge that is easy to fabricate, insert, and remove—a technique that can be accomplished with the use of the LOCATOR F-Tx® Fixed Attachment System (Zest Dental Solutions, zestdent.com).

Many details must be addressed when creating a final fixed prosthetic restoration in an empty space. After tooth loss and the subsequent bone resorption and soft-tissue changes that accompany it, typical use of a full removable denture with pink acrylic changes the patient's phonetics and esthetics, as well as the muscular tension needed to hold a total removable denture. Ultimately, successful treatment involves many more factors than the osseointegration of the implant(s). Patients expect full function, good esthetics, and natural phonetics after a denture is replaced with a fixed implant-supported restoration. Fabrication and use of a temporary restoration can help ensure that these goals are attained.

Often any mismatches between the maxillary restoration and the facial aspect appear only after the insertion of the final high-cost restoration upon completion of treatment or when patients complain in the months following treatment. Flawed esthetics, phonetic deficiencies, or inadequate function are some of the shortcomings that can result, and these can be difficult to predict in advance when converting a patient from a conventional denture to a full-arch fixed restoration. The elimination of the labial flange, for example, can be a problem for patients who had been wearing a full denture in the maxilla; the flange that supported the lip for many years is no longer present. When the implant bridge is inserted, the lip support is lost. The face appearance changes, as do aspects of the soft tissue in the oral cavity. Such complications must be taken into consideration during the course of therapy and are especially problematic if the definitive restoration has already been inserted.

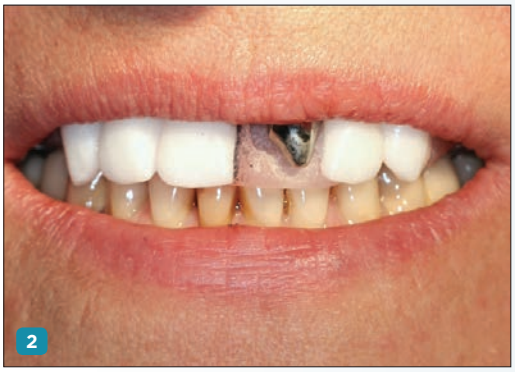
DISCLOSURE: *The author is a consultant for Zest Dental Solutions.*

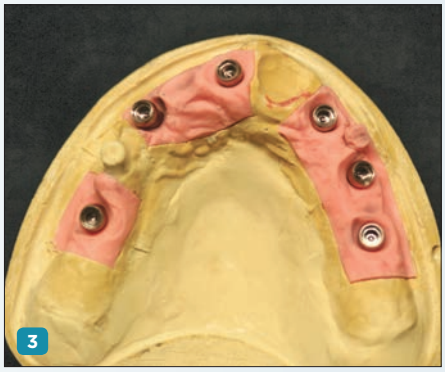
Long-term provisionals, which can be modified according to the facial esthetics, can be used to overcome these issues, and the LOCATOR F-Tx Fixed Attachment System can simplify the process. The fixed maxillary restoration can be precisely planned and is easy to both insert and remove by the dentist. The patient is afforded the opportunity to "test drive" the fixed bridge with regard to esthetics, function, and phonetics. Moreover, musculature and soft tissue are conditioned. Also, subjective factors on the part of the patient are determined during this trial period and modifications can later be incorporated into the final restoration.

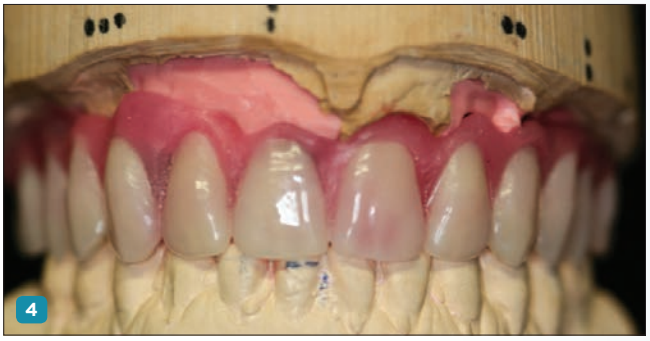
In the case presented (Figure 1 through Figure 10), the patient had a denture that was insufficient in the upper jaw. The prosthesis did not offer adequate support due to problems with reduced retention, nor did it meet the patient's esthetic desires. After a consultation with the patient it was decided that six implants would be inserted in the upper jaw. During the osseointegration period the patient wore the existing denture.

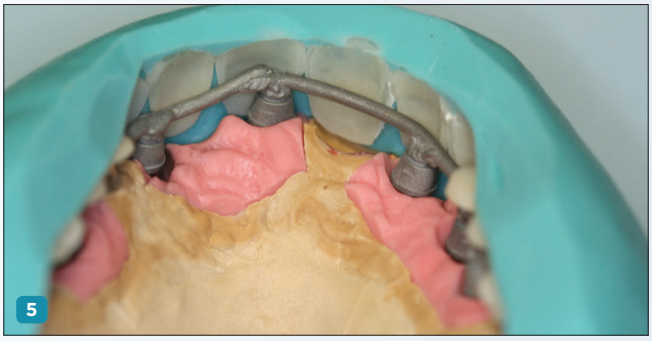
After osseointegration was achieved, a fixed metal-reinforced temporary bridge was fabricated using the LOCATOR F-Tx system, according to the patient's ideal occlusion, esthetics, phonetics, and function. The patient would need time to adjust to the new situation without a labial flange, as changing directly to the final fixed restoration could be a risk to both esthetics and phonetics. With the LOCATOR F-Tx solution, the patient is able to use the long-term temporary to get a feel for what the fixed implant-supported bridge will be like. Changes to facial expressions and phonetics, improvements in the outcomes of soft-tissue papillae, and mid-facial soft-tissue contour are among the factors that can be determined and fine-tuned during the time the patient wears the long-term temporary bridge. Moreover, all of this is achieved without cement or screws, allowing for quick and easy removal of the temporary bridge for any desired adjustments to the prosthesis during the trial period prior to designing and finalizing the definitive fixed prosthesis.

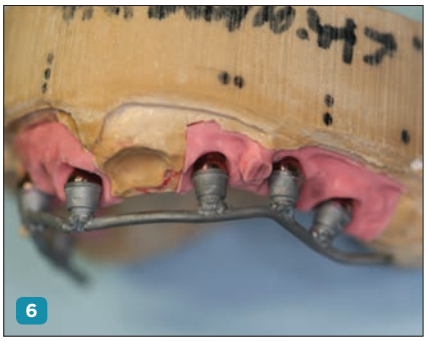
ABOUT THE AUTHOR
Marius Steigmann, DDS
Private Practice, Neckargemünd, Germany

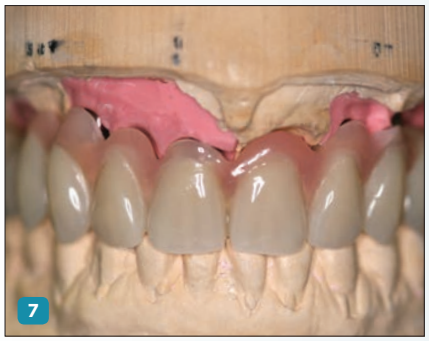


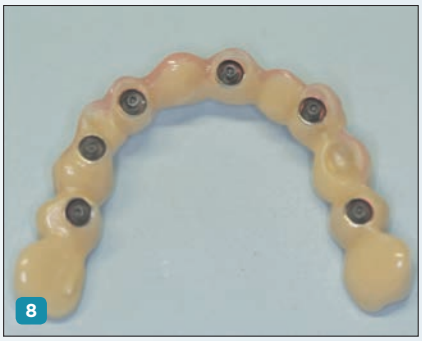


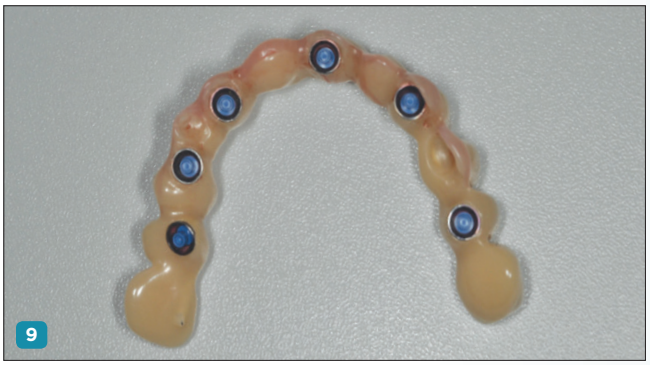












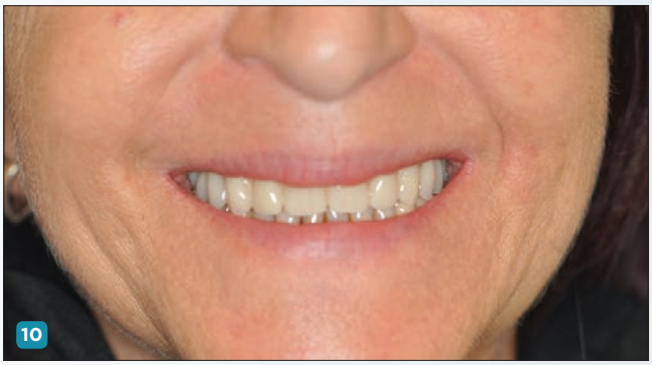


FIG 1. The patient presented with a partial denture retained by two telescopic crowns, with those two teeth failing and the denture becoming mobile. She wanted a fixed implant-retained bridge, but first it had to be determined whether such a solution was possible based on her anatomical situation and desired esthetic outcome. **FIG 2.** Before surgery the smile was prototyped in the ideal situation. This prototype was then used to position the implants in an ideal prosthetic position and help the clinician decide if a fixed implant-retained restoration was possible. **FIG 3.** Cast after implant-level impression, with LOCATOR F-Tx abutments inserted. **FIG 4.** The design of the teeth for the long-term temporary bridge, developed in the laboratory. **FIG 5.** After the ideal teeth positioning had been determined, acrylic veneers were connected to a metal frame. **FIG 6.** After insertion of the housings on the LOCATOR F-Tx abutments and making them parallel, they were welded in the dental lab with a titanium wire for cross-arch stabilization and reinforcement of the temporary bridge. **FIG 7.** Final metal-reinforced temporary bridge was fabricated with the ideal smile designed. This bridge was then prepared for insertion on the LOCATOR F-Tx abutments. **FIG 8.** Final bridge with the black processing balls for the initial positioning of the bridge. **FIG 9.** The processing balls were then replaced with the blue retention balls to provide fixed stability for the bridge, but allow for easy clinician removal for adjustments. **FIG 10.** Ideal smile and lip support 6 months after insertion of the LOCATOR F-Tx supported bridge. By allowing the patient to test phonetics, function, esthetic outcome, and muscular adaptation, a new definitive bridge can be fabricated.

Salvaging the Fixed Full-Arch Screw-Retained Prosthesis Using Novel Fixed Attachment System After Late Implant Failure

Alan M. Meltzer, DMD, MScD; and Robert Del Castillo, DMD

ABSTRACT

Implant-supported prostheses contribute to many positive life-altering benefits for edentulous individuals by eliminating the disadvantages associated with conventional removable dentures. Unfortunately, despite diligent treatment planning and efforts to mitigate complications, dental implants supporting fixed full-arch restorations occasionally fail. When such failures occur after osseointegration and attachment of the prosthesis, the complications can be particularly troublesome, costly, time-consuming, and uncomfortable for patients. The increased use of a novel fixed attachment system as a cost-effective approach to converting existing dentures to a fixed full-arch provisional prosthesis as well as use in a definitive fixed prosthesis has encouraging implications when clinicians are faced with salvaging full-arch fixed screw-retained restorations after late implant failure.

LEARNING OBJECTIVES

- Discuss the implications of late failures of implants supporting fixed full-arch restorations.
- Explain the challenges traditionally involved with salvaging an existing full-arch restoration after a supporting implant fails.
- Describe a chairside technique for salvaging an existing full-arch implant-supported restoration after implant failure using a technique to retrofit and salvage the existing prosthesis chairside.
- Discuss the characteristics of a novel fixed attachment that facilitates salvaging a full-arch restoration after late implant failure.

DISCLOSURE:
The authors occasionally receive honoraria from Zest Dental Solutions for lecturing engagements.

Endosseous osseointegrated implants have gained in popularity among edentulous individuals based on their ability to stabilize, retain, and support full-arch overdentures or full-arch restorations.[1-3] By eliminating the disadvantages associated with conventional removable dentures, implant-retained or supported prostheses contribute to many positive life-altering benefits for edentulous individuals, including a better ability to eat the foods they want for enhanced nutritional intake; improved comfort by eliminating movement and sore spots; and greater self-confidence, enhanced facial esthetics, and self-esteem.[1,4,5]

Success of implant-supported or -retained prostheses, in general, is predicated on meticulous patient selection and preplanning multiple treatment aspects. Patient selection criteria must consider the individual's oral health status, periodontal risk, hygiene habits and ability, and potential occlusal issues. Prosthetic considerations include, but are not limited to, restoration design; implant type, width, and length; implant location and angulation; and abutment/connection type.[6,7] Then, employing excellent surgical techniques and controlling conditions that could affect treatment longevity (eg, retained cement, divergent abutment/connection angles, nonpassive fit) will help to ensure clinical success.[8]

However, despite diligent treatment planning and efforts to mitigate complications, dental implants occasionally fail, without any specific indication or the clinician's ability to determine which implant will fail, if any.[8] This situation is particularly troublesome in cases involving late implant failures that occur after implant osseointegration. Late implant failures have been associated with moderate to severe bone loss, a larger number of failed implants per patient, a higher incidence in male patients, and occurrence mostly in posterior areas.[9] They have also been associated with functional occlusal overload when implant failure involves fracture of the components of the implant restoration, whether a single restoration or a mandibular overdenture retained by two implants.[10]

In cases involving full-arch implant-supported restorations, late implant failure can be particularly catastrophic due to the implant failure's impact on the prosthetic component of treatment. For example, the complete loss of an implant in a full-arch prosthesis supported by four implants will render the treatment unstable. Alternatively, the catastrophic loss of an implant may limit the size or extension of the planned or already functioning prosthesis.

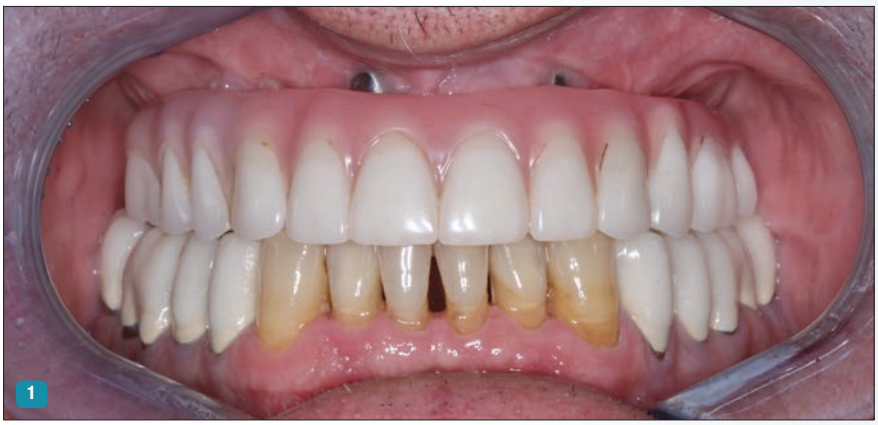
Therefore, the quandary that clinicians face is ascertaining whether sufficient implants remain in the appropriate location to support and

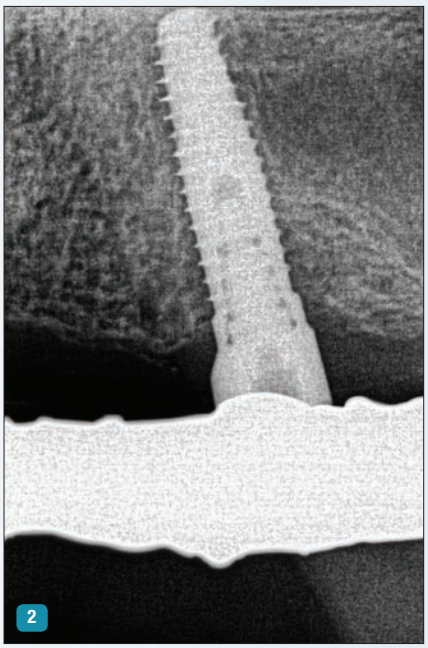
sustain the original prosthesis. If so, depending on the nature of the failure, the failing implant can be removed or covered,[11] and the original prosthesis can be secured to the remaining implants. If not, the challenge becomes determining whether a new implant can be placed, either at or to the mesial or distal aspect of the failed site, in addition to how best to alter the existing prosthesis so it will be acceptable to the patient in consideration of the new implant.

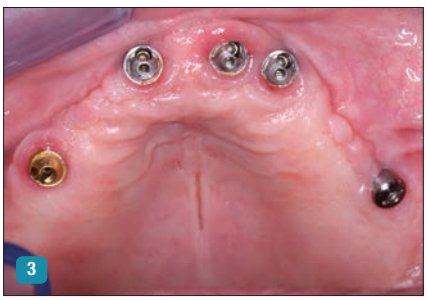
For patients, late implant failure is synonymous with additional costs, procedures, and recovery time.[12] Considering that pain, cost, and recovery time are among the three key concerns for patients facing any implant procedure,[3] it behooves clinicians to familiarize themselves with simplified, cost-effective chairside procedures for salvaging implant-supported fixed full-arch prostheses for those instances when implant failures occur.

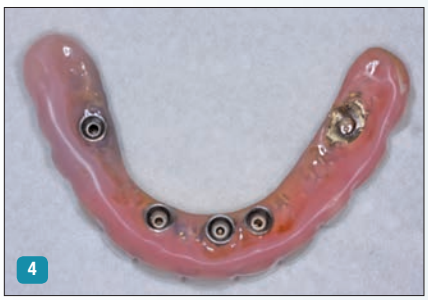
NOVEL ATTACHMENT SYSTEM FOR SALVAGING A SCREW-RETAINED PROSTHESIS

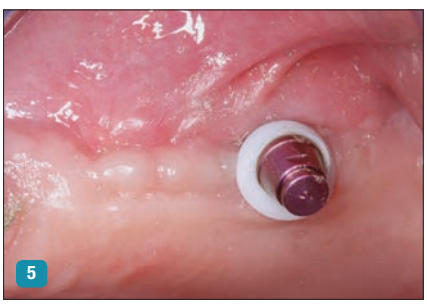
LOCATOR removable attachments for retaining implant overdentures have become an increasingly routine, lower-cost alternative to more complex and costly fixed implant prosthetic options.[13] Contributing to their routine use are simple, predictable, and efficient chairside processing techniques, in addition to subsequently decreased laboratory fees, appointments, and chair time.[13] Building upon the success of the LOCATOR removable attachments, Zest Dental Solutions has developed a new fixed attachment system that does not require the use of screws or cement. The new LOCATOR F-Tx® Fixed Attachment System is indicated for the rigid connection of partial (with cross-arch stabilization) and full-arch restorations on endosseous dental implants in the maxilla or mandible and can be used to stabilize newly fabricated full-arch restorations (eg, PMMA, zirconia) or convert a patient's existing full denture to a temporary fixed bridge. LOCATOR F-Tx abutments demonstrate a spherical coronal geometry that, in conjunction with a Denture Attachment Housing, can be tilted and rotated up to 20 degrees from a common vertical. This allows for positioning in the ideal location and angulation for the prosthesis, without the need for an angled abutment utilized in off-axis implant placement for screw- or cement-retained options.[15,16] The











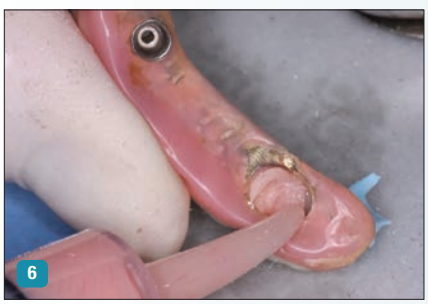
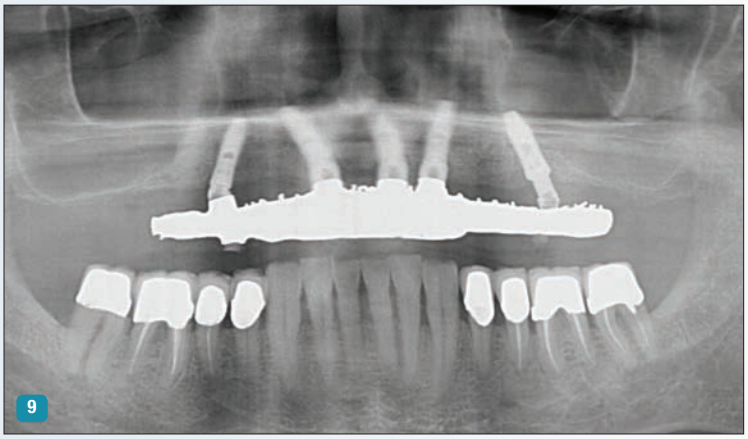


FIG 1. Preoperative retracted facial view of a 61-year-old man who presented with a failing maxillary hybrid prosthesis. FIG 2. Preoperative radiograph revealing the failing implant at No. 13 that would be explanted; then the site would be curetted and a new, wider-diameter implant placed. FIG 3. A healing abutment was placed on the new implant. FIG 4. The existing framework was modified to allow the healing abutment to provide an occlusal stop on the underside of the framework. FIG 5. A spherical 4-mm fixed LOCATOR F-Tx abutment was placed into the implant at No. 13. FIG 6. A denture attachment housing was then luted to the existing modified framework.



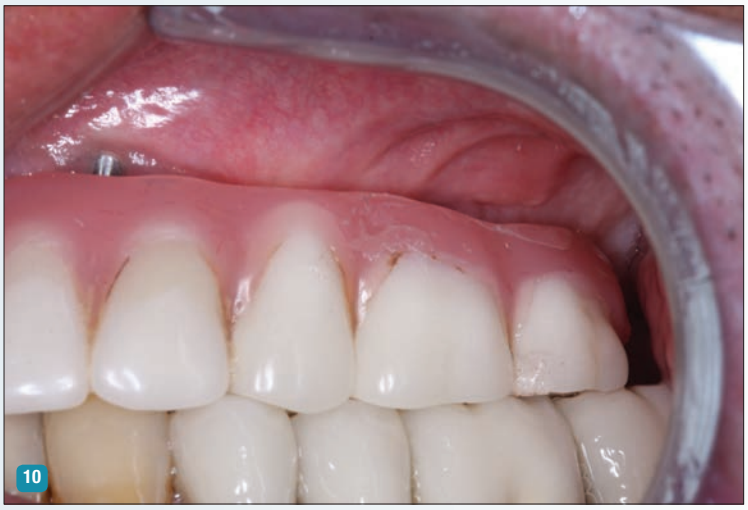


FIG 7. View of the black processing ball before removal. FIG 8. The underside of the prosthesis was then cleaned, adjusted, and polished. FIG 9. Postoperative radiograph confirming osseointegration. FIG 10. Left-lateral close-up view illustrating the ideal esthetics and fit achieved with the LOCATOR F-Tx attachment.

LOCATOR F-Tx attachment system eliminates this need for angled abutments and ensures a stress-free, passive fit of the prosthesis.

These characteristics have beneficial implications for salvaging full-arch restorations after implant failure and placement of a new implant in the same site. The following cases demonstrate the treatment planning and chairside protocol involved with using a unique attachment system to salvage full-arch implant-supported restorations after late implant failures.

CASE PRESENTATION 1

A 61-year-old man residing in Ohio was referred to the author's New Jersey practice for diagnosis and treatment of a failing maxillary hybrid prosthesis (Figure 1). The patient's maxillary teeth had been extracted in June 2011, when five implants were placed. Restoration of the maxillary arch was completed in April 2012. Aside from a sensitivity to aspirin and taking 20 mg of atorvastatin per day, the patient's medical history was negative.

When the patient presented in March 2016, the definitive hybrid (fixed-removable) prosthesis was removed, revealing radiographic and clinical evidence of a failed implant in the area of tooth No. 13 (Figure 2). The patient returned in May, at which time the maxillary prosthesis was removed and the implant at site No. 13 explanted. The site was curetted, and a wider-diameter implant was immediately inserted into the explanted site, producing excellent primary stability. A healing abutment was then placed on the new implant, and the existing framework was modified, allowing the healing abutment to provide an occlusal stop on the underside of the framework (Figure 3 and Figure 4).

The patient returned in August 2016, when the maxillary prosthesis and healing abutment were removed. A LOCATOR F-Tx abutment was placed into the implant at No. 13 (Figure 5).

The existing prosthesis framework was then modified, and the system denture attachment housing was luted to the framework using a chairside acrylic material (Figure 6). The underside of the prosthesis was cleaned, adjusted, and polished (Figure 7). The prosthesis was delivered using a medium PEEK retention ball (tan) to secure the prosthesis at this site, snapping into the abutment; the remainder of the prosthesis continued to be retained by prosthetic screws in the sites with screw-retained abutments (Figure 8). A postoperative radiograph confirmed osseointegration (Figure 9), and a left-lateral close-up view illustrated the ideal esthetics and fit achieved with the LOCATOR F-Tx fixed attachment. (Figure 10).

CASE PRESENTATION 2

A 74-year-old woman was referred for treatment of extensive and unesthetic wear of her mandibular teeth (Figure 11 and Figure 12). Her left posterior tooth and right posterior and premolar teeth were implants; three different implant systems had been previously placed by the same dentist on the same day. Her maxillary teeth had been previously restored with zirconia full-coverage restorations.

The treatment plan proposed and accepted by the patient involved extracting her remaining mandibular teeth, placing three additional implants, and providing a full-arch implant-supported prosthesis. An alternative that was also presented was completely rehabilitating her lower arch, which would have required endodontic treatment of all remaining teeth, extensive prosthetic work on the existing implants and natural teeth, and substantial cost.

Immediate Load and Provisionalization

An immediate load of the lower arch was performed after three additional implants were placed. The patient wore an immediate provisional for 6 months, but due to her very aggressive grinding and clenching habit and despite wearing an occlusal night guard, the prosthesis was replaced because she wore the occlusal surface down to the metal frame. A second provisional prosthesis was provided that the patient also wore down after approximately 14 months.

Prototype and Zirconia Overdenture Fabrication

Therefore, the patient was advised that a full zirconia screw-retained prosthesis would be best to help prevent continued destruction. A polymethyl methacrylate (PMMA) acrylic prototype screw-retained bridge was first made by the laboratory using a digital scan of the tooth setup, which enabled the patient to function for 2 months and approve the anticipated size, color, and shape of the proposed zirconia definitive prosthesis. Any occlusal adjustments required could also be made.

After it was determined that all aspects of the PMMA prototype were acceptable, the laboratory was instructed to proceed with milling the definitive full-arch zirconia screw-retained bridge using the previously acquired scan file. No occlusal adjustments were necessary.

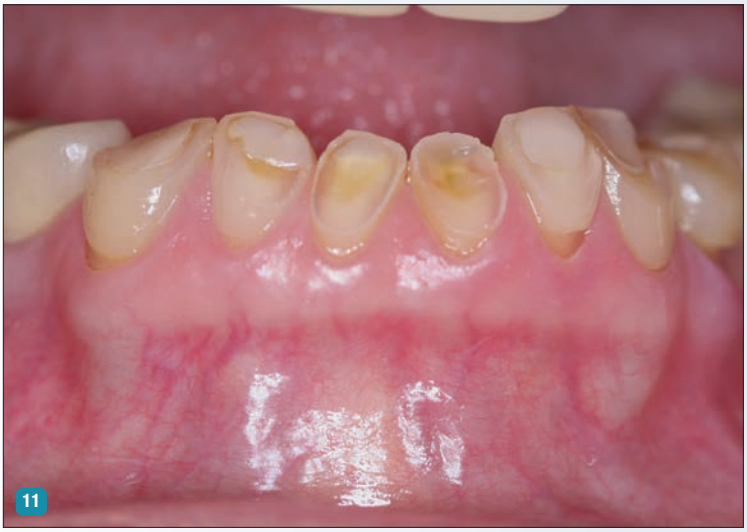
On completion of the full zirconia screw-retained bridge, the patient returned for the delivery appointment and requested anesthesia during placement. She indicated she had felt a slight "twinge" on the lower right side during previous appointments when checking her bite.

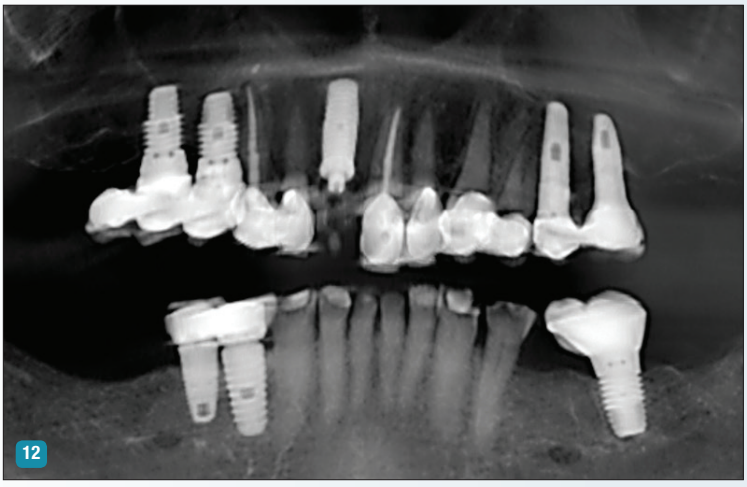
Anesthesia was administered, after which the retaining screws were removed from the PMMA interim screw-retained prosthesis beginning at the distal left. However, the distal right screw could not be removed; the prosthesis and implant came out as one unit after pulling (Figure 13). Based on the distance between where the implant had been and where the next implant was in the front (ie, one of the newly placed implants), engagement of the interim screw-retained prosthesis would now have to occur at the previously placed implant site. However, because the laboratory advised that the implant at that site should be buried, resulting in a potentially large cantilever on the posterior right side, three options were considered:

1. Attempt to place an implant further back, which was contraindicated due to the patient's insufficient bone in that area.
2. Place a new implant at the site of the failed implant if sufficient bone remained, either buccally or lingually.
3. Graft the failed implant site and replace failed implant with a new implant in the same position after healing takes place in the grafted site.

Immediate PMMA Retrofitting

A new computed tomography (CT) scan was taken to ascertain the location and amount of available bone and identify the location of the alveolar nerve. It was determined that the best approach would be curetting the failed implant site and placing a new, larger (ie, wider and longer) implant. All granulation tissue was curetted from the implant site and, without drilling an osteotomy, a new tapered implant was threaded into the site. The new implant must be placed within 20 degrees of the path of insertion of the existing prosthesis. The implant at No. 28 was not compatible with the full-arch zirconia protocol because of its restorative limitations, so the screw-retained abutment was removed and replaced with





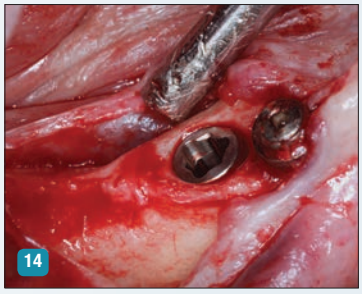


FIG 11. Preoperative close-up retracted facial view revealed extensive and unesthetic mandibular tooth wear. FIG 12. Preoperative radiograph revealed the location and spacing of previously placed implants. FIG 13. The posterior right screw retaining the PMMA prosthesis the patient wore for 2 months did not come out until the prosthesis was pulled, at which time the entire implant came out. FIG 14. The failed implant site was curetted, and a new wider and longer implant was placed without osteotomy.

an implant cover screw to take this implant out of service for the restoration. (Figure 14).

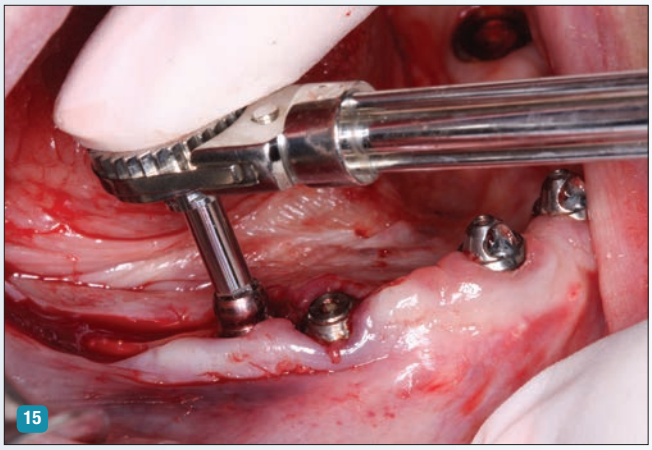
Enabling the patient to continue functioning with the existing PMMA screw-retained prosthesis required "salvaging" or "retrofitting" it to accommodate the new implant arrangement. This was easily accomplished using a LOCATOR F-Tx Fixed Attachment System that supports full-arch restorations on endosseous dental implants without prosthetic screws or cement.

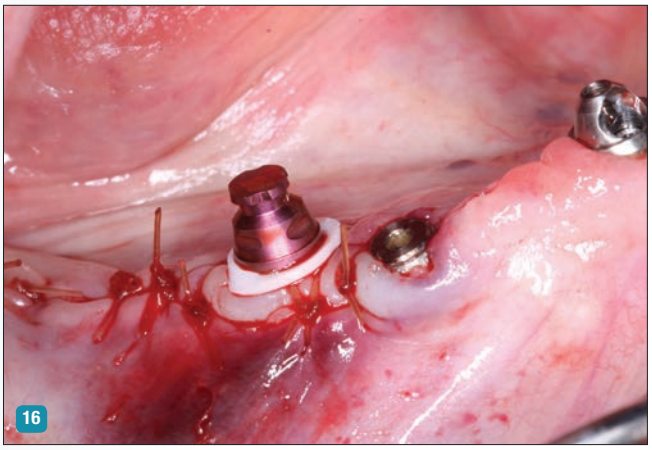
The spherical abutment of the appropriate cuff height was selected and torqued into place using a dedicated abutment driver (Figure 15). Considering the need to immediately retrofit the patient's PMMA screw-retained bridge, as well as anticipate retrofitting the already fabricated full zirconia prosthesis, using an abutment with a spherical geometry that enables the denture attachment housing to pivot in any direction would be significant to ensuring a stress-free, passive fit and proper prosthesis alignment.[17,18]

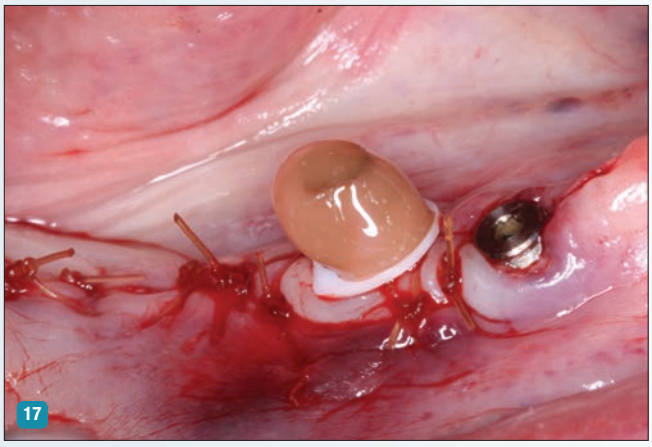
After achieving primary closure with a 4.0 chrome gut suture (Figure 16), a denture attachment housing and white spacer were placed onto the LOCATOR F-Tx abutment and pivoted into the correct orientation (Figure 17), creating an easily drawn path of insertion and removal for the PMMA prosthesis. To limit vertical and rotational movement, contribute to stability, and lock the prosthesis into place, the denture attachment housing features grooves and flats that ensure the housings remain locked into place within the prosthesis. Internally threaded to accept polyether ether ketone (PEEK) retention balls and a processing ball that snaps into the abutment, the attachment housing eliminates otherwise intensive chairside procedures to retain the screw-retained prosthesis.

To retrofit and salvage the PMMA prosthesis, a slow-speed handpiece and trephine bur were used to remove the screw-retained metal cylinder embedded in the interim prosthesis at the failed implant site. After removal, CHAIRSIDE Attachment Processing Material was placed into the recess created within the prosthesis and onto the denture attachment housing.

The existing prosthesis was then seated into the patient's mouth, engaging the ball into the abutment and then securing the rest of the prosthesis using the existing prosthetic screws for the screw-retained abutments (Figure 18). The patient closed into light occlusion and held that position while the material set. To accelerate setting, an ultraviolet (UV) light was used for two 20-second cycles each from the buccal and lingual aspects. The screws were then removed, after which the prosthesis was removed. The prosthesis was then disengaged from the LOCATOR F-Tx abutment disconnecting







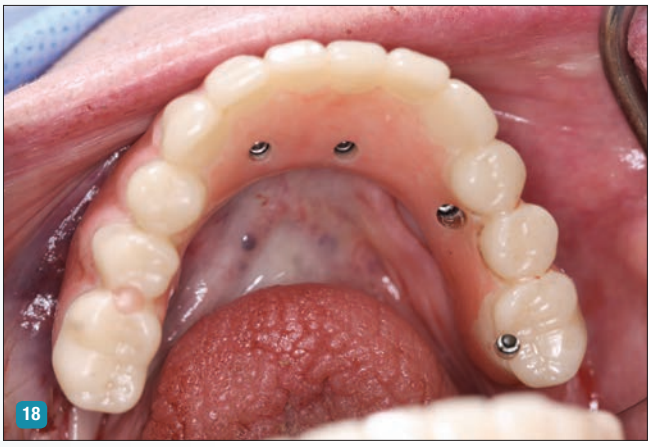


FIG 15. The LOCATOR F-Tx abutment was torqued into place. FIG 16. Primary closure was achieved using a 4.0 chrome gut suture. FIG 17. A denture attachment housing and white spacer were placed onto the LOCATOR F-Tx abutment and pivoted into the correct position and angulation. FIG 18. The overdenture was then seated and secured using the original fixation screws.

the black processing ball captured in the denture attachment housing, now picked up in the newly hollowed-out recess in the existing prosthesis.

The black processing ball was removed and replaced with a protective polishing cap using the dedicated retention ball hex driver, and any voids present around the denture attachment housing were back-filled with additional material and light-activated. A polishing bur was used to remove any excess material and to polish the intaglio surface. The polishing cap was removed, and green PEEK high retention ball was selected.

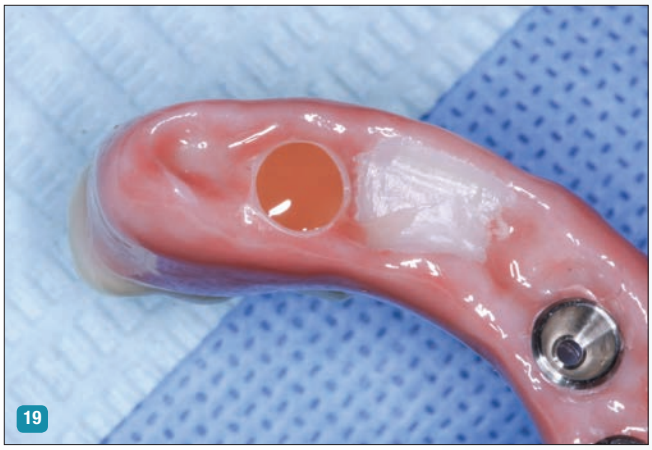
The prosthesis was then seated by first engaging the green retention ball in the LOCATOR F-Tx abutment and then maneuvering the prosthesis so the cylinders align over the screw-retained abutments. The prosthetic retaining screws were reattached to the screw-retained abutments securing the prosthesis to the rest of the implants. The patient was dismissed and allowed to heal for 3 months.

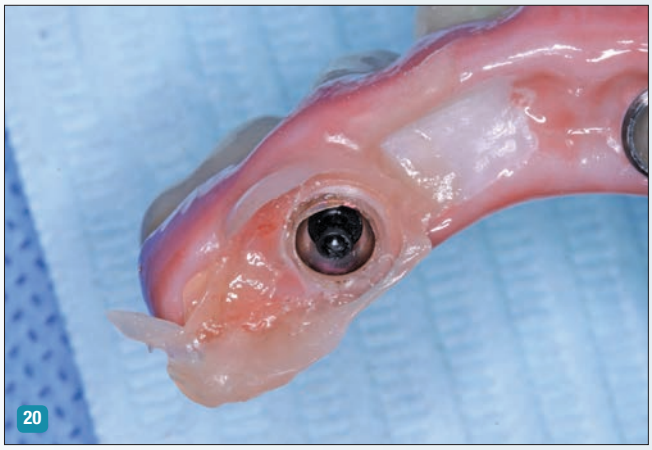
Retrofitting a Full Zirconia Restoration

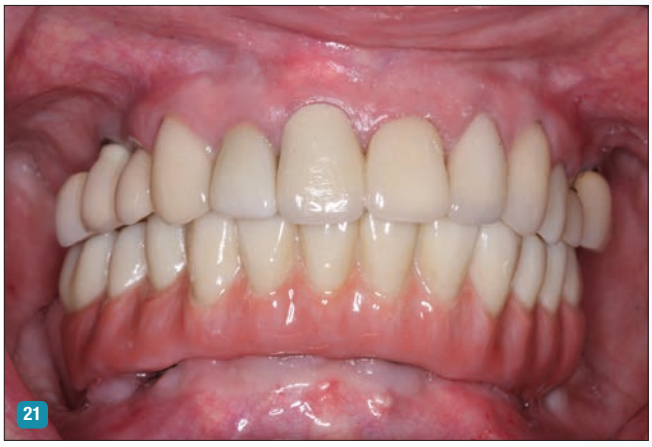
After 3 months, radiographs confirmed that the new rescue implant demonstrated excellent bone up to the platform, so the decision was made to replace the salvaged PMMA overdenture with the definitive full zirconia restoration. However, rather than mill a new restoration without the screw metal cylinder at the failed implant site, the patient agreed to try to salvage the previously fabricated full zirconia prosthesis and the metal screw-retained cylinder was drilled out of the prosthesis creating a recess to accept the denture attachment housing of the LOCATOR F-Tx Fixed Attachment System.

The right distal implant screw cylinder was drilled out, without fracturing the zirconia. To gauge the size required of the new recess hole, a denture attachment housing was placed on an analogue, and attempts to insert it into the recess indicated that a larger hole was required. The recess was enlarged to seat the entire denture attachment housing, and the intaglio surface of the zirconia restoration was adjusted to accommodate the cover screw of the buried implant and allow proper seating.

Intraorally, a new denture attachment housing and white spacer were placed onto the LOCATOR F-Tx abutment and pivoted into the correct position and angulation. To prepare the enlarged recess for the addition of the chairside attachment material, which otherwise could not be bonded to the zirconia restoration, a diamond bur was used to undermine the recess walls, similarly to a 360° undercut. The dual/







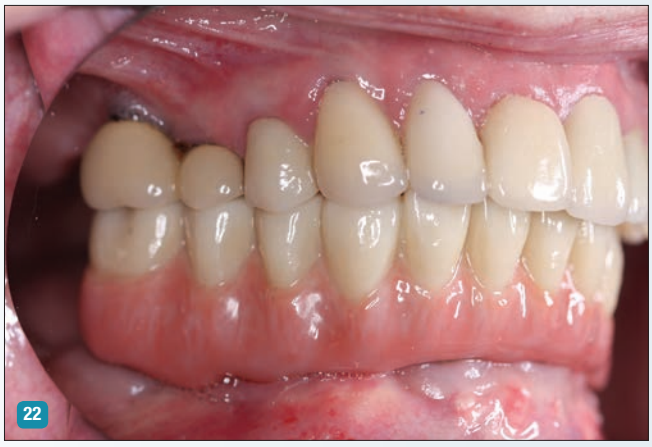


FIG 19 AND FIG 20. Attachment material was placed into the enlarged, undercut recess before seating in the patient's mouth for 10 minutes to pick up the denture attachment housing and black processing ball. **FIG 21 AND FIG 22.** Postoperative close-up retracted facial view and right lateral view of the patient with her full zirconia implant-supported restoration that was salvaged using the fixed locator system.

light-cured material was placed into the recess and allowed to set (Figure 19). Although the UV light would not penetrate the zirconia to cure the material in the recess, it was used for curing any excess flash material.

As in the process followed for the PMMA interim prosthesis, the full zirconia restoration was seated into the patient's mouth, placed onto the denture attachment housing, and secured in place to the remaining screw-retained abutments using the prosthetic retention screws. After 20 minutes, the screws were removed, and the prosthesis was removed by dislodging the black processing ball attachment that was picked up in the denture attachment housing (Figure 20).

Chairside processing of the full zirconia prosthesis continued according to the protocol followed for the PMMA interim fixed prosthesis. The black processing ball was removed and replaced with a protective polishing cap, excess flash material was removed with a laboratory bur and polishing wheel, and the polishing protector was replaced with a high-retentive green PEEK retention ball.

Delivering the Salvaged Full Zirconia Prosthesis

The retrofitted and salvaged full zirconia prosthesis was then reseated; proper and full seating of the green retentive ball was confirmed by an audible clicking sound. The prosthesis was then secured to the screw-retained abutments. The screw access holes were then sealed using polytetrafluoroethylene tape and either pink (eg, in gingival areas) or tooth-colored (eg, premolar area) acrylic material (Figure 21 and Figure 22). Considering the patient's aggressive grinding habit, her occlusal night guard was adjusted to ensure a correct fit to the new prosthesis.

CONCLUSION

The value, service, and benefits of salvaging implant-supported prostheses cannot be overstated. After patients endure initial extractions and implant placement, along with immediate load and function of their arch(es), and anticipate or undergo delivery of their final prosthesis, a late implant failure after osseointegration can be costly, time-consuming, and disheartening. As demonstrated in the cases presented in this article, the use the LOCATOR F-Tx Fixed Attachment System as a cost-effective, efficient, and predictable approach to salvaging full-arch restorations after late implant failure has promising and beneficial implications.

ABOUT THE AUTHORS

Alan M. Meltzer, DMD, MScD

Clinical Professor, Division of Post Graduate Periodontics, University of Pennsylvania, Philadelphia, Pennsylvania; Private Practice in Periodontics and Implant Dentistry, Voorhees, New Jersey

Robert Del Castillo, DMD

Private Practice Limited to Periodontics, Implant, and Regenerative Therapies, Miami Lakes, Florida

REFERENCES

1. Vogel RC. Implant overdentures: a new standard of care for edentulous patients—current concepts and techniques. *Compend Contin Educ Dent*. 2008;29(5):270-276.

2. Little D, Apparicio T. Aesthetic denture rehabilitation. *Dent Today*. 2012;31(1):120-123.

3. DiMatteo A. Dentures and implants: bringing them together for a winning combination. *Inside Dentistry.* 2009;5(1):97-104.

4. Morais JA, Heydecke G, Pawliuk J, et al. The effects of mandibular two-implant overdentures on nutrition in elderly edentulous individuals. *J Dent Res*. 2003;82(1):53-58.

5. Heydecke G, Thomason JM, Lund JP, Feine JS. The impact of conventional and implant supported prostheses on social and sexual activities in edentulous adults: results from a randomized trial 2 months after treatment. *J Dent*. 2005;33(8):649-657.

6. Rossi R, Morales RS, Frascaria M, et al. Planning implants in the esthetic zone using a new implant 3D navigation system. *Eur J Esthet Dent*. 2010;5(2):172-188.

7. Tischler M. Treatment planning implant dentistry: an overview for the general dentist. *Gen Dent*. 2010;58(5):368-374.

8. Ashley ET, Covington LL, Bishop BG, Breault LG. Ailing and failing endosseous dental implants: a literature review. *J Contemp Dent Pract*. 2003;4(2):35-50.

9. Manor Y, Oubaid S, Mardinger O, et al. Characteristics of early versus late implant failure: a retrospective study. *J Oral Maxillofac Surg*. 2009;67(12):2649-2652.

10. Di Iorio D, Sinjari B, Feragalli B, Murmura G. Biomechanical aspects in late implant failures: scanning electron microscopy analysis of four clinical cases. *J Contemp Dent Pract*. 2011;12(5):356-360.

11. Yilmaz B, McGlumphy E. A technique to salvage a single implant-supported fixed dental prosthesis having a nonretrievable implant screw fragment. *J Oral Implantol*. 2013;39(1):81-83.

12. Levin L. Dealing with dental implant failures. *J Appl Oral Sci*. 2008;16(3):171-175.

13. Priest G. Efficient placement of implant overdenture attachments. *Dent Today*. 2011;30(12):58-60, 62.

14. Strong SM. The spare implant overdenture: retrofitting an existing denture to Locator attachments. *Gen Dent*. 2011;59(1):20-22.

15. Wilson TG Jr. The positive relationship between excess cement and peri-implant disease: a prospective clinical endoscopic study. *J Periodontol*. 2009;80(9):1388-1392.

16. Linkevicius T, Puisys A, Vindasiute E, et al. Does residual cement around implant-supported restorations cause peri-implant disease? A retrospective case analysis. *Clin Oral Implants Res*. 2013;24(11):1179-1184.

17. Ferrare N, Leite AF, Caracas HC, et al. Cone-beam computed tomography and microtomography for alveolar bone measurements. *Surg Radiol Anat*. 2013;35(6):495-502.

18. Van Assche N, van Steenberghe D, Guerrero ME, et al. Accuracy of implant placement based on pre-surgical planning of three-dimensional cone-beam images: a pilot study. *J Clin Periodontol*. 2007;34(9):816-821.

Salvaging Fixed Full-Arch Screw-Retained Prosthesis Using Novel Fixed Attachment System After Late Implant Failure

Alan M. Meltzer, DMD, MScD; and Robert Del Castillo, DMD

1. **Why have osseointegrated implants gained in popularity among edentulous patients?**
   a. They have the same disadvantages as conventional removable dentures.
   b. They stabilize dentures.
   c. They enhance their ability to eat.
   d. Both b and c

2. **Patient selection criteria for implant-supported or -retained prostheses include which of the following?**
   a. periodontal risk
   b. hygiene habits
   c. age
   d. Both a and b

3. **When preplanning implant-supported or -retained prostheses, considerations include which of the following?**
   a. restoration design
   b. implant type
   c. abutment/connection type
   d. All of the above

4. **Which of the following is associated with late implant failures?**
   a. adequate quantity of bone
   b. higher incidence in female patients
   c. higher incidence in male patients
   d. occurrence mostly in anterior areas

5. **The quandary clinicians face when dealing with the late failure of implants supporting and/or retaining overdentures or full-arch restorations involves what?**
   a. whether remaining implants are in the appropriate location to support the original prosthesis
   b. whether there are sufficient implants remaining to support the original prosthesis
   c. how best to use the existing prosthesis without alteration
   d. Both a and b

6. **For patients, late implant failure is synonymous with:**
   a. additional costs, procedures, and recovery time.
   b. additional costs only.
   c. additional procedures only.
   d. additional recovery time only.

7. **Fixed locator attachments are increasingly being used based on what reasons?**
   a. They offer simple, efficient, and predictable chairside processing techniques.
   b. They typically involve decreased laboratory fees and chair time.
   c. They are cost-effective.
   d. All of the above

8. **Which of the following statements characterizes the fixed attachment system discussed in the article?**
   a. It supports full-arch prostheses in the mandible and maxilla without prosthetic screws, cement, or angled abutments.
   b. It is not indicated for rigid connection of full-arch restorations onto endosseous dental implants.
   c. The locator attachments cannot rotate in any direction.
   d. It does not eliminate the need for angled abutments.

9. **In the case presentation, enabling the patient to continue with the existing PMMA screw-retained prosthesis required:**
   a. salvaging it.
   b. refining it.
   c. taking a CT scan of it.
   d. None of the above

10. **When the fixed attachment system is used, prostheses can be removed:**
    a. only by a dentist.
    b. only by a patient.
    c. by a dentist or patient.
    d. by any healthcare professional.

PAYMENT **INFORMATION**

CIRCLE YOUR ANSWERS ABOVE & COMPLETE THE INFORMATION BELOW, OR LOG ON TO COMPENDIUMCE.COM/GO/1729.

☐ **CHECK** (payable to AEGIS Communications)

☐ **CREDIT CARD** Please complete information and sign below: ☐ VISA ☐ MC

Exp. Date: Month/Year ☐☐ / ☐☐☐☐

CVV Code ☐☐☐

Card Number ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

SIGNATURE _____ DATE _____

(PLEASE PRINT CLEARLY)

ADA Number ☐☐☐☐☐☐☐☐☐

LAST 4 DIGITS OF SSN ☐☐☐☐

AGD Number ☐☐☐☐☐☐

Month/Day of Birth (Example, January 23 is 01/23, no year.) ____ ____ /____ ____

NAME _____

ADDRESS _____

CITY _____ E-MAIL ADDRESS _____

STATE _____ ZIP _____ DAYTIME PHONE _____

PROGRAM EVALUATION

Please circle your level of agreement with the following statements.
(4 = Strongly Agree; 0 = Strongly Disagree)

1. Clarity of objectives 4 3 2 1 0
2. Usefulness of the content 4 3 2 1 0
3. Benefit to your clinical practice 4 3 2 1 0
4. Usefulness of the references 4 3 2 1 0
5. Quality of the written presentation 4 3 2 1 0
6. Quality of the illustrations 4 3 2 1 0
7. Clarity of review questions 4 3 2 1 0
8. Relevance of review questions 4 3 2 1 0
9. Did this lesson achieve its educational objectives? Yes No
10. Did this article present new information? Yes No
11. How much time did it take you to complete this lesson? _____min

AEGIS Publications, LLC, provides 2 hours of Continuing Education credit for this article. Course is valid from 1/1/2018 to 1/31/2021. Participants must attain a score of 70% on each quiz to receive credit. Participants receiving a failing grade on any exam will be notified and permitted to take one re-examination. Participants will receive an annual report documenting their accumulated credits, and are urged to contact their own state registry boards for special CE requirements.

By visiting **compendiumce.com/go/1729**, you can take the quiz for $16 and print your certificate immediately, or you can fill out and mail the Answer Sheet above for $32. Allow approximately 2-3 weeks for processing. For more information, call 877-4-AEGIS-1.

Address: AEGIS Communications CE Department, 104 Pheasant Run, Suite 105, Newtown, PA 18940. Fax: 215-504-1502.

ADA C·E·R·P® | Continuing Education Recognition Program

AEGIS Publications, LLC, is an ADA CERP Recognized Provider. ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry. Concerns or complaints about a CE provider may be directed to the provider or to ADA CERP at www.ada.org/cerp.

Academy of General Dentistry PACE Program Approval for Continuing Education

Approved PACE Program Provider FAGD/MAGD Credit Approval does not imply acceptance by a state or provincial board of dentistry or AGD endorsement 1/1/2017 to 12/31/2022. Provider ID# 209722

The Screwless Fixed Restorative System: Laboratory Perspective

Thomas Peterson, MDT, CDT

Most laboratory technicians are familiar with the LOCATOR® Attachment System, introduced by Zest Dental Solutions (zestdent.com) in 2001. Clinicians have chosen it to retain removable partial and complete dentures over freestanding implant abutments and bars. Early in 2016, Zest Dental Solutions released the LOCATOR R-Tx® Removable Attachment System, an improved version of the original LOCATOR system. Improvements were made in wear resistance, seating insertion, and increased capacity to seat over misaligned implants. However, the R-Tx system was still limited to removable prosthetics.

In October 2016, Zest Dental Solutions released the LOCATOR F-Tx® Fixed Attachment System, designed to secure the patient's prosthesis in a fixed manner; it may only be removed by the clinician. Advantages to this system include rigidly fixed restoration for the patient, easy retrievability for the clinician, and the ability to be used on various implant systems. The attachment system can be considered with implants tilted up to 20° from a common path of insertion. This article describes the LOCATOR F-Tx system and explains how technicians have used it to successfully fabricate complete fixed maxillary and mandibular definitive prostheses in a cost-efficient manner.

FIG 1. LOCATOR F-Tx components.

The LOCATOR F-Tx system consists of a straight abutment, impression coping, abutment analog, healing cap, denture attachment housing, processing and retention balls, block-out spacer, waxing cap, processing cap, and polishing cap (Figure 1). Tools include the abutment driver (manual and latch type), retention ball driver, and three types of prosthesis removal tools.

The abutment is available in five to six cuff heights from 1.5 mm or 2 mm to 6 mm in height, depending on the implant system. It has a gingiva-colored titanium carbon nitride wear-resistant coating similar to the LOCATOR R-Tx and has a spherical-shaped coronal portion. The coronal portion has a recess that is machined to accept the abutment driver for insertion/removal. Also, this recess serves as the receptacle of the processing/retention ball. The spherical shape allows the attachment housing to pivot to achieve parallelism and eliminates the need for angulated abutments. One of the author's laboratory's clients prefers that the apical portion of the sphere be placed at the gingival height or above. The manufacturer recommends matching the cuff height to the tissue depth at its deepest point. If any portion of the bottom half of the sphere is supragingival, care must be taken to block out this area when processing. The laboratory maintains an inventory of various cuff heights to assist with abutment selection. The denture attachment housing that connects to the abutment adds 4.1 mm of height to the cuff for total 5.6 mm minimum vertical height from the implant platform.

The denture attachment housing is anodized pink. It comes with a black processing ball in place, which can be unscrewed with the dedicated hex ball driver and replaced with a retention ball of choice. The retention balls are polyether ether ketone (PEEK) high-performance polymer and are available in color-coded retention levels of low (blue), medium (tan), and high (green) retention. During finishing or polishing of the prosthesis, the processing ball may be removed and the polishing cap screwed into the denture attachment housing to protect the machined surface of the housing.

Impression copings and analogs are available to use when the dentist desires to select and install the abutments

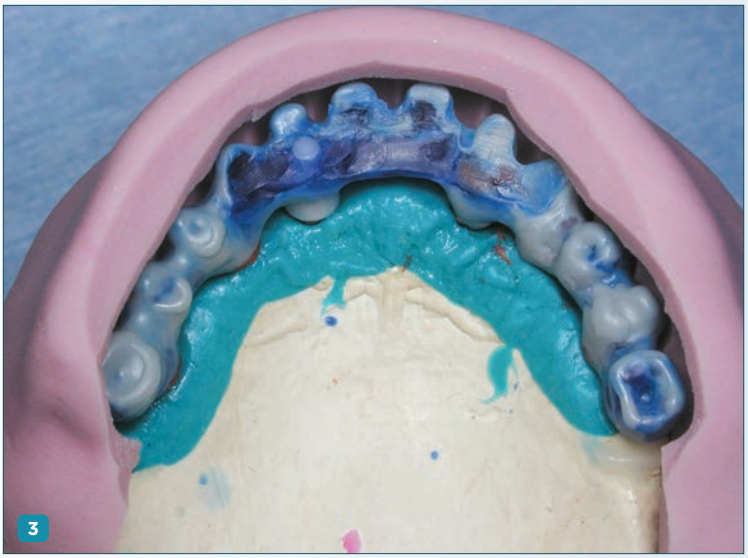
and have the laboratory fabricate the prosthesis. Healing caps are available to place onto the abutments to protect the attachment mechanism of the abutments when left in the mouth.

The author's laboratory has fabricated prostheses utilizing the LOCATOR F-Tx system for different circumstances, such as immediate load with Navigator® (Zimmer Biomet, zimmerbiometdental.com) protocol, replacement for existing screw-retained prostheses, and typical delayed-load cases. After the implant cast is mounted accurately and the correct position of the denture teeth is known, the laboratory's protocol for fabricating the prosthesis is the same. The following case illustrates the technique.

CASE REPORT

The dentist supplied the laboratory with an implant-level impression, opposing cast, preoperative cast, and bite registration. The soft-tissue cast was poured with nine implant analogs using low-expansion die stone (Diamond Die™, Hi-Tec Dental Products, hi-techdental-com.3dcartstores.com). The preoperative cast was mounted against the lower opposing cast on a Stratos® 200 articulator (Ivoclar Vivadent, ivoclarvivadent.com) using the bite registration supplied by the dentist. A laboratory silicone bite registration (Zetalabor® 85 Shore-A, Zhermack, zhermack.com) was made on the articulator, which recorded the palatal of the maxillary preoperative cast relative to the opposing cast in maximum intercuspation position. The soft-tissue implant cast was fitted to the silicone matrix and was mounted in the same position as the preoperative cast. Denture teeth were selected based on the preoperative cast and then set up on the implant cast. Two silicone matrixes were fabricated: one keyed to the cast showing the facial contours of the wax setup, the second totally closed for the fabrication of the processed resin.

The wax setup was removed from the cast, and LOCATOR F-Tx abutments were secured to the implant analogs. The abutment heights were selected by the dentist to position the apical end of the sphere at the free gingival margin. The denture attachment housings were snapped onto the abutments and uprighted to fit within the confines of the prosthesis. The waxing caps were placed onto the denture attachment housings (Figure 2). The extensions on these waxing caps were removed. A wax-up, designed to reinforce the prosthesis, was made around these caps using the silicone matrix as a guide (Figure 3). The pattern was invested and cast in cobalt-chrome alloy (Wirobond® C, Bego, bego.com). The casting was air abraded with 100 µm aluminum oxide, steam cleaned, and then opaqued with Sinfony™ Opaquer (3M, 3m.com). The metal attachment housings were blocked out with wax on the cast, except for one that was intended to be processed in the laboratory. The original thinking was that processing one attachment indirectly would be helpful, but the laboratory's protocol has since been revised to have all the attachments processed in the mouth.



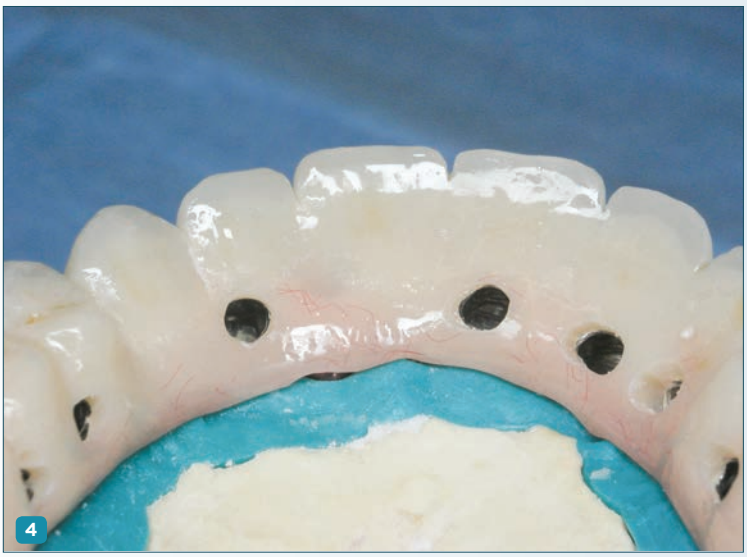


FIG 2. Waxing caps over denture attachment housing. FIG 3. Wax-up for cast reinforcing framework. FIG 4. Lingual openings to process denture attachment housing.

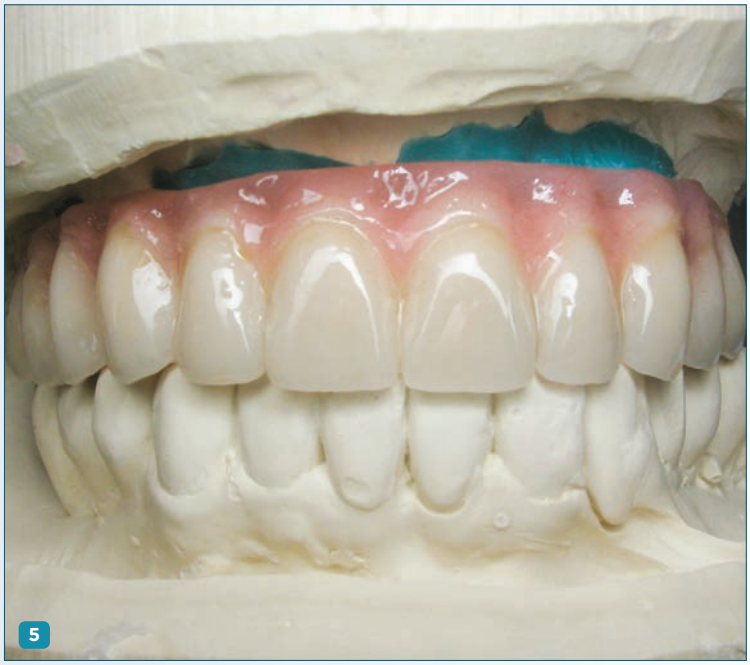


FIG 5. Finished del Castillo bridge.

The opaqued framework was placed over the blocked-out housings on the cast. Acrylic resin (New Outline, Anaxdent®, anaxdentusa.com) was mixed, flowed around the framework on the cast, filled into the second silicone matrix, and seated onto the cast, allowing excess resin to flow out of the matrix, according to the technique of Magne.[1] The cast with resin was placed in a pressure pot in 125°F water at 15 lbs of pressure for 10 minutes to fully cure. The cured resin prosthesis was removed from the cast and trimmed. A pink, 2-mm buccal flange was then added to the prosthesis freehand (ProBase® Cold, Ivoclar Vivadent), and it was again cured in the pressure pot. A small buccal and lingual flange in pink resin is helpful in stabilizing the prosthesis when processing the denture attachment housings intraorally.

The acrylic resin was then finished and polished. Horizontal undercuts were ground into the axial surface of the wells. This provided mechanical retention for intraoral processing of the denture attachment housings. The openings on the lingual aspect were reopened and refined (Figure 4). For the one denture attachment housing that was processed in the prosthesis, the black processing ball was unscrewed and a polishing cap was attached to protect the machined surface. After finishing, a new black processing ball was inserted and the prosthesis reseated on the cast (Figure 5). Finally, a bite registration index was fabricated on the articulator to assist the dentist with exact placement of the prosthesis (Blu-Mousse®, Parkell, parkell.com). The abutments, denture attachment housings, and prosthesis were then cleaned and packaged for the client for delivery. At try-in, the dentist had to remove the one processed attachment due to lack of engagement, which encouraged protocol as stated earlier with all pick-up of the housings done chairside. The dentist processed all the metal housings chairside after eliminating all abutment undercuts with the block-out spacers. CHAIRSIDE Attachment Processing Material (Zest Dental Solutions) was injected through the lingual openings to secure the metal housings to the prosthesis. The black processing balls were then removed and replaced with the proper retention balls, and the prosthesis was seated and verified.

DISCUSSION

The method above describes how the author's laboratory fabricates a metal-reinforced acrylic resin prosthesis, intended as the definitive restoration, supported and retained by LOCATOR F-Tx abutments. The laboratory calls this prosthesis the del Castillo bridge after the periodontist who originally conceived it, Robert A. del Castillo, DMD, of Miami Lakes, Florida. The laboratory has been fabricating these bridges for 10 years, originally as immediate-load screw-retained bridges retained by non-engaging titanium cylinders. The idea was to deliver a strong, esthetic, and cost-effective final restoration at the time of extraction of hopeless teeth and insertion of dental implants. The laboratory would process one cylinder into the prosthesis, and the dentist would process the remaining through the holes the laboratory made through the prosthesis. The dentist in this case has remarked that he has seen a dramatic decrease in the amount of time it takes to deliver a del Castillo bridge with LOCATOR F-Tx abutments because there are no screws to contend with or occlusal holes to repair.

The laboratory has had only one instance of restorative material failure: a piece of acrylic broke at an incisal edge shortly after delivery. A second prosthesis was fabricated to switch out and repair the first; the patient now maintains a spare. A few patients with opposing porcelain or zirconia bridgework tend to wear the acrylic resin more quickly and require stripping and new acrylic resin every couple of years. Many cases hold up very well for much longer. Anyone regularly fabricating maxillary and mandibular fixed-detachable prostheses on milled CAD/CAM titanium frameworks is aware they are not without problems. The laboratory's recommendation is to fabricate two prostheses so the patient never needs to go without teeth during normal maintenance or any catastrophic event.

ABOUT THE AUTHOR
Thomas Peterson, MDT, CDT
President, NORTHSHORE Dental Laboratories, Inc.
Lynn, Massachusetts

ACKNOWLEDGMENT
The author would like to acknowledge Alex Zorin, the highly skilled technician who fabricated the prosthesis.

REFERENCE

1. Magne M, Magne P, Cascione D, Munck I. Optimized laboratory-fabricated provisionals: Esthetic provisional restorations using the sandwich technique. *Dental Dialogue*. April 2006:68-76.

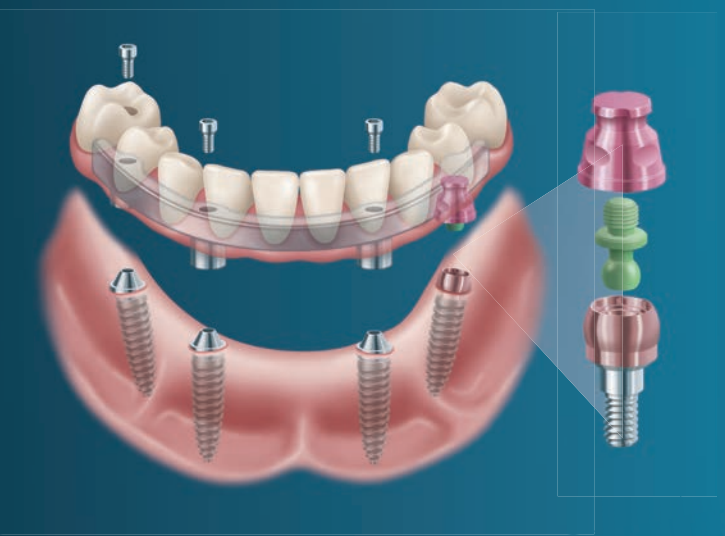
LOCATOR F-Tx®
FIXED ATTACHMENT SYSTEM

FIXED-HYBRID EMERGENCY!

Why Redo When You Can Rescue?

When a failing implant needs to be replaced in a fixed-hybrid case, it often leads to a prosthesis emergency. Replacing the prosthesis was the only available option as it was impossible for the existing screw-retained components to realign back into the original position and maintain a passive fit. **UNTIL NOW!**

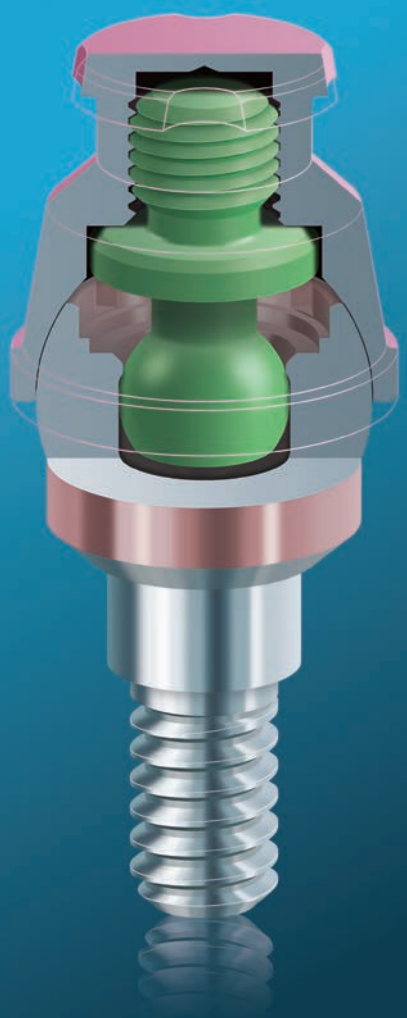
The LOCATOR F-Tx® Fixed Attachment System is the ONLY immediate treatment solution available today that can rescue a patient's existing fixed-hybrid prosthesis after replacing an implant. The novel, "snap-in" attachment is picked up chairside, ensures a passive fit, and works in harmony with the existing screw-retained fixtures saving both clinicians and patients substantial time, money and frustration.



Replace A Failed Implant, Rescue The Prosthesis.
Learn how at WWW.ZESTDENT.COM/FTXTOTHERESCUE.

ZD ZEST DENTAL SOLUTIONS®
ZEST | DANVILLE MATERIALS | PERIOSCOPY

LOCATOR F-Tx®
FIXED ATTACHMENT SYSTEM

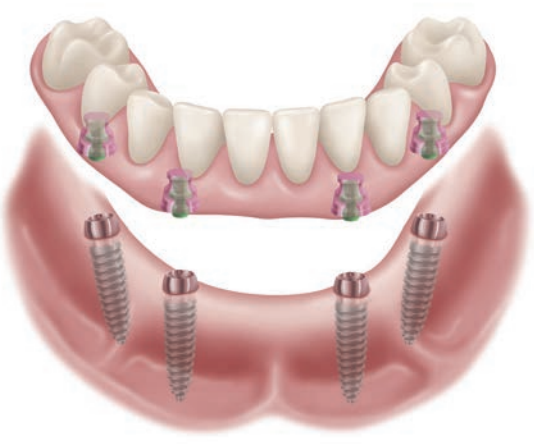


WE'VE MADE FIXED FULL-ARCH RESTORATIONS A SNAP.

NO SCREWS. NO CEMENT. NO COMPROMISES.

Fixed for the patient. Easily removed by the clinician.

LOCATOR F-Tx® is a simplified, time-saving solution for full-arch restorations with no compromise to prosthesis strength or esthetics. Optimized for efficiency and chair time savings compared to conventional screw-retained systems, LOCATOR F-Tx features a novel, "snap-in" attachment that eliminates the need for sub-gingival cement or screw access channels. LOCATOR F-Tx is the latest innovation from Zest Dental Solutions expanding treatment options for the edentulous patient—**with less chair time and higher patient satisfaction.**



To learn more, please visit our website at **www.zestdent.com/ftx** or call **800.262.2310.**

ZD ZEST DENTAL SOLUTIONS®
ZEST | DANVILLE MATERIALS | PERIOSCOPY