Simplifying Implant Overdentures

Contemporary Overdenture Abutment and Attachment Systems

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INTRODUCTION

Full-mouth rehabilitation of the edentulous patient using dental implants has long been considered one of the most challenging procedures that clinicians perform. With a variety of options available to the clinician, many patients choose one of the following 3 methods of restoration: metal-ceramic restorations, fixed complete dentures, and implant overdentures. These options all have a long track record of clinical success; however, each option has its place in implant dentistry. Many of the clinical and nonclinical factors make full-mouth restoration challenging, such as patient preferences, aesthetic and functional desire, long-term maintenance, and cost. Ultimately, many patients opt for implant overdentures due to the large improvement in quality of life when compared to their cost.[1]

A denture retained by 2 to 4 dental implants in the mandibular arch has been long regarded as a safe and highly effective long-term treatment option for edentulous patients.[2-4] Additionally, the implant overdenture is the commonly accepted, first-choice standard of care for the edentulous mandibular arch.[5] Many patients are treated effectively both with standard-diameter or narrow-diameter implants in both standard- or narrow-ridge applications.[4] Logical and effective treatment planning steps for proper implant overdenture restoration is important and results in optimal outcomes.[4] Proper implant position, angulation, distribution, and the choice of retentive abutment are important deciding factors in the aforementioned outcomes.[4] A significant challenge occurs when patients present with challenging anatomical features, insufficient bone volume in all dimensions, and critical anatomy that precludes the ideal placement of dental implants.

This article will describe the challenges that exist with conventional approaches and how they can be managed utilizing a contemporary overdenture abutment and attachment system.

OVERDENTURE ABUTMENT DESIGN WITH ANATOMICAL CHALLENGES

The ideal placement of dental implants for an overdenture are parallel to each other and perpendicular to the occlusal plane of the denture. Utilizing this implant configuration, clinicians are able to easily restore utilizing commercially available stud-style abutments, such as LOCATORs (ZEST Anchors). Stud-style abutments have a long track record of clinical success with reasonable long-term maintenance.[6] As compared with more complex restorations, such as is used with a splinted bar restoration, utilizing 2 to 4 stud-style LOCATOR abutments results in optimal retention, stability, and comfort of the prosthesis with minimal bulk, maintenance, and cost. Many authors have advocated that overdenture design should be as simple as possible to ensure enhanced clinical outcomes.[7]

Dental implants should be placed as parallel as possible to enhance clinical outcomes of overdenture restorations. Patients, however, often present with anatomical features that preclude the ideal placement of implants.[8] Features such as bony undercuts, narrow bone volume, anterior position of the inferior alveolar nerve or maxillary sinus, proximity to vascular structures that would induce significant bleeding, or desire to avoid extensive bone grafting may cause a clinician to angulate a dental implant, resulting in nonparallel positioning. Figure 1 shows a patient treated with 2 implants and LOCATOR abutments. This clinical image illustrates 2 challenges that exist with conventional stud-style abutments: angulation and long-term hygiene concerns. Many times, patients who have to have implants angulated for the aforementioned reasons have an increased difficulty in inserting and removing the prosthesis. This challenge can also make it difficult for patients to properly clean inside of the retentive portion of the LOCATOR abutment.

With existing overdenture abutment designs,

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Figure 1. A patient had 2 implants placed and standard LOCATOR abutments (ZEST Anchors) to retain a mandibular denture. While the implants were placed in this orientation to avoid a significant facial bony undercut, significant prosthetic challenges exist due to the angulation.

Figure 2. Angulation of the 2 implants can be verified with paralleling posts and an intraoral measuring guide (ZEST Anchors). The measuring guide illustrates 2 implants 20° divergent from each other for a total of 40° of total divergence.

Figure 3. Contemporary stud-style attachment systems, such as LOCATOR R-Tx (ZEST Anchors), have designs that permit dual retention, increased resiliency to accommodate significant angulation, low profile heights, low hygiene maintenance, and a pink Titanium Carbon Nitride coating that reduces wear.

Figure 4. A patient presented with 2 periodontally involved teeth retaining a mandibular interim removable partial denture.

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such as an o-ring or ball and cap, increased angulation results in enhanced wear of the retentive portion. Stud-style abutments offer off-axis or angled nylon inserts to accommodate nonideal implant positions. Existing designs, however, have limited angle correction to 40° of total divergence. Figure 2 shows a paralleling device to measure relative angulation of the 2 implants described earlier, indicating a total angle of 40°. Some advocate using a bar to correct excessive angulation of implants; however, using a bar is dramatically more expensive and a substantially more complex restoration than a stud-style abutment. Additionally, hygiene challenges are increasingly more difficult with the more complex the bar design.

CONTEMPORARY OVERDENTURE ABUTMENT DESIGN

Many clinicians prefer individual stud-style abutments because they offer a tremendous amount of flexibility and simplicity. Rather than erring on the side of complex designs, many opt for the simplest design that results in successful clinical outcomes.[7] Simpler abutments, such as the LOCATOR abutment (ZEST Anchors), have long been advocated as a simple and effective overdenture system due to low height, dual retention, and a simple pick-up technique combined with easy long-term maintenance. However, for patients whose implants were placed with excessive angulation, stud-style abutments like LOCATOR would be more challenging to insert and remove. The nylon insert can become damaged and can bend inside of the housing as the patient attempts to place the denture, ultimately requiring the insert to be replaced prematurely. Some clinicians have advocated for a pre-angled abutment, custom castings, or a splinted bar to change the angulation of a LOCATOR abutment. These methods, however, introduce increased complexity and costs that may preclude some patients from receiving overdenture care.

A new overdenture abutment design can overcome some of the previous limitations of angulation and hygiene maintenance concerns while keeping many critical features that many advocate for enhanced physical properties. LOCATOR R-Tx (ZEST Anchors) is a contemporary update of the LOCATOR abutment with several unique designs (Figure 3). The LOCATOR R-Tx Implant Attachment System permits implant angulation up to 30° per implant, or 60° of total divergence between implants. The dual retention features of the original LOCATOR system have been moved completely to the outside part of the abutment, obviating the need for a large recess inside of the abutment. This design ultimately eases the hygiene maintenance and simplifies insertion of the abutment. Finally, the R-Tx abutment uses a pink-colored titanium carbon nitride coating, which is harder and with greater wear resistance compared to the original gold-colored titanium nitride coating.

The slight movement of a denture (up/down and rotation) is a critical feature of overdentures. This property, known as *resiliency*, imparts some slight movement of the denture onto the soft tissues, minimizing the forces dispersed upon the dental implant. When these occlusal or lateral functional and nonfunctional forces are kept to a minimum, enhanced longevity of the nylon inserts can be expected. Additionally, as forces are kept off of the dental implant, occlusal and nonocclusal overloading forces are minimized. LOCATOR abutments have long employed pivoting housings, enabling the denture to slightly rotate during function. The LOCATOR R-TX abutment has enhanced resiliency compared to the original LOCATOR abutment, making it able to accommodate challenging implant angulation and patients with excessive parafunctional forces.

Figure 5. Intraoral examination revealed minimal alveolar crestal bone volume, significant bony undercuts surrounding each tooth, and adequate keratinized tissues.

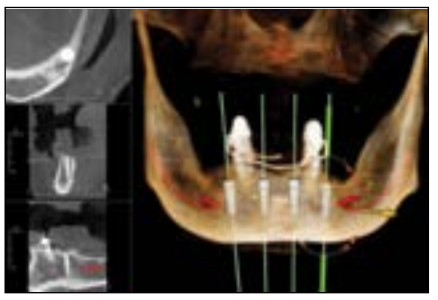

Figure 6. CBCT radiograph viewed in a dental implant software (Invivo [Anatomage]). Virtual implants were placed in positions for optimal bone volume surrounding the implants.

Figure 7. Alveoplasty was performed and four 3.7-mm x 13-mm implants (Legacy 3 [Implant Direct]) were placed in the anterior mandible, interforaminally, keeping a 5-mm safety zone anterior to the mental foramen. A surgical guide was utilized to verify angulation of implants to be compatible within the contours of the intaglio of the denture.

Figure 8. A periodontal probe was utilized to measure the soft-tissue thickness above the platform of each implant. This image shows a measurement of 3.0 mm; a 3.0 mm tall abutment was chosen.

Figure 9. Crestal incisions were made and healing abutments were removed. Four 3.0-mm LOCATOR R-Tx abutments were placed using a .050-in hex driver and hand tightened, confirming complete adaptation with the assistance of a radiograph.

Figure 10. Each abutment was torqued to 30 Ncm utilizing a spring-style torque device (Low Torque Kit [Zimmer Biomet]).

CASE REPORT

LOCATOR R-TX Implant Overdenture

Immediate implant placement after extraction can be challenging due to bone conformation and proximity of critical anatomical features. Many partially dentulous patients present with failing teeth and compromised alveolar bone conditions. Determining implant positions while still being able to achieve proper implant stability can be difficult. This case report illustrates a patient who presented with a failing dentition and a desire for full-arch rehabilitation with an implant overdenture.

A partially dentulous patient presented who had delayed treatment because of a fear of having to wear a lower denture (Figure 4). Bi-digital manipulation of the anterior mandible revealed limited alveolar volume and measurements of the removable partial denture revealed adequate prosthetic space (Figure 5). A CBCT radiograph was made to verify bone volumes prior to dental implant placement (Figure 6). The patient's CBCT digital imaging and communications in medicine (DICOM) files were imported into a computer planning software (Invivo [Anatomage]) and images were verified. The mandibular and incisive nerves were outlined to ensure a safety zone around this critical structure. Four 3.7-mm x 13-mm standard-diameter implants (Legacy 3 [Implant Direct]) were planned in tooth position Nos. 20, 23, 26, and 29. To accommodate a 5.0-mm safety zone anterior to the mental foramen and a substantial bony undercut, moderate angulation of the implant in the No. 20 position was anticipated. Implants were placed in this orientation to aim for wide distribution of dental implants in the anterior mandible to enhance retention and stability of the overdenture.[9] A duplicate of her removable partial denture was fabricated to act as a surgical guide to assist in implant placement. The patient's existing removable partial denture was modified and converted into a complete denture the day prior to surgery.

The patient was anesthetized and a full-thickness flap was elevated. Alveoplasty was performed using rongeur hand instruments and tapered surgical burs. Osteotomies were prepared using cylindrical drills, and surgical procedures were completed, preparing a fully sized osteotomy according to the manufacturer's recommendations. The 4 implants (Legacy 3) were placed, and angulation was confirmed with the assistance of the surgical guide (Figure 7). Special attention was given to the distal implants where moderate angulation of the dental implants was anticipated. Healing abutments were placed on the implants, and the flap was closed with expanded polytetrafluoroethylene (ePTFE) sutures (Cytoplast

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[Osteogenics]). A soft liner (COE-SOFT [GC America]) was placed and the patient was seen for routine follow-up for 8 weeks. During this period, the patient was instructed to eat a soft food diet and to keep forces minimal on the anterior ridge to enhance implant osseointegration.

After 8 weeks, the patient returned for implant uncovery and to convert her existing complete denture into an implant-retained overdenture. After anesthesia was applied, a periodontal probe was utilized to measure the soft-tissue thickness height above each implant prior to elevating a flap (Figure 8). Based upon this measurement, cuff heights for each LOCATOR R-TX abutment was selected. A crestal incision was made above each implant with an effort to preserve the keratinized soft tissue. A small envelope flap was elevated, healing abutments were removed, and irrigation was performed using sterile water and 2.0% chlorhexidine (Consepsis [Ultradent Products]). Using a readily available 0.050" hex driver (Low Torque Kit [Zimmer Biomet]), a LOCATOR R-Tx abutment was placed on each implant, tightening each using finger pressure (Figure 9). A radiograph was taken to confirm full adaptation of the abutment to the implant surface. A spring-style torque device (Low Torque Kit) was utilized with a .050" hex driver to torque each abutment to 30 Ncm (Figure 10). After abutment placement, white block-out rings were placed on each abutment, lightly pressing down over the top just to cover the retentive portion. Retentive housings with black processing male inserts were placed on top of each abutment (Figure 11).

The soft liner in the intaglio surface of the complete denture was removed using a laboratory bur and hand instruments. After removing, the denture was placed on the alveolar ridge, verifying complete adaptation in the posterior, proper occlusal vertical dimension, and centric. Due to the alveoplasty performed prior to implant placement, a moderate amount of space existed between the LOCATOR R-Tx housings and the intaglio surface of the denture. To account for this space, a closed-mouth reline impression was performed using a fast-setting, medium-body vinyl polysiloxane impression material (CHAIRSIDE Impression Material [ZEST Anchors]) (Figure 12). Special attention was made to ensure the patient was properly in centric at her preoperative occlusal vertical dimension, and comprehensive border molding movements were preformed prior to polymerization. The LOCATOR R-Tx housings were removed from the abutments and the patient was dismissed to return after laboratory procedures were completed. The denture with reline impression was taken to the laboratory, and a laboratory hard reline was performed (Kris Feichtmeir, CDT; QRP Dental Lab, Modesto, Calif).

The patient returned after the laboratory portion was completed. The white block-out spacers and LOCATOR R-Tx housings were placed onto the abutments. The denture was tried in and adjustments were made using acrylic burs designed for preparation of overdenture recesses (CHAIRSIDE Denture Prep & Polish Kit [ZEST Anchors]). Undercuts were placed within the recesses to aid in mechanical retention, and a vent was placed through the lingual slope of the denture to ensure passive material pressure during housing pickup. Attachment processing material (CHAIRSIDE Attachment Processing Material [ZEST Anchors]) was placed in the recesses, ensuring that the material only filled the recesses half full (Figure 13). The LOCATOR R-Tx housings were thoroughly dried and the denture was passively seated onto the edentulous ridge. The patient was instructed to keep her cheeks and tongue relaxed, and light finger pressure was placed during the polymerization of the attachment processing material, ensuring venting of the material through the lingual slope of the denture (Figure 14). This author prefers this technique as opposed to having the patient biting down, which can introduce heavy forces and can potentially cause the denture to seat unevenly on the alveolar ridge. A curing light (Bluephase Style [Ivoclar Vivadent]) was utilized to accelerate the polymerization of the attachment processing material.

After 2 minutes, the denture was removed and inspected, ensuring the white block-out spacers had been properly removed. Complete attachment processing was verified, and any voids were filled in using the attachment processing material and a curing light to set the material. Trimming and polishing was completed, ensuring the denture intaglio and cameo surfaces were smooth. The black processing males were replaced with LOCATOR R-Tx light retentive males (Figure 15). The denture was placed back onto the edentulous ridge, activating the retentive males feeling for a tactile click. Stability, occlusion, and full adaptation of the denture were confirmed using tactile feedback. Retention of the denture was verified by the patient practicing inserting and removing the denture.

Figure 11. White block-out spacers were placed and LOCATOR R-Tx housings with black processing inserts were placed on each abutment. The denture was adapted to the alveolar ridge, confirming complete adaptation and space around each housing.

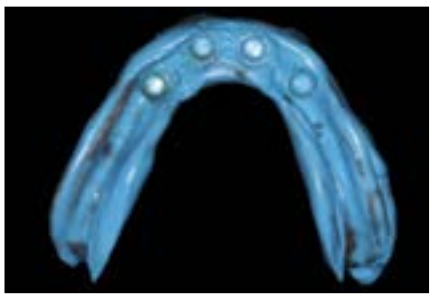

Figure 12. A closed-mouth reline impression was made utilizing medium-body vinyl polysiloxane impression material (CHAIRSIDE Impression System [ZEST Anchors]). Careful attention was paid to ensure that the patient was closed in centric at the appropriate occlusal vertical dimension.

Figure 13. The denture was hard relined in the laboratory and placed onto the alveolar ridge. Recesses and vent holes in the denture were prepared using a specialized bur block system (CHAIRSIDE Denture Prep & Polish Kit [ZEST Anchors]). Attachment processing material (Chairside Attachment Processing Material [ZEST Anchors]) was placed, filling each recess half full.

Figure 14. The denture was seated onto the alveolar ridge using finger pressure only, ensuring that attachment processing material vented out the lingual holes. The patient was instructed to not bite down during this procedure, ensuring complete tissue adaptation of the denture.

Figure 15. The denture was removed from the mouth, polished, and black processing inserts were removed and blue retention inserts were placed. The denture was placed back onto the alveolar ridge, ensuring a tactile click was felt. The retention, stability, and comfort of the denture were verified.

DISCUSSION

This case report illustrates a routine prosthetic procedure completed in the author's practice. In many cases where a moderate to extensive amount of alveoplasty is required prior to implant placement, implant placement and conversion of the denture into an overdenture is best treated with a delayed surgical approach. After 2 months of integration and soft-tissue healing, the denture bearing surface is optimal. During this time, the patient is wearing a denture with a soft liner placed within the denture. After integration, a minor incision can be made, exposing the dental implants just enough to place LOCATOR R-Tx abutments. Many patients tolerate this procedure very well because it is minimally invasive, compared to implant placement. This approach also allows for optimal abutment cuff height decisions and combined with a reline procedure, optimal prosthetic results can be obtained. The LOCATOR R-Tx abutments easily accommodate the moderate amount of angulation required to ensure that the implants were placed in optimal bone volumes.

CLOSING COMMENTS

Implant overdenture therapy has long been regarded a safe and effective treatment for patients who require full-arch rehabilitation. While implants ideally should be as parallel as possible, patients often present with compromised alveolar bone volumes necessitating implant placement in nonideal positions. The traditional overdenture attachment systems permit a moderate amount of angle correction; this article introduced a new overdenture attachment system that permits a greater amount of divergence between implants. Additionally, simplification of insertion and removal and an improvement in long-term wear resistance are important factors

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to consider for choice of abutments for overdenture attachment systems.✦

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Disclosure: Dr. Scherer is a clinical consultant to ZEST Anchors.

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