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# Implants: A Primer

A Peer-Reviewed Publication  
Written by Ian Shuman DDS, MAGD, AFAAID

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## Abstract

The surgical placement and maintenance of a dental implant requires preoperative requirements as well as postoperative maintenance. The surgical aspect is dependent on a variety of factors. These include the preoperative assessment of the implant site, surrounding anatomy, occlusion, implant type and placement position, among others. In addition, proper maintenance is a primary determinant of the longevity of the implant and prosthesis. This course will demonstrate the assessment, preparation, placement and maintenance of a dental implant.

## Educational Objectives

At the conclusion of this educational activity participants will be able to:

1. Assess the need and evaluate a potential site for implant placement surgery
2. Prepare the patient and site for implant surgery
3. Discuss the placement of an implant
4. Discuss the requirements for maintenance of the implant and the surrounding periodontium

## Author Profile

**Ian Shuman DDS, MAGD, AFAAID** maintains a full-time general, reconstructive, and aesthetic dental practice in Pasadena, Maryland. Since 1995 Dr. Shuman has lectured and published on advanced, minimally invasive techniques. He has taught these procedures to thousands of dentists and developed many of the methods. Dr. Shuman has published numerous articles on topics including adhesive resin dentistry, minimally invasive restorative, cosmetic and implant dentistry. He is a Master of the Academy of General Dentistry, an Associate Fellow of the American Academy of Implant Dentistry, a Fellow of the Pierre Fauchard Academy. Dr. Shuman was named one of the Top Clinicians in Continuing Education since 2005, by Dentistry Today.

## Author Disclosure

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## Abstract

The surgical placement and maintenance of a dental implant requires preoperative requirements as well as postoperative maintenance. The surgical aspect is dependent on a variety of factors. These include the preoperative assessment of the implant site, surrounding anatomy, occlusion, implant type and placement position, among others. In addition, proper maintenance is a primary determinant of the longevity of the implant and prosthesis. This course will demonstrate the assessment, preparation, placement and maintenance of a dental implant.

## Introduction

Dental implant surgery and restoration is unlike any other dental procedure. It is a procedure of root replacement that is dependent on bone health and adequacy. It is unique in the way the soft tissue models around the junction between the implant and its fixed prosthesis. It is different in the way the occlusion must be balanced. Placing a dental implant is dependent upon a wide array of issues that contribute to the decision making process. Foremost is assessment of the potential site and its suitability to receive an implant. In addition, the patient must be an appropriate candidate for the procedure. This includes their medical history, current health, and the condition of available bone and health of the gingiva. The ability of the operator to place the implant and the long-term maintenance of the implant are critical to its success.

## Assessment

There are a host of factors that must be considered when evaluating a patient's suitability for implant surgery. As mentioned, the patient's health is first and foremost when assessing candidacy. Patients who are considering implant placement must be healthy overall, as well as intraorally.

A thorough medical history must be reviewed including past and current medications that could affect the healing of bone and implant integration. In a study of medical contraindications to implant therapy,<sup>1,2</sup> Hwang and Wang discussed the importance of selecting patients who do not possess local or systemic contraindications to implant therapy. In a review of the medical diseases that reportedly preclude conventional dental implant treatment, absolute contraindications to implant rehabilitation included recent myocardial infarction and cerebrovascular accident, valvular prosthesis surgery, immunosup-

pression, bleeding issues, active treatment of malignancy,<sup>3</sup> drug abuse, psychiatric illness, as well as intravenous bisphosphonate use.<sup>4</sup> In addition, systemic conditions and habits influence dental implant survival to varying degrees. Illnesses that impair the normal healing cascade worsen surgical success. The mere presence of a disease, however, does not necessarily preclude implant therapy or significantly affect long-term outcomes. Certain disorders, when controlled, or other situations allow implant survival rates that match those in health. These relative contraindications include adolescence, aging, osteoporosis, smoking,<sup>5</sup> diabetes,<sup>6</sup> positive interleukin-1 genotype, human immunodeficiency virus positivity, cardiovascular disease, and hypothyroidism.

The intraoral health of the bone and associated periodontium as well as occlusion and parafunctional habits<sup>7</sup> all weigh heavily toward a successful outcome. Once it has been established that the patient is indeed a good candidate for the procedure from a medical and intraoral health perspective, the next phase is to determine the amount of available bone in which to place the implant.

To determine whether the site is ideal, there are several methods from the simple to the more complex. Selection of the specific imaging technique should be based on its suitability for providing the diagnostic information required by the implant team at different stages of treatment.<sup>8</sup> These include but are not limited to; visual inspection, digital palpation, periodontal probing, (Figure 1) the use of bone calipers, (Figure 2) radiographs, computerized tomography, and cone beam computerized technology. Regardless of how the bone is evaluated, an implant occupies a three-dimensional space and three measurements are needed to determine adequacy of bone volume: horizontal distance between the adjacent roots, vertical height of available bone, and the width or thickness of the available bone.

Figure 1



Figure 2



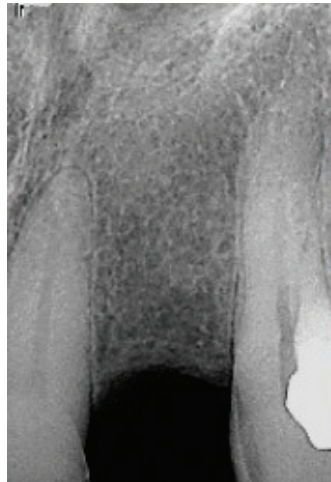
A radiograph of a single site can be used to measure the two-dimensional distances between the adjacent roots: the horizontal distance between roots and the vertical length or height of available bone. (Figures 3,4) The minimum distance between the implant and adjacent roots is 1.5 – 2.0mm. This provides an adequate amount of inter-implant-radicular bone space necessary for an adequate blood supply. This blood supply is required to nourish the periodontal ligament of adjacent tooth roots and the bone surrounding the implant with the cells required for creating osseointegration of the titanium-bone interface. Encroaching on this space will compromise the blood supply and potentially damage the periodontal ligaments.

The height of available bone is measured from the most coronal aspect of the surgical site to the desired apical height. In addition, probing the periodontal spaces of adjacent teeth will aid in determining the health of the site. Any periodontal therapy needed for adjacent teeth can be performed prior to implant surgery and the site reevaluated following healing.

Figure 3



Figure 4



## Preparation

**Pre-Surgical Preparation:** The patient must be prepared for the upcoming surgery. It is vital to review the informed consent documents with the patient. It should include all unforeseen sequelae of treatment. Patients must also be made keenly aware that while the track record for implant success is excellent, it is not perfect and implant failure and fixture and bone loss may result.

The surgical site should also be prepared. Preparation for implant surgery is critical to a successful outcome and this attention to detail and care will greatly aid the dental surgeon in its execution. If the site was an extraction in anticipation of a dental implant, (Figure 5) the most important issue is bone preservation and this must be the primary focus. The gold standard is to graft the socket at the time of extraction and place a guided tissue membrane, (Figures 6,7) if needed, to aid in the growth of any missing bony walls and/or defects due to infection or

Figure 5

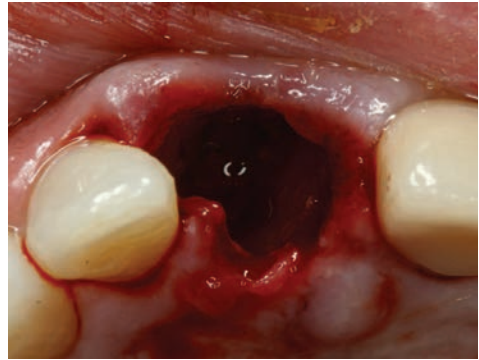


Figure 6

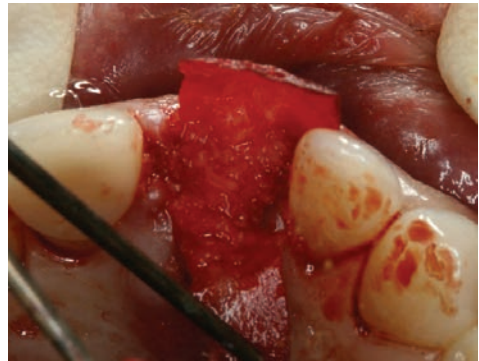


Figure 7



trauma. The proper armamentarium is critical to a successful outcome. Extractions should be done with minimal trauma. This can be accomplished through the incremental loosening of the root using a series of instruments. A periosteal elevator is first used to sever the periodontal ligament, (Figure 8) followed by gradual widening of the PDL space and gentle luxation of the root using instruments such as those shown in figures 9 and 10. Forceps with a design that provides engagement at the root surface reducing tooth breakage and preserving the buccal plate should be used for implant sites. (Figure 11) Socket debridement should always be performed and surgical curettes can be used. (Figure 12) A bone rasp should be used to induce bleeding in the host bone to promote osteogenesis. (Figure 13)

Figure 8.



Figure 9.



Figure 10.



Figure 11.



Figure 12.



Figure 13.



Bone grafting can be done using specific bone placement instruments (Figure 14) and condensers (Figure 15) that ideally feature a non-stick coating. Membrane can be placed with a membrane placement instrument. (Figure 16) With an appropriate period of healing to allow bone formation, implant success is usually excellent. In addition to pre-selecting the implant, a surgical stent can be very helpful especially when used to create the initial depression in the bone and pilot drill orientation.

**Day of Surgery:** Preparation also includes systemic preparation and antibiotic prophylaxis is often used at the surgical appointment. In general, antibiotic prophylaxis in surgery is only indicated for patients at risk for infectious endocarditis<sup>9,10</sup>. However, scientific evidence suggests that, in general, antibiotics are beneficial for reducing failure of dental implants placed in ordinary conditions. Specifically, 2 g or 3 g of amoxicillin given orally one hour preoperatively significantly reduces failure of dental implants. No significant adverse events were reported. It might be sensible to suggest the use of a single dose of 2 g prophylactic amoxicillin prior to dental implant placement. It is still unknown whether postoperative antibiotics are beneficial, and which antibiotic is the most effective. In addition to antibacterial systemic treatment, intraoral bacterial reduction at the surgical site is highly recommended and patients should be instructed to use a bacteriostatic rinse.<sup>11</sup>

Figure 14.



Figure 15.



Figure 16.



## Placement

*Surgical Phase:* The decision to access the alveolus with a flap or flapless approach is based on aesthetic results and location of the surgical site. (Figure 17) In a clinical study by Rousseau,<sup>12</sup> based on preoperative or intraoperative decision making, patients eligible for flapless surgery can benefit from a less stressful and invasive procedure without affecting the high success rate of dental implant surgery. (Figure 18) The flapless approach is a predictable procedure when patient selection and surgical technique are appropriate. This technique is often aided by using a tissue punch to gain access to bone.

Figure 17.

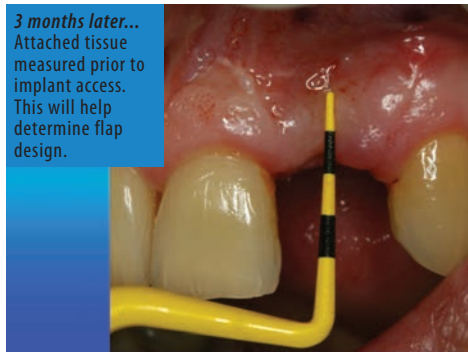


Figure 18.



If a flap is desired in an aesthetic area, a papillae sparing incision (Figure 19) is made beginning on the palatal aspect of the ridge and extending several millimeters into the mucogingiva on the buccal. This is often best accomplished by using a scalpel handle and 15C blade, tissue forceps and a periosteal elevator.

Figure 19.



When working in the smile zone, a papillae-sparing incision is critical to maintaining the integrity of the adjacent periodontium, both from a functional and aesthetic standpoint. Even though a case can be accomplished using a flapless approach, there is no substitute for direct visualization of the surgical site and complete evaluation of the available bone. When operating in a non-aesthetic zone, such as the posterior maxilla or mandible, a full thickness flap may be raised. Here, periosteal elevators and tissue retractors aid greatly in reflecting the soft tissue during surgery. (Figure 20)

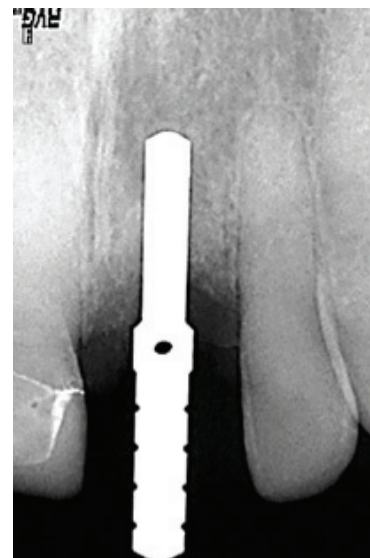
Figure 20.



With the flap reflected, the bony crest is fully evaluated. It is at this time that any irregularities in the bone can be contoured.

If a surgical stent is desired it is seated at this time and the osteotomy can be performed in part or whole through this guide. For ease of placement, radiographs may be taken with parallel pins (Figure 21) or the actual surgical drills themselves to help determine angulation. Osteotomy creation is based on the surgical system provided by the manufacturer to best suit their implants.

Figure 21.



In general, maxillary bone is less dense than mandibular and care must be taken not to over widen the osteotomy. In this particular case and with this implant system, it is the circumferentially undersized osteotomy that will aid in retention of the implant. It is this bone that the fins or blades of the self-threading implant will compress against, providing stabilization during the healing phase of osseointegration. The implant is then screwed into the osteotomy and may be seated at or below the crest of bone depending on location in the arch. (Figure 22) Final imaging should be taken to verify ideal placement and distances from various anatomic landmarks that will provide a successful outcome. At this point, the operator may choose to place either a cover screw, healing cap or provisional restoration on the implant. If a flap was created, closure can be accomplished in the aesthetic zone using polyglycolic acid (PGA) and chromic gut in non-aesthetic sites. Scissors uniquely designed to trim suture material are ideal to create a non-frayed, clean end and avoid pulling on the knot during trimming. (Figure 23) Prescriptions are given to the patient as needed to aid in post-operative healing and pain management, and home care instructions should be given orally and written prior to patient dismissal. The patient should be seen anywhere from 7-10 days post-operatively for evaluation and examination.

Figure 22.



Figure 23.



*Initial Prosthetic Phase:* After a determinant amount of time based on operator experience, time for optimal osseointegration and suggested manufacturer protocol, the implant may be restored. If a cover screw was placed, the implant can be accessed in several ways either via a full thickness flap, tissue coring with a tissue punch, or laser. Following cover screw or healing cap removal, (Figure 24) a cement or screw retained provisional restoration can be placed. (Figures 25-27) Full seating should be verified with imaging. Unlike a healing cap, a provisional crown offers improved control over the planned soft tissue growth and therefore a more idealized aesthetic result. The advantage of a well-constructed and contoured provisional crown in the anterior is that the gingival col will form to an ideal architecture. It truly sets the stage for a highly aesthetic result.

Figure 24.

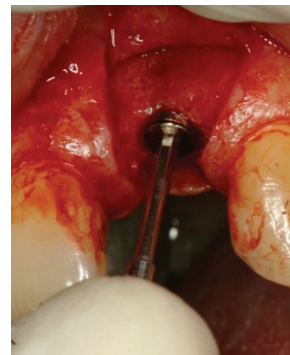


Figure 25.



Figure 26

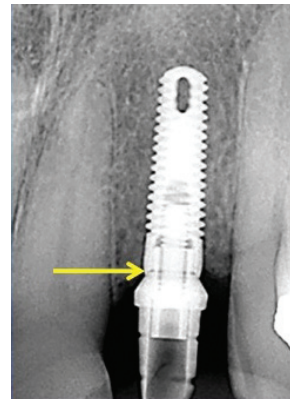


Figure 27.

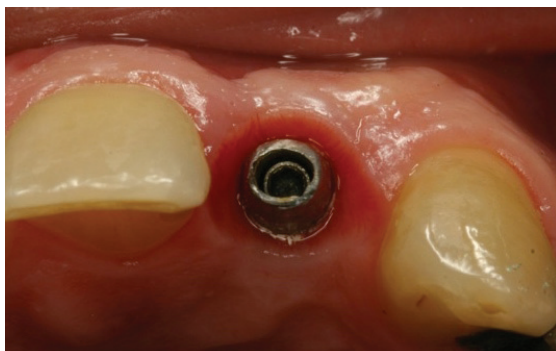


*Final Prosthetic Phase:* Once the tissue has healed, a final impression is made and the lab is instructed to fabricate the operator's restoration of choice. The two options available for single unit crowns are cement and screw retained. Upon receipt of the definitive prosthesis, the restoration is torqued to manufacturers specifications and the occlusion evaluated and adjusted as needed.

### Maintenance

Maintenance is critical to the long term success of the implant. (Figure 28) It is dependent on a variety of factors including frequency of professional care, dedication to home care and the instruments used for prophylaxis. It requires that patients present for hygiene on a regular basis (3, 4, or 6 months depending on need) and excellent home care.

Figure 28.



*Professional Care:* In an article entitled "Growing body of evidence on survival rates of implant-supported fixed prostheses" by Abt E., the author states; "As more and more patients are opting for dental implant treatment, it is essential that both the general dentist and hygienist understand how to properly monitor and maintain the health of the peri-implant tissue. Natural teeth and dental implants differ not only in surrounding anatomy, but also in surrounding disease; the traits of which require a keen awareness to distinguish. Failure to make these distinctions can result in practices that contribute to iatrogenic crown loosening, bone loss, and even the loss of the dental implant itself." His study concluded, "high survival

rates of implants and implant-supported crowns can be expected, but biological and, particularly, technical complications are frequent." This is extremely important to remember when maintaining implant-supported restorations. Regardless of the implant restoration type (cement or screw retained) issues such as peri-implant bone loss, screw loosening and fracture, among others, must be constantly evaluated, examined and cared for if they occur.

In addition, the following should be evaluated and/or performed: A review of health history, intraoral, prosthetic and osseous examination, probing, radiographs (when indicated), debridement of soft and hard deposits, selective polishing, flossing, and sodium fluoride treatments if teeth are present when indicated.<sup>13</sup>

Because implants can accumulate plaque and calculus,<sup>14</sup> they require debridement and research supports the complete deposit removal of all dentition—natural and implants. This is best achieved with non-metal instruments and instruments made of unfilled resin (Figure 29). These are proven to produce the least amount of surface alteration in the titanium implant surface and selective polishing may be executed with non-abrasive pastes.<sup>15,16</sup>

Figure 29.



Under appropriate clinical conditions, research supports the use of gentle, yet thorough probing around implants, while being careful to not interrupt the biological seal.<sup>3,6</sup> Dental implants have a peri-implant soft tissue seal, in which, the junctional epithelium attaches to the implant surface via hemidesmosomes, but the gingival fibers do not insert into the implant. Use of non-metal assessment instruments, is advantageous to reduce alterations to the abutment environment.<sup>17,18</sup>

If the wrong probe is used, or the operator probes incorrectly, the seal may be inadvertently broken. This can result in an over-exaggerated pocket depth reading, and passageways may be created through which opportunistic bacteria can gain access to bone and propagate its loss. If gingival surgery was performed in conjunction with the seating of the final restoration, then probing should be delayed until tissue is completely healed (approximately 6 weeks).<sup>19</sup>

Research has demonstrated the relationship between surface and peri-implant environmental alterations and the development of peri-implant mucositis and peri-implantitis. This roughened surface is more conducive to the formation and retention of bacterial plaque, resulting in an adverse biologic response caused by plaque-induced inflammation.<sup>20,21</sup>

A study published in *The International Journal of Oral and Maxillofacial Implants*<sup>22</sup> compared the effects of various implant scalers on titanium abutments. Research has shown that scaling with instruments made of unfilled resin designed with optimum rigidity should be used to avoid alteration to implant surfaces.

Another deposit on implants that has a negative impact is excess cement that was not removed during crown cementation. This will result in inflammation. Cement may remain even after meticulous attempts at removal, and is particularly true with deep sub-gingival margins. It may create inflammation even after being dormant for many months or years. A loose crown may also induce inflammation. The screw has a finite area to which it can loosen, which prevents the crown from being removed. Instead, as the gap between the crown and the implant fixture grows, more bacteria and debris will accumulate leading to halitosis, inflammation and even bone loss. Crown loosening should also be documented during dental implant maintenance appointments. When a loose crown is identified, it must be corrected.

### Home Care:

According to “Guidance for the Maintenance Care of Dental Implants: Clinical Review” by Todescan et al., a regimen for thorough oral hygiene, customized according to the condition of the tissue and the extent of plaque and calculus around the implants, should be implemented.<sup>23,24</sup> Home care devices and aids that have been shown to be safe for use around implant surfaces include interdental brushes with nylon-coated core wire, soft toothbrushes (both manual and power), end-tuft brushes, gauze, many types of floss (e.g., plastic, braided nylon, coated, floss with stiffened end to clean under bridges, dental tape).<sup>25,26,27</sup> Home care instructions should be customized according to implant design and accessibility. For example, smaller-diameter toothbrush heads, such as end-tuft brushes, may be helpful for areas that are difficult to access.

In addition, chemical control of biofilms, as an adjuvant to mechanical oral hygiene, is fully justified by its simplicity and efficacy proven by studies based on clinical evidence.<sup>28</sup> In a study by Pedrazzi et al., it was concluded that there is strong clinical evidence that at least two mouthrinses have scientifically proven efficacy against different oral biofilms, i.e., chlorhexidine digluconate and essential oils.

### Summary

There are many criteria that affect the decision making process when it comes to the placement of a dental implant and restora-

tion. While this course is able to offer general information for many factors in the decision making process, it is by no means a comprehensive study and further information should be sought.

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**Notes**

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