

SOFT TISSUE RECESSON AROUND IMPLANTS: IS IT STILL UNAVOIDABLE?

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When treatment with dental implants is indicated, an accurate diagnosis must be made to evaluate the clinical parameters and determine the optimal time for immediate or delayed (ie, early or late) implant placement and loading following tooth extraction. It is also important to identify complications and their implications on the aesthetic outcome.† This article explains behavior of the hard and soft tissue around the implant, evaluates the timing of implant placement after extraction, and reviews various parameters that influence tissue marginal remodeling.

Learning Objectives:

This article discusses the importance of the hard and soft tissue's condition surrounding the implant site and how this can be affected by the timing of the extraction. Upon reading this article, the reader should:

- Understand how the papilla height, biologic width, and adjacent teeth can affect the success of an implant.
- Realize why immediate implantation can be more conservative and is the technique that may prove to be the most successful.

Key Words: gingival recession, biologic width

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In the anterior maxilla, the alveolar ridge dimensions influence the implant location, the position of the lip, and the architecture in the free gingival margin due to labial plate resorption.² Certainly, a beautiful aesthetic result is difficult to obtain with implants in the anterior.³ Both the alignment of the gingival margin and the presence of papilla are essential elements in resolving aesthetic implant problems in the anterior region. These two soft tissue entities, however, are closely related to the biotype and to the quality and quantity of underlying structural alveolar bone.

The peri-implant mucosa, particularly if it is narrow, with a thin-scalloped biotype, inevitably retracts six months after the abutment connection and restoration, due to the reformation of the biologic space.⁴ The peri-implant bone and gingival tissues are almost similar to the periodontal tissues, and have virtually the same reaction to the absence of hygiene, to plaque accumulation, and to occlusal overload. Understanding the biological, microbiological, immunological, and other mechanisms that control the periodontium make it easier to manage peri-implant problems.⁵

The purpose of this article is to explain the biological rationale between the hard/soft tissue around a dental implant, to evaluate the importance of implant placement timing after extraction, and to review the influence of the different implant parameters on tissue marginal remodeling.

Biological Rationale

The predictability of the peri-implant aesthetic outcome is ultimately determined by the patient's particular anatomical condition and the clinician's ability to manage the different procedures without trauma to the site or invasive surgery. In healthy dentition, tooth contour and bone architecture determine the gingival height and form. There is,



Figure 1. Preoperative facial view of patient, who presented with a fracture on tooth #9(21).



Figure 2. Facial view showing the root fracture. The adjacent teeth are restored with defective metal-ceramic crowns.

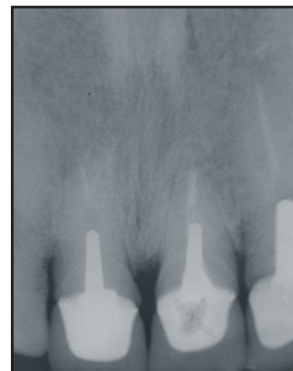


Figure 3. Preoperative alveolar radiograph confirming loss of the interproximal alveolar bone.

therefore, an interrelation between the two entities and the formation of the biological width. Whereas the biological space is located supracrestally for the teeth, it is almost always subcrestal around the implant.

The biologic width around a tooth and the biologic width around an implant present several differences, such as their length (ie, 2 mm versus 4 mm, respectively), histological composition, and their vascularization. Histologically, there are more collagen fibers running parallel to the implant surface, thereby functioning as a mucosal scar tissue with a weak adherence. This rich composition of collagen fibers will allow them to be stretched or compressed, which is a tension that cannot be exercised on teeth without violating the biologic width. The peri-implant soft tissue is less vascularized, which makes bacterial invasion more destructive around an implant than around a tooth.⁶

In implantology, marginal bone is the key to aesthetic soft tissue contour. Even after tooth extraction, one must attempt to ensure retention of the buccal bone lamella.⁷



Figure 4. Occlusal view showing the extraction at the site of tooth #9(21), where implant placement is indicated.

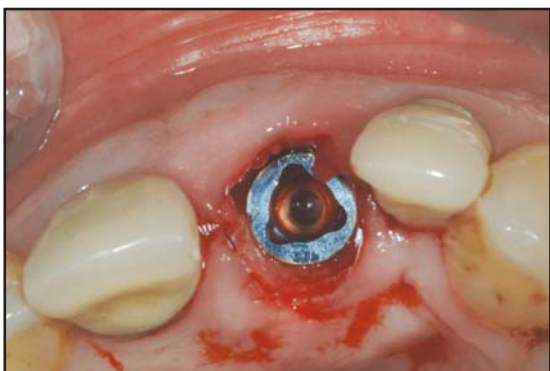


Figure 5. The 0.5-mm × 13-mm implant was immediately placed with its zirconia abutment following extraction of the left central incisor.

During bone augmentation, implantologists are increasingly turning to slowly resorbed bone substitutes. These will help to ensure that the results achieved in bone and soft tissue augmentation will be retained for the long term after implant restoration.

To obtain ideal implant aesthetics, papilla height and form should be restored to the original situation observed with natural teeth. When single implants are placed adjacent to natural teeth, a predictable aesthetic result can be achieved—provided the supporting tissues of the natural dentition are in a healthy state and the optimal distance between the teeth and the implant is respected. Therefore, implants placed adjacent to natural roots with normal bone levels will have normal papilla peaks, since the adjacent roots contribute to the stability of the bone and gingival papilla.

When two or more adjacent implants are placed in the anterior maxilla, predictable aesthetics are often difficult to achieve. Between adjacent implants, the peri-implant tissue significantly alters their histological

characteristics and physiological behavior, thereby intensifying the limitations in achieving aesthetic results. The aesthetic challenge in implant dentistry remains the restoration of adjacent implants, where the interimplant papilla typically forms more apical than the interdental papillae of the adjacent dentition.⁸ As the biologic width is established around neighboring implants, there is a flattening of the interimplant bone and a change in the level of the soft tissue. As a result, a normal progression of the papilla from the missing natural teeth through the adjacent implant is lost. The proximal crown contact areas are generally longer and more apical, and the interimplant papillae are often more apical than the papilla level between the adjoining natural teeth.⁹

Furthermore, even with 3 mm of space between conventional implants, the interimplant bone level flattens to some extent, and is accompanied with the loss of a natural papilla form.¹⁰ In the anterior region, retention and regeneration of a papilla height of 4 mm to 5 mm can be achieved with implants if:

- The implant distances are ~~not~~ greater than 3 mm;
- The interimplant buccal bone volume is augmented in order to prevent the occurrence of bone resorption¹¹; and
- The thickness of the buccal lamella is greater than 3 mm for optimal support of the soft tissue.

The most difficult areas in which to achieve this are between a maxillary lateral and central incisor or between a maxillary lateral incisor and canine because of the limited room. Nevertheless, in a situation where one tooth or several teeth are missing due to trauma, periodontal disease, or, in a healed site, the presence of soft hard tissue defects, the aesthetic outcome becomes increasingly less predictable because of new unfavorable anatomic conditions.



Figure 6. The implant collar is placed 2.5 mm below the free gingival margin and all bone contacts are carefully checked.

Implant Placement Timing

In the anterior maxilla, bone volume and the thickness of the buccal cortical plate are decisive for the aesthetic outcome of an implant restoration. Therefore, the placement of an implant postextraction creates numerous challenges for the practitioner.¹² To select between the different alternatives for implant placement, a precise presurgical diagnosis is necessary in order to evaluate the gingivo-osseous parameters to determine the best moment to extract the tooth and place the implant, and to decide whether implant loading should be immediate or delayed (Figures 1 through 5).¹³

Immediate Implantation

Immediate implantation after any extraction proves to be favorable to the conservation of bone and gingiva, shortens treatment time for the patient, and is, therefore, more conservative (Figures 6 and 7).^{14,15} When a tooth with a poor diagnosis is still in the arch, timing the extraction, immediate implant placement, and provisionalization may not preserve the wall of the socket and, in particular, the external cortical wall, which is the most vulnerable in the anterior maxilla on a thin periodontium and more prone to gingival recession. Immediate placement with the temporary crown will, however, maintain the volume and profile of the soft tissue contour on a thick periodontium.¹⁶

Early Implantation

The tooth should be extracted very delicately to preserve bone and gingivae, and a provisional bridge or an acrylic removable denture should be immediately inserted to guide soft tissue healing. Implantation is completed 6 to 8 weeks following tooth extraction. With early implantation, the soft tissue situation is mature, and bone resorption is usually limited at this point. It enables a more satisfactory aesthetic outcome on patients with the thin gingival type. A flap preserving the adjacent papilla



Figure 7. Initial temporary crowns immediately cemented on teeth #8(11) through #10(22).



Figure 8. A vent hole is placed on the lingual aspect of the implant provisional to prevent any excess amount from flowing into the socket since the mucosal barrier has not yet reformed.



Figure 9. A careful cleaning of all excess cement is indispensable to sound soft tissue healing.

Table 1

Horizontal Biological Criteria for Implant Placement

- Mesiodistally, 1.5 mm to 2 mm from implant to adjacent teeth
- Mesiodistally, 3 mm to 4 mm from implant to adjacent implant
- Buccolingually, 2 mm to 3 mm from the cervical height of contour
- Coronoapically, 2.5 mm to 3 mm from the buccogingival margin

should be avoided to prevent scarring of the releasing vertical incision. An autogenous bone or xenograft covered with a membrane and connective graft can be used prior to¹⁷ or in conjunction with¹⁸ implant placement to maintain and to gain buccal thickness. This helps pre-



Figure 12. Three crowns were placed on the second laboratory cast, which was fabricated from the pick-up impression of the bisques.



Figure 10. The zirconia customized abutment CAD/CAM fabrication displays a concave transmucosal profile to thicken and immobilize the soft tissue.



Figure 11. Metal-ceramic posts and cores were placed on the adjacent teeth.

vent bone resorption and soft tissue recession that always occur postextraction. A membrane can also be placed onto the internal wall of the extraction socket covering the defect, filling the socket with an effective bone graft and eliminating the need for flap reflection.¹⁹

Late Implantation

Late implantation takes place more than 16 weeks after extraction. If the anterior alveolar ridge is narrow, it will be necessary to choose two-stage surgery using guided bone regeneration with an autogenous graft and/or a connective tissue graft before or in conjunction with implant placement to recreate an overall contour of bone and gingiva. A bonded temporary restoration will prevent loss of papilla height and soft tissue contour and also may enable implant healing without micromovement and patient comfort.

Prevention of Peri-Implant Recession

Marginal bone loss of 1 mm in the first year following the abutment connection, followed by 0.2 mm per year, were among the criteria for implant success.²⁰ Recently, the accumulation of data regarding marginal bone loss and a better understanding of bone and soft tissue behavior around the implant neck and body have shown these criteria to be inaccurate for a wide variety of implant systems.²¹ Saving a few tenths of a millimeter of bone around an implant does not increase the longevity of the implant, and should be selected only for aesthetic reasons.²² To prevent or decrease peri-implant bone resorption and gingival recession following implant restorations on the anterior zone, several options have been suggested regarding the implant's design, timing of extraction, flap design, methods of grafting, and other related factors.

Implant Design, Diameter, and Collar

A distinct trend of soft tissue recession around all the implants occurred from second-stage surgery to the final restoration. Soft tissue recession around a wide-diameter implant averaged 1.58 mm compared to 0.57 mm around a standard-diameter implant. While the wider-diameter platform should provide an anatomically correct emergence profile, it may be more prudent to use standard-diameter implants in the aesthetic

Table 2

Implant Restoration Criteria Affecting the Papilla

- Vertical biological criteria for single- and multiple-implant restorations¹
- Bone crest/Tooth-implant contact point restoration: 4.5 mm
- Bone crest/Implant-implant contact point restoration: 3.4 mm
- Bone crest/Implant-pontic contact point restoration: 5.5 mm

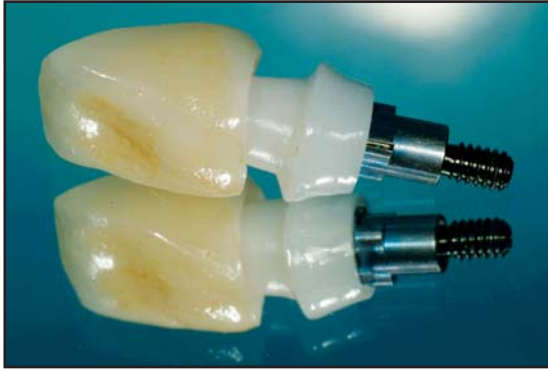


Figure 13. The submergence profiles of the Procera restorations (Nobel Biocare, Yorba Linda, CA) are concave.

zone to avoid thinning the buccal cortical bone and excessive soft tissue recession.²³

In clinical study, no statistically significant difference in bone loss around the polished collar was detected among different implant groups (ie, machined dental implants or rough-surface implants) or among different regions of the oral cavity.²⁴ Implant design continues to evolve, and the alterations that impact the most tissue recession are located primarily in the cervical and collar area:

- The design of the implant in the collar aspect should stabilize the crestal bone by bringing the roughness and the thread as close as possible to the platform;
- The implant collar shifts from a divergent neck to parallel or convergent walls;
- The collar becomes the last thread in order to biomechanically lock, three-dimensionally, the crestal bone and transform deleterious shear forces into compressive forces; and
- The polished neck is covered with a rough surface.

A study of the effect of a machined/rough implant collar on a coronal hard tissue has shown that the least marginal bone loss with each implant occurred when the collar of the implant was placed above the alveolar crest.²⁵ A change in implant design towards a scalloped collar to mirror the bone and soft tissue topography with rough surfaces and grooves could help conserve the tissue architecture by minimizing the bone remodeling induced by the subosseous position of the implant head, thus improving the support of the papilla.²⁶

The thread position of the implant determines the effective level of remodeling after loading, and that this

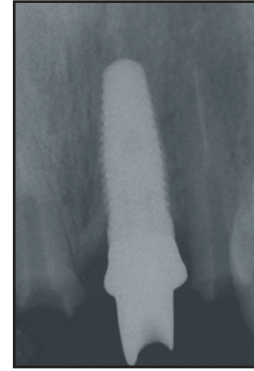


Figure 14. Postoperative alveolar radiograph of the two definitive restorations showing perfect junction between the abutments/restorations and the implant platform.

is perhaps even more important than the position of the implant/abutment microgap.²⁷ The availability of numerous implants with microthreads reaching the col seems to follow this recommendation to prevent bone resorption from occurring. The results of such designs, however, must still be proven by research.

Implant Placement and Extraction Timing

The moment of immediate, delayed, or late implant placement after tooth extraction is therefore an important part of the treatment plan,²⁸ in particular as a means of preventing gingival recession. Locating the proximal implant platform 1.5 mm above the bone will help to minimize bone loss as the biological space around the implants is established.⁹

When two extracted teeth are replaced by two adjacent implants, it has been recommended that the surgeon maximize support of the papilla throughout the surgical and restorative procedures via progressive extraction of the teeth and immediate implant placement.²⁹ This requires extraction of one tooth and its replacement and restoration with an implant before the adjacent tooth is treated. The concept is to maintain the dental bone adjacent to the integrated implant, which would be more likely to act as a stable scaffold for an interimplant papilla peak. This will not be seen with adjacent implants placed at the same time, where coalescing lateral interimplant bone remodeling results in bone loss for that papilla, particularly if the interproximal distance is less than 4.5 mm between the adjacent maxillary central incisors.

Forced Eruption

Orthodontic treatment is the best solution for patients with a thin biotype who wish to limit the number of surgical



Figure 15. Postoperative facial view of the definitive restoration with minimal space between teeth #9 and #10.

sessions to the single operation required for the placement of implants, and to enhance the hard and soft tissue profile prior to extraction and implant placement.³⁰ During this controlled orthodontic movement, the teeth and their surrounding periodontium (ie, alveolar bone and gingiva) will be displaced coronally—provided that periodontal inflammation has been controlled. After 8 weeks, the gingival margin and interdental papilla are located at a level that is compatible with the morphology of the future implant crowns. After another 3 months of splinting for bone maturation and gingival stabilization, a single surgery is performed; the incisors are extracted and replaced immediately by implants and temporary crowns. Conserving teeth until implant placement stabilizes cortical bone and enables the convex form of soft tissues to be maintained at the vestibular level, thus creating the illusion of natural roots.

Flap Design

Immediate implant placement after extraction is generally a flapless surgery. The extraction is performed with a periosteal elevator to achieve atraumatic removal of the tooth and to prevent any damage to the buccal hard and soft tissue. A comparative study, conducted on healed sites using the widely mobilized flap design with interproximal papillae and the limited flap design with a minimum of 1 mm of interdental papilla, has shown that interproximal bone and crestal bone loss (1.2 mm) is more important for the wide than the limited flap.³¹ The use of the limited flap design, which protects the papillae, minimizes interproximal bone loss and possible loss of the papillae for the healed site and consequently provides a better interproximal aesthetic outcome with less papillae recession, but the incision scar could remain and be

visible, hence, the importance for the incision should become sulcular on the buccal site.

Conclusion

Although aesthetics represent an essential part of the dental treatment, the value of the results, the predictability of the different therapeutic modalities, and the long-term prognosis involve a scientific approach in all clinical procedures. In order to establish an optimal aesthetic implant restoration, and to achieve a successful outcome, the essential prerequisites should always remain a precise, comprehensive, biological, and prosthetic diagnosis as well as the choice of the most conservative, appropriate, and least traumatic treatment for the patient; these prerequisites are established to prevent any injury to the periodontal and dental structure with an adequate tridimensional position/orientation. The final objective is to achieve an optimal aesthetic restoration implant surrounded by its natural gingival environment in harmony with the adjacent teeth, using delicate osseous and/or mucogingival aesthetic surgery. The second part of this presentation will discuss tridimensional implant placement and the use of connective tissue grafting to complete the aesthetic restoration.

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CONTINUING EDUCATION (CE) EXERCISE No. X



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Soft tissue recession around implants: Is it still unavoidable?," by André P. Saadoun, DDS, MS, and Bernard Touati, DDS, MS. This article is on Pages 000-000.

- 1. A dental implant in the anterior zone that is perfectly osseointegrated and functional is a success. Despite an inadequate aesthetic outcome, this implant may be considered a failure.**
 - a. Only the first statement is true.
 - b. Only the second statement is true.
 - c. Both statements are true.
 - d. Neither statement is true.
- 2. Different slowly resorbing biomaterials incorporated into the alveolar implant gap do which of the following?**
 - a. Support the soft tissue.
 - b. Improve the aesthetic result.
 - c. Preserve the dimension of the alveolar crest.
 - d. All of the above.
- 3. Which part of the new implant design will prevent marginal soft tissue recession from occurring?**
 - a. The rough col.
 - b. The rough body.
 - c. The polished col.
 - d. The machined body.
- 4. The least marginal cervical bone loss is achieved when the platform of the implant is placed at which level?**
 - a. Below the bony crest.
 - b. At the bony crest.
 - c. Above the bony crest.
 - d. The level makes no difference.
- 5. New implants with microthreads or grooves up to the col can do which of the following?**
 - a. Prevent interdental bone resorption.
 - b. Activate the osseointegration process.
 - c. Has no significant influence on cervical bone.
 - d. Both a and b.
- 6. Immediate placement of the implant after atraumatic extraction is considered favorable to preserve the bony envelope. This statement is correct for which of the following situations?**
 - a. Thin biotype.
 - b. Thick biotype.
 - c. Both a and b.
 - d. Neither a nor b.
- 7. What modality of implant-placement timing will reduce alveolar bone loss from occurring after tooth extraction?**
 - a. Late implantation.
 - b. Immediate implantation.
 - c. Early implantation.
 - d. None of the above.
- 8. The forced-eruption concept applied before extraction and implant placement is mainly recommended in which of the following?**
 - a. Thin biotype.
 - b. Thick biotype.
 - c. Enhancing coronal hard and soft tissue.
 - d. Both a and c.
- 9. The predictability of the aesthetic outcome does not depend upon which of the following?**
 - a. Patient's age.
 - b. Surgical trauma.
 - c. Patient's biotype.
 - d. Understanding the biological implications.
- 10. Which of the following does incision flap design at implant placement and/or implant exposition determine?**
 - a. The interproximal bone level.
 - b. The final aesthetic outcomes.
 - c. The healing type of the mucosa.
 - d. All the above.