The Single-Stage Implant Procedure:
Science or Convenience?

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Effective Date: 03/01/2016 Expiration Date: 03/01/2019

Learning Objectives: After reading this article, the individual will learn: (1) if there is a strong clinical rationale for immediate implant abutment placement (IAP), and (2) the risks and benefits of delayed implant abutment placement versus IAP.

About the Author

Dr. Rosenbach received his undergraduate degree in biology from Yeshiva University and his dental degree from New Jersey Dental School. After completing a one-year general practice residency (GPR) at Woodhull Medical Center (Brooklyn, NY), he worked in private practice for a year, then he attended Columbia University for his postdoctoral training in periodontics and implant dentistry, completing a master’s degree focusing on the effects of abutment dis/reconnection on initial peri-implant bone loss. He is a Diplomate of the American Board of Periodontology, and is currently the associate director of the PGY-2/3 implant fellowship and course director of the periodontics and implant dentistry lecture series in the GPR at Woodhull Medical Center. He serves as the head of project for WikiProject Dentistry on Wikipedia, and is an internationally recognized lecturer, presenting more than 400 hours of continuing education on topics related to periodontics, implant dentistry, and adjunctive surgical procedures. He maintains a practice limited to periodontics and surgical implantology in New York City. He can be reached at rosenbachperio@yahoo.com.

Disclosure: Dr. Rosenbach has received honoraria for lecturing from Implant Direct.

Historically, a dental implant was placed into an edentulous site, at which time a cover screw was affixed. The implant platform was ideally countersunk to a depth of about one to 2 mm subcrestally so as to be “fully embedded”—thus, even after placement of the cover screw, the soft-tissue flap could be replaced over the surgical site and be able to “rest on the jaw between fixtures and not directly on the cover screws.”

According to original Brånemark protocols and depending on the site, after waiting anywhere from 4 to 6 months for osseointegration, an abutment was placed during a second-stage surgical entry as part of what is termed a 2-stage procedure—this can also be referred to as delayed abutment placement (DAP).

Thirty years later, some would argue that due to both our more advanced understanding of osseointegration and our remarkably overwhelming emphasis on soft-tissue aesthetics of the final restoration, we witness the placement of healing abutments often at the same time as implant placement in what is termed a single-stage procedure—this can also be referred to as immediate abutment placement (IAP). But others might counter that healing abutments are placed with increasing frequency at the time of implant placement simply because it’s more convenient.

The paucity of formal investigation on the relative risks and benefits between IAP and DAP unfortunately precludes a rigorous evaluation of evidence-based best practice. Instead, this article presents an informal review of the risks and benefits of the 2 procedures as currently understood. Support will be drawn from the literature, when available, as well as from clinical experience, opinion, and consensus, in the hopes that this review might guide clinical practice until such time as a preponderance of well-controlled data can direct clinicians in a more authoritative fashion.

THE ROLE OF THE HEALING ABUTMENT

Early descriptions in the literature involving the role of the healing abutment are difficult to locate. Some texts refer to Stage II (initial fixture uncovering after healing) by discussing the placement of a final abutment. It is only if the clinician has difficulty in determining the final apicocoronal height of the gingival collar to which to match an appropriately sized final abutment collar height that it is recommended to instead opt for a healing abutment.2 The benefit provided by this intermediate step is that a healing abutment possesses an undefined collar...

Figure 1. Contrasting use of a final abutment and a healing abutment at Stage II. If a final abutment is used at Stage II, the formation of the gingival margin may be at the restorative margin (A), coronal to it (B), or apical to it (not shown). Conversely, because there is no finish line on a healing abutment, it does not matter if the gingival margin forms more apically (C) or more coronally (D), and an appropriate final abutment may be chosen to match the level of the gingival margin that formed on the healing abutment.

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1. Historical context.
2. Immediate vs. Delayed Abutment Placement.

[Diagram: A, B, C, D showing different gingival levels]
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height—in a sense, its entire height is collar height due to the absence of a finish line (Figure 1). The soft tissue is permitted to heal against the healing abutment and define its own dimensions, which can then be measured and matched to a corresponding stock or custom final abutment.

Throughout time, a number of objectives have been developed for the second-stage surgery. It is important to note, however, that they are really objectives of abutment placement, notwithstanding the timing of this placement, and it is only because DAP was universally employed in all cases that the 2 became synonymous. Now that IAP is a clinical reality, it is essential to conceptualize the 2—placement of the healing abutment and second-stage surgery—as distinct entities.

In order to recognize IAP as an acceptable alternative to DAP, it must be established that IAP can be reasonably expected to meet or exceed the stated goals of DAP (and in reality, of abutment placement as a whole) without contributing unnecessary compromise from surgical, restorative, functional, and aesthetic perspectives.

This article will begin by examining the stated objectives of second-stage surgery, assessing whether IAP achieves the same goals, with recommendations made to best achieve each objective. After discussing some other considerations related to IAP versus DAP, reasonable therapeutic recommendations will be advanced for the best timing of abutment placement.

THE OBJECTIVES OF SECOND-STAGE SURGERY

The objectives of DAP at second-stage surgery are listed in the Table.3,4

1. To expose the submerged implant without damaging the surrounding bone
2. To control the thickness of the soft tissue surrounding the implant
3. To preserve or create attached keratinized tissue around the implant
4. To ensure proper abutment seating
5. To develop appropriate soft-tissue contours

regarded as clinically insignificant in some cases, in others it may not be. More investigation is necessary to reach a conclusive assessment.

When apically positioning the soft tissue in order to preserve or positively augment the zone of keratinized tissue (in fulfillment of objective 3), one can employ a split-thickness flap to maintain vascularization to the superficial aspect of the ridge, thus diminishing the effect that raising a flap might cause. However, some investigations found that split-thickness flaps contributed to more superficial bone loss and greater risk of flap necrosis due to an increased disturbance to the flap vasculature and delayed re-anastomosis of flap vessels.

Conclusion: Peri-implant bone preservation associated with IAP appears to be at least as good as, if not superior to, that associated with DAP.

Objective 2: Controlling Soft-Tissue Thickness

Minimizing an excessive thickness of tissue at the time of implant placement avoids the need for raising a more considerable flap at the time of DAP (see objective 1). Repeated tissue manipulation during oral surgical procedures has been shown to result in compromise to both osseous crest and gingival levels, although some have countered that high plaque levels and short follow-up duration, respectively, can be blamed for the unfavorable research data.

If the intention is to thicken the peri-implant soft tissue, such as by adding a connective tissue graft or by employing a palatal roll technique, such a procedure can be done simultaneously with IAP, although results may be better if the tissue is augmented without the presence of a transmucosal metal component.

Soft-tissue thickness is of critical concern at the buried implant site. If the soft tissue is too thin over a submerged implant and a communication forms during healing so that the cover screw becomes exposed at the level of the gingival margin, biologic width will form on the coronal extent of the circumference of the fixture, resulting in initial peri-implant bone loss (Figure 2).
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To summarize, IAP has the potential for similar or better results when the tissue is either sufficiently thick or abundantly thick and there is an intention to thin it out. When the tissue in the area surrounding and overlying the occlusal aspect of the fixture is very thin, soft-tissue grafting may be performed at the site prior to implant placement, at the same time as implant placement following the placement of a cover screw, or against a healing abutment during IAP. Greater success has been observed when the graft is placed against denuded bone or split-thickness connective tissue and sandwiched under flap tissue than if allowed to both remain somewhat exposed and if placed mostly against the avascular surface of exposed roots for the purposes of root coverage when maximal blood supply was not afforded to the graft, and this may be extrapolated to the avascular surface of metal transmucosal components. Following grafting, soft-tissue stability may not be achieved at the peri-implant site for up to 3 to 6 months, especially in the maxillary anterior where soft tissue may tend to be thinner and where aesthetic demands may be higher. For this reason, when gingival margins are deemed very thin on the flaps formed during surgical access for implant placement, connective tissue grafting may be recommended along with DAP, as opposed to attempting to graft against an abutment during IAP.

Figure 2. Gingival fenestration due to excessively thin occlusal soft tissue. Early inadvertent exposure of an implant as viewed from the (a) occlusal and (b) facial perspectives. Because transgingival exposure necessitates the formation of biologic width, and a cover screw does not possess enough apico-coronal height for biologic width to form onto it alone, biologic width forms on the implant fixture itself, leading to (c) initial peri-implant bone loss.

Figure 3. Apically positioned flap during delayed abutment placement (DAP) for multiple adjacent fixtures. (a) Cover screws for implant Nos. 2, 3, and 5 are visible through the thin soft tissue, and the mucogingival junction passes over the occlusal aspect of the ridge. (b) To maintain a wide zone of keratinized tissue, an apically positioned flap was performed during DAP. (c) To minimize peri-implant bone loss following flap reflection, a less invasive split-thickness flap was employed. (d) The flap was then sutured securely into place against the buccal aspects of the healing abutments.

While some have argued that research on peri-implant keratinized tissue is irrelevant either due to statistical skewing or nongeneralizable data from implant surfaces no longer used, the fact is that keratinized tissue demonstrates either equivalent or superior results when it comes to indices such as plaque accumulation, inflammation, probing depths, and loss of either bone or clinical attachment. As such, if one can easily preserve, or create in its absence, a zone of keratinized tissue, it might be prudent to do so (Figure 3). If a deficiency of keratinized tissue is evident during the treatment planning phase of implants, some researchers have reasonably proposed augmenting the tissue either prior to implant placement or simultaneously with implant placement, followed by DAP.

The literature discusses imaginative proposals as to how one might develop keratinized tissue around healing abutments, although they are technique sensitive and some have been published as retrospective case reports. Other approaches that are much less technique sensitive and have demonstrated compellingly successful increases of keratinized tissue at tooth sites may be employed around healing abutments (or final abutments with crowns) with greater ease, but they are largely intended for midfacial augmentation. Papillae reconstruction techniques have also been developed, but they are far from ideal; their own investigators lament the difficulties involved in splitting mini-flaps and employing these techniques in the presence of thin facial soft tissue, and the majority of cases demonstrated partial papillae fill.

Conclusion: In a situation where keratinized tissue is lacking, DAP may be more appropriate, unless grafting procedures can be implemented simultaneously with IAP.

Objective 3: Preserving or Creating a Sufficient Zone of Keratinized Tissue

While the preponderance of evidence has still not demonstrated the essentiality of a sufficient zone of keratinized tissue to prevent inflammation, attachment loss, or recession around teeth or implants, some would argue that this is a pressing issue to consider when it comes to implants.
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Objective 4: Ensuring Proper Abutment Seating
One can encounter varying degrees of difficulty when attempting to seat a component on an implant platform, including cover screws and also healing abutments during both IAP and DAP. A cover screw is virtually always either the same diameter as the implant platform (termed platform matching) or of a smaller diameter (termed platform switching), and so is quite simple to place once the male thread pattern of the screw catches in the female thread pattern of the internal well of the implant fixture. However, if an implant platform is placed even partially subcrestal, a platform matched cover screw may catch on the coronal edge of bone. This can also occur with platform matched healing abutments, during both IAP and DAP, and it is important to confirm seating upon all subcrestal platforms with appropriately angled radiographs (generally, bite-wings provide the greatest diagnostic accuracy to confirm component seating).

Even though the components match the diameter of the fixture, the latter might not have been held up by the edge of bone as a result of the greater torque applied to seat it completely into the depth of the osteotomy.

Healing abutments may be flared in what is often termed an anatomic profile, and if this flare begins apically enough, the healing abutment may catch on the edge of the osteotomy and not seat fully. This can also be an issue in the case of IAP on an immediate implant for which the flare of the healing abutment is greater than the flare of the walls of the extraction socket. In such a case, the bone may be reduced or a straight profile healing abutment may be appropriate (Figure 4).

Because of the tendency of anatomic profile healing abutments to catch on bone that extends coronally past the implant platform, one may encounter enormous difficulties when attempting to perform DAP through a punch access to the bone during Stage II. This is because coronal irregularities of the crest relative to the implant platform may not be obvious without visual access in the absence of a soft-tissue flap, and radiographic examination of the area may not pick up on minute prematurities of contact between the flare of the healing abutment and the osseous crest, especially if they are on the facial or lingual/palatal and thus superimposed on the abutment as seen on the radiograph. Even though such prematurities may also exist during IAP, good access and visualization of the surgical site are usually available, except in the instance of a flapless implant placement (Figure 5).

Conclusion: Full surgical and visual access to the implant platform is ideal when placing healing abutments. IAP affords this opportunity without additional compromise to the peri-implant bone (see objective 1).

Objective 5: Developing Appropriate Soft-Tissue Contours
Maintaining the greatest volume of bone and of soft tissue can have a favorable influence on the development of soft-tissue contours around implants. And, as stated above, decreasing the number of surgical re-entries has been shown to provide exceptional benefits in terms of both soft- and hard-tissue preservation (Figure 6).

When these objectives were first conceived and delineated, immediate implant dentistry (implants being placed at the time of tooth extraction) was either nonexistent or still in its infancy, and so the discussion revolved around developing appropriate soft-tissue contours as opposed to maintaining these contours. With the benefits of minimally invasive surgical
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Figure 6. Soft-tissue access for implant placement and developing soft-tissue contours by employing immediate abutment placement (IAP). Anticipating IAP with placement of this fixture into edentulous site No. 3, the alveolar ridge was accessed with a double-papilla sparing H incision that placed the midcrestal incision in an ideal location to accept the healing abutment. An anatomic healing abutment is used here to develop a better soft-tissue emergence profile. The mean dimensions of a maxillary first molar at the cemento-enamel junction are 7.9 mm mesiodistally and 10.7 mm buccopalatally,* but the implant used is only 5 mm in diameter. This abutment brings the soft tissue to 6.5 mm in diameter, more closely resembling that of the natural tooth. (*Woelfel’s Dental Anatomy, published data from investigation spanning 1974 to 1979.)

OTHER CONSIDERATIONS

Time Management

The most obvious and objective gain of IAP is avoiding the need for a second surgery. The benefit of simplified patient management should not be understated. It is not a secret that some patients fear the dentist in general, and perhaps the underlying issue can be tied to a more specific fear of administration of local anesthesia and surgical intervention, no matter how seemingly insignificant. Furthermore, distinct financial reimbursement for DAP is often nonexistent; therefore subsuming the abutment placement procedure into the same visit as the implant placement procedure is both time and cost efficient. The fewer the number of procedures, the more superior the care, assuming no significant compromises are introduced as a result.

Risk of Occlusal Loading

Occlusal loading may be the greatest concern related to IAP. Initially, it was thought that it was necessary to allow implant fixtures time to integrate prior to exposing them to the oral cavity with transmucosal attachments. Current information shows that this is not the case.

If IAP is performed, some worry that forces applied to the exposed abutment during healing can result in failure to integrate successfully. In contrast to this, a remarkable volume of literature has been published endorsing IAP on the grounds that it carries many potential benefits (as discussed above) while not contributing to diminished survival. The literature even demonstrates that when ample primary stability is achieved, immediate loading can be a predictably successful option.

In contrast, if an implant does not possess sufficient primary stability, early force application via an exposed healing fixture may interfere with osseointegration.

Bone Grafting at the Time of Implant Placement

Introducing bone graft material at an implant site during initial placement may make it more difficult to perform IAP (Figure 7). In such a case, DAP may be advantageous because of how the presence of a healing abutment may interfere with such things...
as planning the incision design, use of membranes, flap advancement procedures, desire for primary closure, ease of suturing, and flap securement.\footnote{4}

For more conservative peri-implant grafting, such as when an osteotomy was shifted during enlargement or in the gap around an implant placed immediately into an extraction socket, there may not be as much need for concern. If immediate implants are placed into sockets at which no flaps were raised, management of the surgical site becomes far simpler. If peri-implant gaps are large enough to manage and graft material is introduced around the secured fixture, bone may either be left exposed or graft containment techniques utilizing collagen tape may be employed that either lie over the healing abutment or through which the healing abutment perforates with no decrease in success.\footnote{5,6}\footnote{7,8} Alternatively, a custom healing abutment may be used to contain the graft material and effectively seal in the blood clot.\footnote{9}

**CONCLUSION**

**Clinical Recommendations**

IAP appears to be equivalent to DAP in all objectives except when there is either a deficiency in primary stability, or soft-tissue thickness or keratinization. Notwithstanding, some investigators have developed methods of soft-tissue augmentation that have been shown to be predictable even when done at the same time as placement of a healing abutment.

Based on the available data and the clinical experience of those who have been performing IAP with regularity for a considerable amount of time, the following factors ought to be taken into account when considering the timing of abutment placement:

1. IAP has been shown to meet or exceed the demands of healing abutment placement in many situations.
2. IAP reduces both chair time and the number of surgical procedures. IAP also reduces the number of times a patient needs to be anesthetized, a procedure that most patients would prefer to avoid.
3. When sufficient primary stability has been achieved, the concern of early overloading may be overemphasized. At this time, however, the characteristics of sufficiency of stability (ie, degree of stability and extent of fixture surface area engaging bone) have not been well defined. Two currently utilized parameters of stability, final surgical torque value and implant stability quotient, are only modestly informative, as they do not take primary stability into account as a function of the surface area, which may be a critical component that is overlooked. Further study is required in this area.
4. Healing abutments should not extend more than 2 mm coronally from the gingival margin to limit force transmission during mastication. It should be out of occlusion in all excursions and protrusive. Care should be taken in patients with a history of parafunctional habits, and clinicians should confirm that healing abutments exhibit clearance not only from opposing teeth, but also from any removable appliances or devices, such as athletic guards or nightguards.
5. If there is no intention to augment the zone of keratinized tissue, healing abutments should be placed at the time of implant placement to avoid unnecessary surgical re-entry. Even if keratinized tissue is deemed deficient, techniques do exist for augmenting soft tissue following fixation of transmucosal components, although the clinician should either be familiar with these types of procedures or consult with another who is.

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POST EXAMINATION QUESTIONS

1. All of the following are true about the second-stage implant procedure except:
   a. It was initially touted as absolutely necessary for successful integration to occur.
   b. It can better prevent forces from transmitting to the healing fixture.
   c. It is synonymous with an immediate abutment placement (IAP) protocol.
   d. It refers to the placement of a cover screw at the time of implant placement.

2. Historically, use of a healing abutment before a final abutment was seen as a benefit because:
   a. Healing abutments are made of aluminum, which prevents an oxide layer from forming at the implant-abutment junction.
   b. Placing healing abutments is easier, faster, and less expensive because they had always been included with the implant.
   c. While final abutments generally engage the anti-rotational device of the implant fixture, healing abutments spin freely until they are flush with the platform.
   d. Instead of trying to get the soft tissue to conform to the finish line of the final abutment, a healing abutment permits the soft-tissue margin to form at will, and the final abutment can then be made to correlate with this level.

3. All of the following are listed as objectives of second-stage surgery in the article except for:
   a. Preserving or creating attached keratinized tissue around the implant.
   b. Exposing the submerged implant without damaging the surrounding bone.
   c. Ensuring that gingival fibers in the soft tissue run parallel to the surface of the healing abutment.
   d. Developing appropriate soft-tissue contours.

4. A healing abutment is virtually always wider than the implant platform it sits upon so as to:
   a. Prevent bone growth over the top of the platform.
   b. Retard apical migration of the junctional epithelium.
   c. Prevent apical transmission of lateral forces.
   d. None of the above.

5. Which radiographic modality provides the greatest diagnostic accuracy when attempting to confirm component seating on an implant platform?
   a. The bite-wing radiograph.
   b. The periapical radiograph.
   c. The Reverse Towne’s projection.
   d. The panoramic radiograph.
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6. Prematurities of the crestal bone may interfere with proper seating during abutment placement. When flap access is performed for implant placement, IAP permits the clinician to have good surgical access and visualization for this procedure.
   a. The first statement is true, the second is false.
   b. The first statement is false, the second is true.
   c. Both statements are true.
   d. Both statements are false.

7. According to the article, why do some researchers emphasize how important it is to begin the restorative emergence profile as apically as possible?
   a. If the emergence profile begins too coronally, there won’t be adequate embrasure space for the papilla.
   b. For the most favorable crown-to-implant ratio, the emergence profile should begin as close to the implant-abutment junction as possible.
   c. For best functional and aesthetic success, it’s best to have a more gradual expansion of the small diameter of the implant platform to the generally larger cross-section cervical shape of the crown.
   d. Without an apically situated emergence profile, excessive stress can be transmitted to the abutment screw, leading to more frequent screw loosening.

8. According to the article, attempting hard-tissue grafting at the same time as implant placement may interfere with IAP in all of the following ways except:
   a. Advancing, securing, and achieving primary closure of the gingival flap.
   b. Incorporating the use of a barrier membrane.
   c. Achieving adequate primary stability of the fixture.
   d. Simplicity of suturing technique.

9. An immediate implant may be placed into porous bone. If immediately provisionalizing such an implant, it is important to ensure that occlusal contact cannot be made in protrusive, but checking lateral excursions is not important.
   a. The first statement is true, the second is false.
   b. The first statement is false, the second is true.
   c. Both statements are true.
   d. Both statements are false.

10. An IAP protocol may be performed with a customized temporary abutment. An IAP protocol is relevant only in the so-called “aesthetic zone.”
    a. The first statement is true, the second is false.
    b. The first statement is false, the second is true.
    c. Both statements are true.
    d. Both statements are false.
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