

Implant Overdentures: Guidelines for Immediate Loading

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About the Author



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facilitated CBCT implant planning, and explore outside-the-box radiographic imaging concepts. He has served as the director of the implant dentistry curriculum at UNLV and is actively engaged in guided surgical placement and prosthetic restoration of implants in private practice. He also maintains the "LearnLODI," "LearnLOCATOR," and "LearnSATURNO" interactive YouTube channels on standard- and narrow-diameter dental implant procedures. He can be reached at mds@scherer.net.

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

INTRODUCTION

The surgical placement of dental implants is a predictable treatment for improving retention with overdentures. The placement of 2 to 4 implants in the mandibular arch or 4 to 6 in the maxillary arch have been historically regarded as safe and highly effective long-term treatment options.¹⁻³ Proper location and positioning of the implants as far as restorative space, distribution, and anatomical structures have been advocated as critical factors in regard to treatment sequencing.⁴⁻⁶ As a result, numerous patients have been successfully treated using implant overdenture therapy.

Implant placement for standard or narrow overdenture implants is typically performed using a 2-stage or delayed approach. The 2-stage approach usually involves flap elevation, osteotomy preparation, implant placement, and closure of the flap over the top of the implant. This traditional approach typically results in undistributed, submerged healing during the osseointegration period, with minimal forces applied to the implant. While this method is conservative as far as implant healing, it does require a second surgical intervention including incision and/or flap elevation to expose the implant.

Immediate Loading Concepts

Immediate loading of implants involves placement followed by prosthetic connection, and an introduction of minimal to moderate occlusal and lateral forces. While many in the profession initially considered immediate loading to be detrimental to osseointegration, reports throughout the literature began surfacing in the early to mid-1990s supporting the promising short- and long-term results of immediate placement and the restoration of implants.^{7,8}

Patient-mediated factors (such as delaying treatment time and postoperative pain reduction) obfuscating the need for an interim removable restoration are typically the primary reasons for the desire to immediately place and restore a dental implant. Patients often report an improved perception of stability, function, health, and a generalized improvement of well-being after immediate implant rehabilitation.⁹ Also, implant placement can be performed with flapless protocols, reducing the surgical invasiveness of the procedure and potentially resulting in improved patient outcomes (Figure 1).¹⁰ Immediate loading of implants has been widely accepted as an effective method that results in a high rate of success with minimal differences in implant or prosthesis failure as compared to delayed loading.¹¹

While many factors are involved with successful immediate implant placement and restoration, there is a general consensus that the overriding concern is to reduce functional and



Figure 1. Flapless implant placement and immediate loading of narrow-diameter implants is a predictable procedure that can result in enhanced patient outcomes.

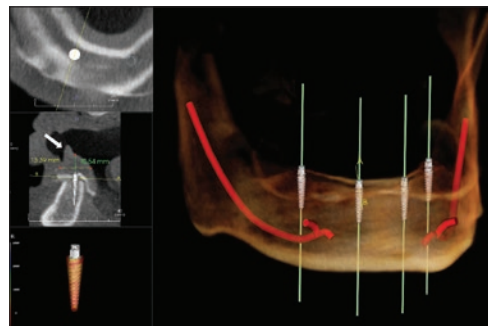


Figure 2. CBCT radiographic image illustrating a virtual narrow-diameter implant (LOCATOR Overdenture Implant System [LODI] [ZEST Anchors]) within the bone volume utilizing a radiographic software (Invivo [Anatomage]). CBCT software lets the clinician measure restorative space (white arrow) and obtain a color map of relative bone density around the dental implants (bottom left).

Implant Overdentures: Guidelines for Immediate Loading

parafunctional forces during osseointegration. This will ultimately prevent microscopic movement of the implant. This movement is called *micromovement*, and minimizing the movement is a critical aspect of implant survival rates with immediate loading.⁹⁻¹²

Immediate Overdentures Versus Fixed Restorations

While immediate placement and restoration has long been advocated for cross-arch splinted fixed restorations, interest in applying similar concepts to overdentures has steadily grown as clinicians have found success with fixed restorations. Immediate loading of removable restorations has not been adopted very quickly because of a lack of confidence and experience with immediate loading, and due to concern about occlusal forces during the healing period. Many clinicians are hesitant to apply these concepts to removable restorations due to the potential to introduce forces on unsplinted implants, thus seemingly increasing the risk of micromovement to individual implants.

Reports have indicated a general concern about controlling micromovement, and authors recommend ensuring that, during the healing, an implant move less than 100 μm .¹² Ensuring implant movement forces less than this amount has been challenging for removable applications, and initial immediate-loading protocols recommend the use of a splinted bar-retained overdenture design.¹³ The use of the splinted design for immediate loading of overdentures seemingly would reduce micromovement to the individual implants similar to fixed restorations. While results were promising, substantial challenges were present when using bar designs, such as limited restorative room, increased prosthetic difficulty, prosthesis bulkiness, and increased hygiene maintenance. While these factors can be minimized by the use of individual stud-style abutments, such as a ball or LOCATOR (ZEST Anchors), clinicians still have concerns regarding using a resilient or semi-resilient attachment with immediate-loading protocols.

Immediate loading of removable overdentures with individual nonsplinted abutments has shown to be predictable and highly effective. Studies have shown a high short- and long-term success rate for immediate loading using individual implants with LOCATOR abutments.¹⁴⁻¹⁶ The principal concern using individual abutments was the limitation of micromovement; however, this has not been seen in vivo as in some cases, slight crestal bone loss is noted,¹⁶ while other studies have indicated similar results with conventional loading protocols.^{14,15}

Immediate placement of implants followed by prosthetic conversion of a solely tissue-supported into an implant-retained, tissue-supported complete denture results in immediate gratification and an improvement in masticatory function,

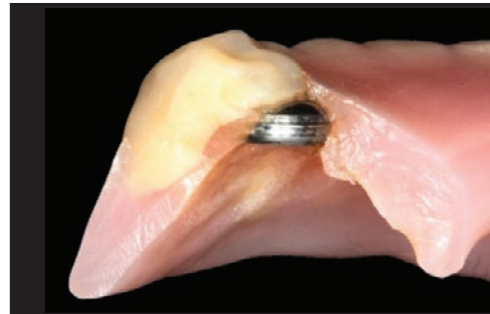


Figure 3. Insufficient restorative space can create prosthetic challenges. An example is this broken denture, which had insufficient room within the denture for the denture housing.



Figure 4. Radiopaque vinyl polysiloxane (VPS) impression material applied to the intaglio of the maxillary and mandibular complete denture.

retention, and patient quality of life.¹⁷ As a result of the aforementioned, this author has had considerable success with immediate loading of overdentures after implant placement. Interestingly, however, this author also finds that patient satisfaction does not improve (or may slightly decrease) within the first week after immediate implant placement and restoration, yet rapidly improves after 7 days. Potential denture soreness due to greatly enhanced pressure against the tissues and minor tissue swelling even after flapless implant placement are likely the reasons for this phenomenon. Patients should be advised that they will experience instant improvement in their retention and stability, and that may be startling. When informed consent is provided, patients respond with increased satisfaction compared to those who are not properly informed.

Anatomical and Patient Factors

Patient host-related risk factors and local anatomical factors are critical to evaluate when deciding if a patient is a candidate for immediate loading with implant overdentures. Patients with risk factors such as uncontrolled metabolic disease (ie diabetes), heavy smoking or tobacco use, and excessive bruxism/parafunctional habits are relatively high-risk and should be excluded from immediate-load therapy. Interestingly, many patients seeking implant overdenture therapy wear tissue-supported complete dentures and may not have an obvious sign of bruxism; however, it is critical to evaluate them. Simple methods to evaluate for potential

Implant Overdentures: Guidelines for Immediate Loading

bruxism include the following: patient questionnaire, temporomandibular head and neck evaluation, and evaluation of occlusal wear patterns on their existing dentures. Many of these are *relative* risk factors because immediate loading can still be accomplished with patients who present with these factors; however, the factors elevate the risk of complications.

Anatomical factors, such as bone quantity and quality, are also relative risk factors. While bone can always be created via augmentation, immediate loading of implants is greatly enhanced and simplified when bone quality and quantity are acceptable. Dental implants immediately placed and restored in low-density bone, in areas of previously placed bone grafts, and in patients with a long history of osteoporosis have a higher risk for lack of primary stability and failure to osseointegrate.¹⁸ General consensus for measuring primary stability acceptable for immediate restoration/loading is performed via measuring insertion torque. When insertion torque is greater than 30 Ncm, most authors believe that an implant is sufficiently stable for immediate restoration.^{7-10,14-19}

Treatment planning steps and surgical protocol to maximize bone availability is an essential step in immediate overdenture procedures. Bi-digital palpation/examination of the patient during clinical exam in combination with diagnostic radiographs is a sufficient method of assessing bone quantity in the anterior mandible. In the maxilla, however, 2-D radiographs are insufficient for measuring bone availability. Using CBCT in combination with software interpretation of the future dental implant site is an effective method of ensuring the patient has sufficient bone volume. In addition, CBCT permits the clinician to make relative assessments of bone quality and density as well (Figure 2). Enhanced knowledge of the bone quality and quantity in planned implant sites greatly enhances the clinician's ability to achieve primary stability in potentially adverse situations.

Sufficient restorative or prosthetic space to accommodate the implant, abutment, and retentive housing within the denture is a step that many clinicians tend to overlook. Using the future prosthetic goals to drive implant positions is an *essential step* of implant dentistry, and ignoring the prosthetics can lead to long-term prosthetic maintenance challenges (Figure 3).¹⁹ Restorative space challenges may not exist initially; however, when the patient gets mild resorption of the posterior ridge, the denture can start to pivot anterior-posteriorly. When the patient bites down on something hard enough, the denture can fracture through the retentive housing.

Anticipating prosthetic space requirements can be achieved by measurement with either hand instruments, such as a Boley gauge, or virtually with the CBCT scan (when used in combination with a radiopaque impression) (Figure 4).¹⁹ When restorative space is insufficient, reshaping of the cameo surface of the

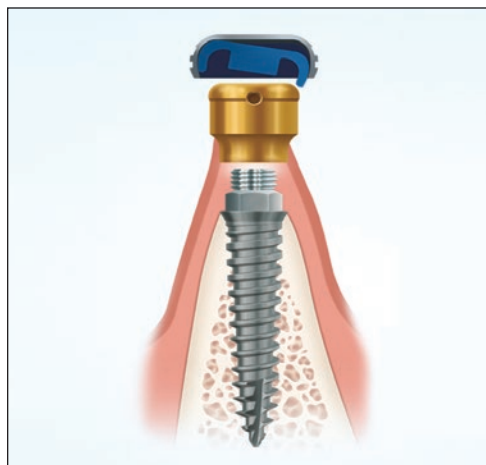


Figure 5. A narrow-diameter implant (LODI) designed for overdentures has geometric features that permit enhanced immediate loading such as aggressive thread design that widens at the coronal portion, square threads near the crest and v-shaped threads near the apex, and apical fluted cutting ends.

denture or alveolar reduction is required. Many patients will not tolerate a large amount of acrylic resin added to the lingual slope of their mandibular denture or the palatal aspect of the maxillary denture, so alveolar reduction is often required. The challenge with immediate placement and restoration is that when implants are placed into a prepared osteotomy, the implant achieves most of its primary stability from the crestal cortical bone or the apical cutting end of an implant. Alveoloplasty removes crestal alveolar bone, exposing lower density trabecular bone underneath and reducing the ability of the implant to engage dense cortical bone. An implant with aggressive self-tapping cutting ends, in combination with under-sizing the osteotomy in the apical, greatly enhances primary stability in lower density trabecular bone.

Implant Geometry and Surgical Procedures

Surgical procedures, techniques, and implant design ultimately dictate whether an implant is going to have primary stability within the bone. In situations of compromised bone density, a clinician may elect to skip a drill during osteotomy preparation. By under-sizing the dental implant in lower density bone, the implant can achieve greater insertion stability, reducing the chances of micromovement and increasing the success rate of the implant.

Some implants have macro geometries that are designed specifically for high insertion stability. Geometric features such as aggressive thread designs with a mixture of square threads at the crestal portion and v-shaped threads at the apical portion enhance the contact of the bone with the implant (Figure 5). Additionally, a progressively tapered implant beginning with apical cutting flutes permits self-tapping during insertion. When used in conjunction with cylindrical parallel-sided drills, the self-tapping nature of an implant permits a clinician to under-size the osteotomy by one or multiple drill diameters.

Implant Overdentures: Guidelines for Immediate Loading

CASE 1



Figure 6. Patient with an edentulous mandibular arch wished for dental implants to stabilize his loose lower denture.

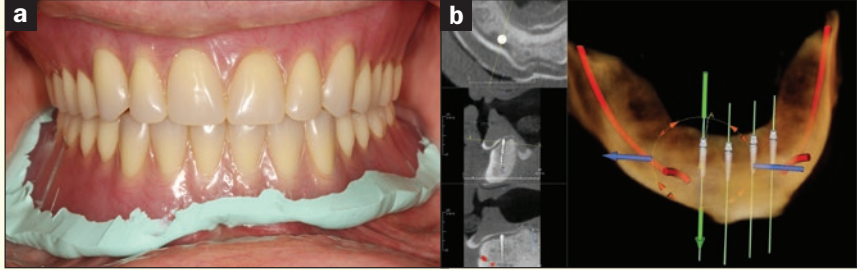


Figure 7. (a) Radiopaque VPS impression material (Green-Mousse [Parkell]) placed onto the intaglio surface of the mandibular denture and a CBCT scan performed. (b) CBCT scan images showing virtual implants, the denture, and the bone volume allow the clinician to make decisions regarding potential implant sites.



Figure 8. Four 2.9-mm narrow-diameter implants (LODI) and abutments (LOCATOR [ZEST Anchors]) placed. All implants had insertion torque > 30 Ncm.



Figure 9. Recesses were prepared inside of the denture using a denture prep kit (Denture Prep & Polish Kit [ZEST Anchors]), and LOCATOR housings were attached using an attachment processing resin (Chairside Attachment Processing Material [ZEST Anchors]).



Figure 10. Follow-up visit showing LODI narrow-diameter implants at 2 years after placement.

Implant length and diameter choice is an important factor for improving the chances of enhancing primary stability for immediate loading. In the mandibular arch, where bone is denser, a 2.4-mm or 2.9-mm implant will achieve insertion torque > 30 Ncm when the full osteotomy has been prepared. In the maxillary arch, where bone is less dense, 2.9-mm implants are preferred with a greatly undersized osteotomy to achieve insertion torque > 30 Ncm. Likewise, many experts recommend implant lengths of 10.0 mm or greater when considering immediately loaded restorations.^{7-8,12} Having sufficient length, especially in the apical and crestal portions, greatly enhances contact of the bone to the implant and the ability of the implant to be stable within the bone.

When bone density is extremely low, such as that found typically in the maxillary arch, a self-tapping implant can even be placed through an osteotomy that is only prepared with a pilot drill. On the contrary, when bone density is high, as typically found in the anterior region of the mandible, the implant can be placed using a full drilling sequence. When encountering

extremely high bone density upon implant insertion, a self-tapping implant will also allow a clinician to back the implant out 3 quarter turns and insert 4 quarter turns. This technique permits the visco-elastic nature of bone to slightly expand upon moderate pressure, and the implant is placed further within bone while equalizing pressure upon the surrounding bone.

CASE REPORTS

Case 1: Mandibular Immediate Overdenture

Mandibular implant overdentures have been a successful, long-term treatment option for many patients. Owing to the success is that the anterior mandible typically has adequate bone volume, moderate-high density bone quality, limited critical anatomical structures such as nerves or blood vessels, is readily accessible, and has optimal properties of bone flexure. Long-term success of implants in the mandibular arch is also higher than the maxillary arch and is an optimal place to put implants to improve patient quality of life.^{2,9,10}

Implant Overdentures: Guidelines for Immediate Loading

CASE 2

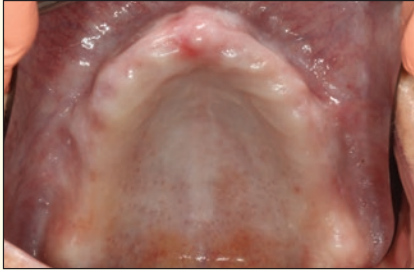


Figure 11. A patient with moderate-advanced resorption desired dental implants to provide stability to her maxillary denture.

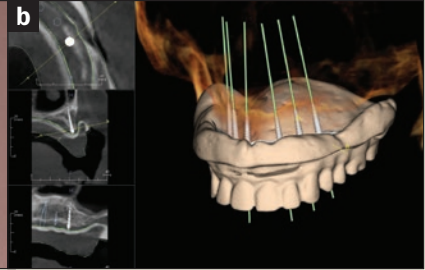


Figure 12. (a) A radiopaque VPS was applied to the intaglio of the maxillary denture and a CBCT scan was performed. A second CBCT scan was made of the denture alone and an optical impression of the relines was also made using an intraoral scanner (True Definition Scanner [3M]). (b) The CBCT scan images showing the surgical guide plan in place with an optical scan of the denture and software virtually superimposed onto each other.



Figure 13. Six 2.9-mm narrow-diameter implants (LODI) were placed and LOCATOR abutments attached to the implants. All 6 implants achieved insertion torque > 30 Ncm.



Figure 14. Recesses were prepared within the intaglio surface of the denture, and LOCATOR housings were attached to the denture. The processing inserts were left in the denture during the osseointegration time period.



Figure 15. The patient was seen one year later for follow-up, and she was very comfortable and satisfied. Note how much taller her lower implants with ball abutments are compared to the LOCATOR abutments.

A patient presented who was edentulous and desired implants to help retain his loose lower complete denture (Figure 6). Bi-digital manipulation of the anterior mandible revealed adequate bone thickness, and measurements of his denture revealed adequate prosthetic space. A reline impression was made of the edentulous ridge using a radiopaque vinyl polysiloxane (VPS) (Green-Mousse [Parkell]), and then a CBCT scan was done (Figure 7). The patient's CBCT Digital Imaging and Communications in Medicine (DICOM) files were imported into computer planning software (Invivo [Anatomage]) and evaluated. The mandibular nerve was traced to enhance visualization and to ensure a safety zone around this critical structure. Four 2.9-mm narrow-diameter implants (LOCATOR Overdenture Implant System [LODI] [ZEST Anchors]) were planned in tooth position Nos. 20, 23, 26, and 29 to achieve adequate distribution of implants in the anterior mandible to enhance retention and stability of his overdenture prosthesis. An "in-house pilot guide" surgical guide was fabricated to assist in implant placement.⁴

The patient was anesthetized, and sequential osteotomies were prepared using cylindrical drills through the holes in the surgical guide. The initial penetration of the pilot drill within the bone was intentionally made short, giving the opportunity to verify and/or correct the parallelism among the 4 implants without having to arbitrarily enlarge the osteotomy. Surgical procedures were completed, preparing a fully sized osteotomy according to the manufacturer's recommendations. The implants were placed and LOCATOR abutments placed on the implants (Figure 8). Using a contemporary denture recess preparation kit (Denture Prep & Polish Kit [ZEST Anchors]) and an attachment processing resin with minimal shrinkage and easy application (Chairside Attachment Processing Material [ZEST Anchors]) simplifies final prosthetic conversion of the denture into an overdenture (Figure 9). The patient was seen the first week for a follow-up and then periodically during the course of 2 years (Figure 10).

This case report illustrates a routine surgical application of overdenture immediate loading in the author's practice. The

Implant Overdentures: Guidelines for Immediate Loading

anterior mandible is an ideal location to achieve implant stability and long-term success. Also, many patients are motivated for surgical treatment in the hope of improving mandibular denture stability. This patient had an ideal bone volume, quality, and quantity. In addition, he had sufficient restorative space to accommodate the LOCATOR housings within the denture and made for a simple conversion from a denture into an implant overdenture. Long-term follow-up during the course of 2 years revealed minor routine maintenance, including changing nylon inserts approximately every 6 to 8 months.

Case 2: Maxillary Immediate Overdenture

Implants for maxillary implant overdentures have mixed long-term success results due to a variety of clinical factors. Typically, patients present with limited bone volume of moderate-low density. Also, patients present with adequate bone in the canine areas but not in the incisor or premolar areas, which tends to limit the distribution of implants within the arch. Wider distribution of implants in either arch can lead to an improvement of physical properties of the denture.^{4,6,20} Furthermore, restorative space is often limited, which can necessitate alveolar reduction and may preclude less invasive flapless procedures.

A patient presented who was previously treated with 6 mandibular implants and an overdenture more than 20 years ago. She had long been tolerant of a tissue-supported maxillary complete denture; however, she had inquired about implants for her maxillary arch many times. Other clinicians had evaluated her maxillary arch and deemed her unable to have implants placed because her ridge was excessively resorbed (Figure 11). The patient was referred to this author's clinical practice for an evaluation.

A reline impression was made of the edentulous ridge using a radiopaque VPS, and a CBCT scan was done (Figure 12). The scan was made with cotton rolls on the buccal aspect of the denture and with instructions for the patient to keep her tongue away from the denture's palatal slope during the scan. The denture was removed, and a CBCT was made of the denture alone. The radiopaque VPS was digitally scanned using an intraoral scanner (True Definition Scanner [3M]). The patient's CBCT DICOM files were imported into computer planning software (Invivo) and evaluated. Six 2.9-mm narrow-diameter implants (LODI) were planned in tooth position Nos. 4, 6, 8, 9, 11, and 13 to achieve adequate distribution of implants in the maxillary arch to enhance retention and stability of her prosthesis. A computerized surgical guide (Anatomage Guide [Anatomage]) was fabricated to assist in placement of the implants.

The guide was received and complete tissue adaptation was verified. After anesthetic was placed, 1.2-mm pilot drill osteotomy preparation was completed through the surgical guide. The guide was kept in place and implants were placed through the

guide. Implant insertion torque was verified > 30 Ncm for all the implants. The guide was removed and abutments were placed, verifying final implant positions (Figure 13). Recesses were prepared (Denture Prep & Polish Kit) and denture housings were attached to the denture (Chairside Attachment Processing Material) converting the denture into an overdenture (Figure 14). Black processing male inserts were left inside the denture for the integration time period to limit rotational forces to the implants. This author feels that in low-density bone, micromovement can be limited by using the rigid, nonresilient processing males along with instructions to the patient to leave the denture in at all hours, except when necessary to clean the prosthesis. The patient was seen periodically for routine follow-up, and one year later, she was very pleased with her final result (Figure 15). Note the restorative height differences between the mandibular ball abutments and the maxillary LOCATOR abutments.

This maxillary case report illustrates a more challenging surgical application of overdenture immediate loading in the author's practice. The maxillary arch presents more challenges in achieving primary stability due to the common presence of low-density bone in cases where bone volume is available. When bone volume is not available, more challenging dental implant placement is required as the bone has substantially resorbed. The ironic challenge of the maxillary arch is that when bone is available, it is often lower in density; yet when bone is not available, it is higher in density. Guided surgery can greatly assist in placement of implants with patients with narrow bone; however, caution must be exercised when using mucosa-supported surgical guides with challenging narrow bone cases.

CLOSING COMMENTS

Patient demands for minimally invasive surgical procedures or for instant gratification drive many clinicians to desire to place and restore implants in the same clinical appointment. Proper steps are required to ensure that the patient meets the clinical requirements necessary for immediate placement and restoration of the dental implant.

This article has described guidelines for surgical and restorative procedures necessary to immediately place implants for the purposes of converting a complete denture into an overdenture. Essential preoperative treatment planning procedures are required, including evaluating the patient's anatomical features in combination with the individual's restorative goals. Ensuring proper restorative space in combination with sufficient bone volume is important prior to surgical intervention. Finally, the choice of implant design and geometry also affects the insertion stability of the dental implant prior to restorative procedures. ♦

Implant Overdentures: Guidelines for Immediate Loading

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