The Role of the Implant Housing in Obtaining Aesthetics: Part 2. Customizing the Peri-Implant Soft Tissue

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The successful placement of single-tooth implants can be evaluated by the degree of implant osseointegration, longevity of the restoration, and the aesthetics provided by the prosthesis. Implant aesthetics can be determined by the degree of scallop and harmony achieved with the surrounding peri-implant collar of gingivae. This article analyzes features of the abutment-restoration complex that are critical to customization of the peri-implant tissues and the development of the ultimate aesthetic peri-implant gingival profiles.

Learning Objectives:

This article discusses customization of the peri-implant tissues and the development of aesthetic peri-implant gingival profiles. Upon reading this article, the reader should:

- Recognize the role of the implant housing on anterior aesthetics.
- Understand the influence of tooth topography on gingival form.

Key Words: single-tooth, implant, emergence profile, soft tissues, aesthetics

For single-tooth implants to be considered aesthetic, they should be appropriately placed in an implant housing that is qualitatively and quantitatively suitable and when this transpires, an adequate peri-implant collar of gingivae can be expected to form.[1] In order for the peri-implant tissues to ultimately harmonize with the gingivae surrounding the adjacent teeth, it is necessary that the tissues be customized or molded by the abutment-restoration complex.[1-3] In the natural dentition, the contours of the teeth influence the profiles of the periodontal gingivae.[4,5] Similarly, the emergence profiles of restored natural teeth will influence the definitive form of the peri-restoration gingival collar.[6] The effect of the emergence profile of the restoration on the aesthetics and health of periodontal tissues can be quite profound despite the relatively small amount of tissue with which it is in contact.[6] By contrast, the peri-implant soft tissue volume is larger and lends itself even more readily to shaping by the emergence profile of the abutment-implant restoration complex.[3,7-10] Consequently, the contours of the abutment-restoration complex can be readily utilized to mold the peri-implant soft tissue for optimal aesthetics.

This article analyzes features of the abutment-restoration complex that are critical to customization of the peri-implant tissues and the development of the ultimate aesthetic peri-implant gingival profiles.

Figure 1. Lateral view of dog mandible with the soft tissue peeled away. The original gingival line is parallel to the bone margins. Tissues peak coronally in concavities on the tooth and recede apically over convexities.

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Figure 2. Bone and gingivae peak into the concave groove and recede apically on the convex tooth surfaces. Note that the acuity of the tooth contours influences the form of the tissues. (Reproduced with permission from *Int J Periodont Rest Dent.*)

Influence of Tooth Topography on Gingival Form

In the natural dentition, the form of the periodontal tissues is largely determined by the surface topography of the tooth.[4,5] These tissues generally peak occlusally into concavities and fall away apically on convex surfaces, giving rise to the scalloped appearance of the gingival margins (Figures 1 and 2). The acuity of the convex tooth contours influences the disparities seen in gingival scalloping, in that the greater the acuity, the more pronounced the scallop (Figure 2). This phenomenon contributes to the determination of the two basic periodontal biotypes.[2,3] The soft tissue margins are generally parallel to the osseous crests, the notable exception being interproximal areas where the formation of a soft tissue 'col' is related to the topography of the adjacent tooth surfaces and the position of the contact point.[4,5] These characteristics are fundamental for successful "barreling" procedures used in management of incipient furcations during root amputation procedures, particularly in the treatment of maxillary molars (Figure 3).

Creation of suitable tooth surface anatomy during these procedures ensures formation of a harmonious gingival form and facilitates health and maintenance. It is, however, possible for soft tissues to have normal scalloped topography and not be strictly parallel to the underlying bone due to differences in the surface anatomy beneath the tooth surface as compared to the surfaces with which the bone is in contact. This can be observed in faciolingual furcation areas of mandibular molars or in first maxillary premolars that may have two facial roots or a deep facial groove. It may also be perceived

Figure 3. Postoperative appearance of a maxillary first molar following distobuccal root amputation in which the form of the tooth has dictated the gingival contours. Peaking of the gingivae into the concave tooth surface is evident.

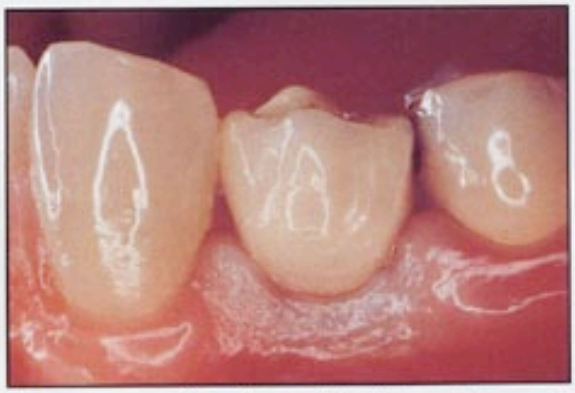

Figure 4. Peri-implant soft tissue blanching can be caused by the modified abutment-restoration complex. The papillae are bulbous and do not yet fill the embrasures 4 weeks following papillae generation at stage 2 surgery.

on the facial surfaces of maxillary central incisors. In these instances, the bone peaks coronally into the furcation or concave groove while the soft tissue over the convex facial tooth surface deteriorates apically to form a natural scallop dictated by the surface curvature. The surface topography of the teeth, therefore, significantly influences the determination of periodontal gingival anatomy and contour.

The Abutment-Restoration Complex and Peri-Implant Gingival Form

The principles that define the effects of tooth surface anatomy on gingival form also apply to the peri-implant gingivae. Altering the acuity of the convex surfaces has allowed clinicians to modify the gingival form and flatten the surface topography of the abutment-restoration complex. This has resulted in more coronal positioning of facial peri-implant gingivae.[11] Increasing the acuity can also cause a more apical positioning of

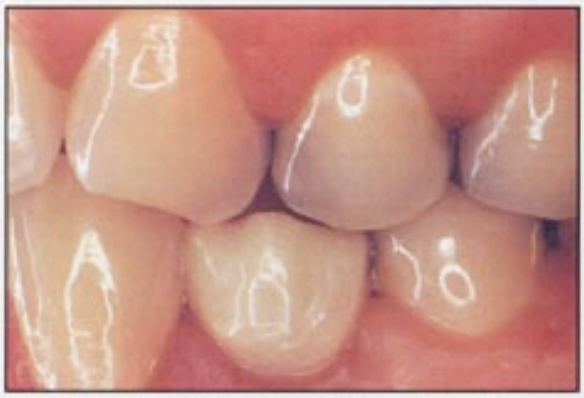

Figure 5. Molding of the soft tissues has resulted in papillae that have aesthetic form and almost completely fill the embrasures.

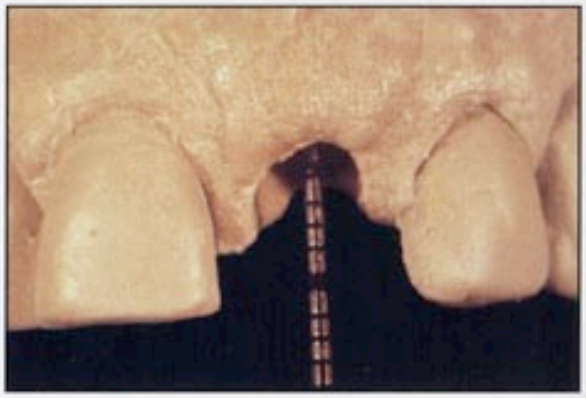

Figure 6. Placement of a periodontal probe on the implant platform analogue demonstrates its placement approximately 2 mm below the gingival margin and 4 mm apical to the tips of the papillae. (Reproduced with permission from *Int J Periodont Rest Dent.*)

the gingival margin. Creating a flatter or slightly more concave surface anatomy on the interproximal surface of the abutment-restoration complex will encourage coronal movement and facilitate development of papillae following stage 2 surgery. In order to exert these effects, the abutment-restoration complex must be in "light contact" with the developing peri-implant soft tissue immediately following stage 2 surgery. During the ongoing customization process, mature tissues will appear to blanch temporally when sufficient pressure has been applied, which indicates that sufficient tissue contact is attained at each restoration modification (Figures 4 and 5). Indexing at stage 1 surgery with proactive fabrication of the provisional custom abutment and stage 2 insertion simplify the tissue sculpting process. The papillae form can be influenced, and a limited height increase can be achieved during the molding process (Figures 6 and 7).[5]

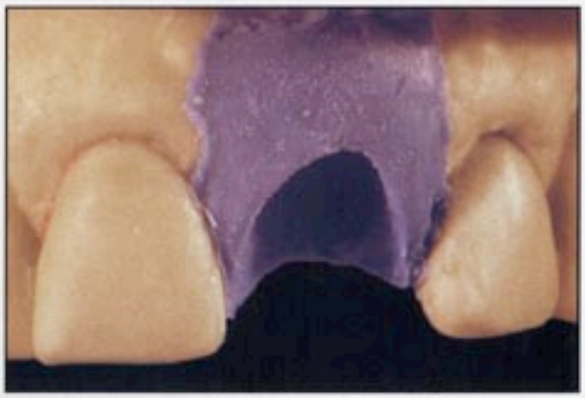

Figure 7. Sharper and more coronally situated papillae are evident, while the midcervical gingival margin is more apical, exhibiting a scallop that closely approximates that of the adjacent sister tooth. (Reproduced with permission from *Int J Periodont Rest Dent.*)

Emergence Profile

The emergence profile should be a straight or slightly concave line from the subgingival restorative margin to the free gingival margin.[6] While the emergence distance for natural dentition is generally small (ie, approximately 1 mm to 2 mm), violations of the emergence profile can cause adverse gingival reactions. In the implant restoration, the distance from the implant platform ranges from 3 mm to 4 mm facially to 4 mm to 6.5 mm in the papillary area. The emergence profile of the implant abutment-restoration complex can, therefore, influence the peri-implant tissue contour. The surface topography of the abutment-restoration complex can be slightly exaggerated, decreased, or otherwise altered to achieve the desired tissue molding. Development of concave contours will promote coronal gingival movement for the abutment as it emerges through the soft tissues. The contours will then gradually assume the shape of the tooth it is replacing to blend into the provisional restoration and further promote gingivae that are harmonious with the adjacent tissues (Figure 8).[5,7,10] Modifications to the provisional restoration (eg, additions to or deletions from the tooth form) can be facilitated over time. The provisional should be polished and varnished (eg, Palaseal, Heraeus Kulzer, Armonk, NY; UltraSeal XT Plus, Ultradent Products, South Jordan, UT; Prisma-Shield, Dentsply Caulk, Milford, DE) after each modification to ensure development of healthy peri-implant gingivae. Customized or prefabricated abutments can be readily adapted to individual circumstances in the anterior region, which increases their applicability in the aesthetic zone.

Figure 8. Approximately 2 mm of space is required external to the abutment for development of an aesthetic restoration.

Figure 9. Occlusal view of an abutment illustrates that its form at the shoulder level closely resembles that of a natural lateral incisor in the cervical region. The platform is approximately 1 mm subgingival and parallels the gingival margin.

For optimal aesthetics, it is advisable that the restorative margin remains subgingival. As is the case with restorations in the natural dentition, this subgingival placement need not be much more than 1 mm in depth, and the finish line should be parallel to the gingival margin (Figure 9). Placement of margins too deep subgingivally can lead to potential retention of excess cement during adhesion, with consequent peri-implant disease implications. Titanium abutments may have an adverse effect on the color of the encompassing gingival collar, and gilding of the abutment or the use of ceramic abutments may modulate or negate these effects. In order to satisfy these placement requirements, soft tissue duplication on the laboratory casts and constant communication with the technician are a necessity. The form of the abutment-restoration complex can only be successfully created after a thorough evaluation of the treatment requirements dictated by the patient's dental biotype, and is consequently a shared responsibility between the clinician and technician.

Conclusions

Implant positioning within a housing that permits the formation of acceptable peri-implant gingivae sets the stage for molding of these tissues so that they can more definitively harmonize with the gingivae around the adjacent teeth. For appropriate customization of the peri-implant tissues, the surface morphology of the abutment-restoration complex must conform to that of the adjacent sister tooth and the dental biotype of the patient at the soft tissue-implant–restoration interface. The initial shape of the abutment should be concave to encourage coronal tissue growth; as the tissues approach the cervical region at the abutment-restoration complex, these structures must assume the shape of the tooth being replaced. Appropriate contact of this abutment-restoration complex with the healing soft tissues will ensure that proper tissue contours will be attained, and the papillae that fill the embrasures will be created.

Acknowledgment

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