

A New Definition of Attached Gingiva Around Teeth and Implants in Healthy and Diseased Sites



Dennis Tarnow, DDS¹
 Mark Hochman, DDS²
 Stephen Chu, DMD, MSD, CDT³
 Paul Fletcher, DDS⁴

There is a need to modify the definition of attached gingiva (AG) as it applies to healthy and diseased teeth and implants. There are two parts to this new definition: Part A is when the biologic width is supracrestal (epithelial attachment and gingival fibers) and is attached to a healthy tooth or tissue-level implant, and the zone of AG is measured from the base of the sulcus to the mucogingival junction (MGJ); Part B is when the biologic width is subcrestal—as with infrabony defects on periodontally involved teeth, periodontally involved tissue-level implants, and bone-level implants placed at or below the bone crest—and the zone of AG is measured from the bone crest (not the base of the sulcus) to the MGJ. Further, what the AG is actually attached to around teeth and different types of implants, and the clinical significance of these differences, are thoroughly discussed.

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The American Academy of Periodontology Glossary of Periodontal Terms defines “attached gingiva” (AG) as the portion of the gingiva that is bound to the tooth and the alveolar bone, extending from the free gingival groove to the mucogingival junction (MGJ).¹ This has also been supported in periodontal textbooks, one of which states, “On the vestibular and lingual side of the teeth, the free gingiva extends from the gingival margin in an apical direction to the free gingival groove, which is positioned at a level corresponding to the level of the cemento-enamel junction. The attached gingiva is demarcated by the mucogingival junction in the apical direction.”² There are two problems with this definition:

First, clinicians do not routinely use the free gingival groove as a reference point, as the free gingival groove is only visible approximately one-third of the time in the gingiva around teeth, according to Ainamo and Löe.³ As a result, most dentists consider the zone of AG to extend from the base of the sulcus to the MGJ. It is determined by measuring the full zone of keratinized tissue and then subtracting the sulcular depth. However, this categorization is not always valid when considering teeth with periodontal disease or implants with an attachment apparatus (the biologic width) below the bone crest. The clinical significance of this

¹Division of Periodontics, Columbia University College of Dental Medicine, New York, New York, USA.

²Ashman Department of Periodontology & Implant Dentistry, Department of Orthodontics, New York University College of Dentistry, New York, New York, USA.

³Ashman Department of Periodontology & Implant Dentistry, New York University College of Dentistry, New York, New York, USA.

⁴Division of Periodontology, Stony Brook University School of Dental Medicine, Stony Brook, New York, USA.

Correspondence to: Dr Dennis Tarnow, 150 East 58th Street, Suite 3200, New York, NY 10155, USA. Email: dennistarnow@gmail.com

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Table 1 When Is Attached Gingiva Present for Part A and Part B Definitions?

Definition	Healthy tooth	Tooth with infrabony lesion on the facial aspect	Healthy tissue-level implant	Tissue-level implant with infrabony lesion on the facial aspect	Healthy bone-level implant	Bone-level implant with infrabony lesion on the facial aspect
Part A	+ (Fig 1)		+ (Fig 2)			
Part B		+ (Fig 3a)		+ (Figs 4a and 7)	+ (Fig 5a)	+ (Fig 6a)

+ = presence of attached gingiva (AG); Part A = AG is measured from the base of the sulcus to the MGJ (supracrestal biologic width); Part B = AG is measured from the bone crest (not from the base of the sulcus) to the MGJ (subcrestal biologic width).

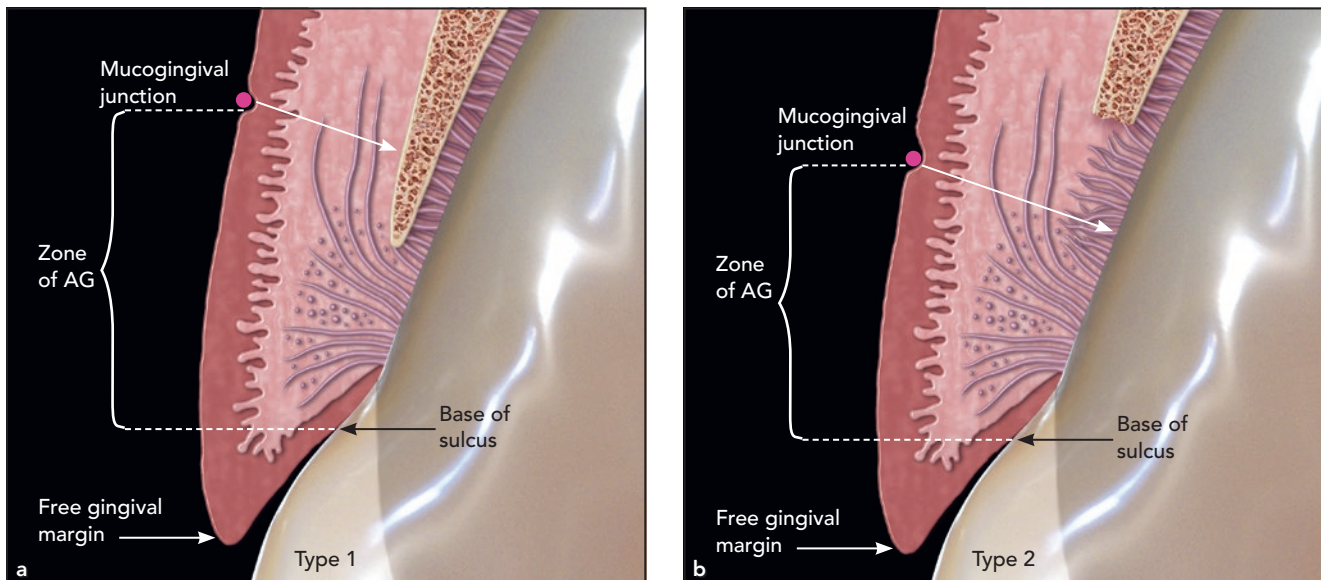


Fig 1 Healthy tooth with the MGJ apical to the bone crest. Part A of the new definition. The AG is from the base of the sulcus to the MGJ. (a) Type 1. The AG is attached via the junctional epithelium, connective tissue fibers, and periosteum over bone. (b) Type 2. The AG is attached via the junctional epithelium and connective tissue fibers, but is not attached to the bone.

is obvious: The base of the pocket cannot be used as a reference point if it is subcrestal. The pocket depth cannot and should not be deducted from the zone of keratinized tissue, as it will have no clinical significance. Therefore, the bone crest must be used as the marker to measure from in these situations.

In light of this, a new, two-part definition for AG is being proposed. Part A is applicable when the biologic width is supracrestal, and Part B is

applicable when the biologic width is subcrestal.

Part A: AG on healthy teeth and tissue-level implants with a supracrestal biologic width is defined as the zone of gingiva coronally bound to a tooth or implant, and/or the apical alveolar bone. Its length is measured from the base of the sulcus to the MGJ (Table 1; Figs 1 and 2).

Part B: AG on teeth or implants with a subcrestal biologic width (as in periodontally involved teeth with

infrabony lesions, or around most bone-level implants unless they are placed in a supracrestal position, like a tissue-level implant) is defined as a zone of gingiva that lies solely on bone. Its length is measured from the bone crest (as opposed to the base of the sulcus) to the MGJ (Table 1; Figs 3 to 7).

The second problem with the current description of AG is that its apical aspect is not always bound to bone. Depending on the location

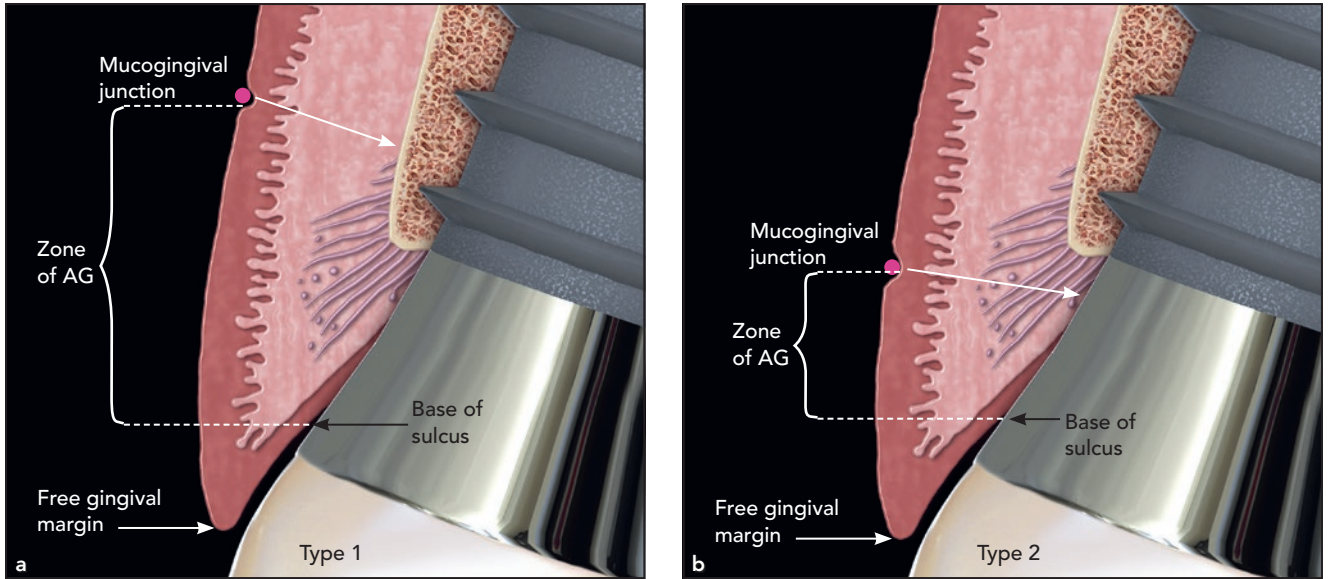


Fig 2 Tissue-level implant with the MGJ apical to the bone crest. Part A of the new definition. The AG is from the base of the sulcus to the MGJ. (a) Type 1. The AG is attached via the junctional epithelium, connective tissue fibers, and periosteum over bone. (b) Type 2. The AG is attached via the junctional epithelium and the connective tissue fibers, but is not attached to the bone.

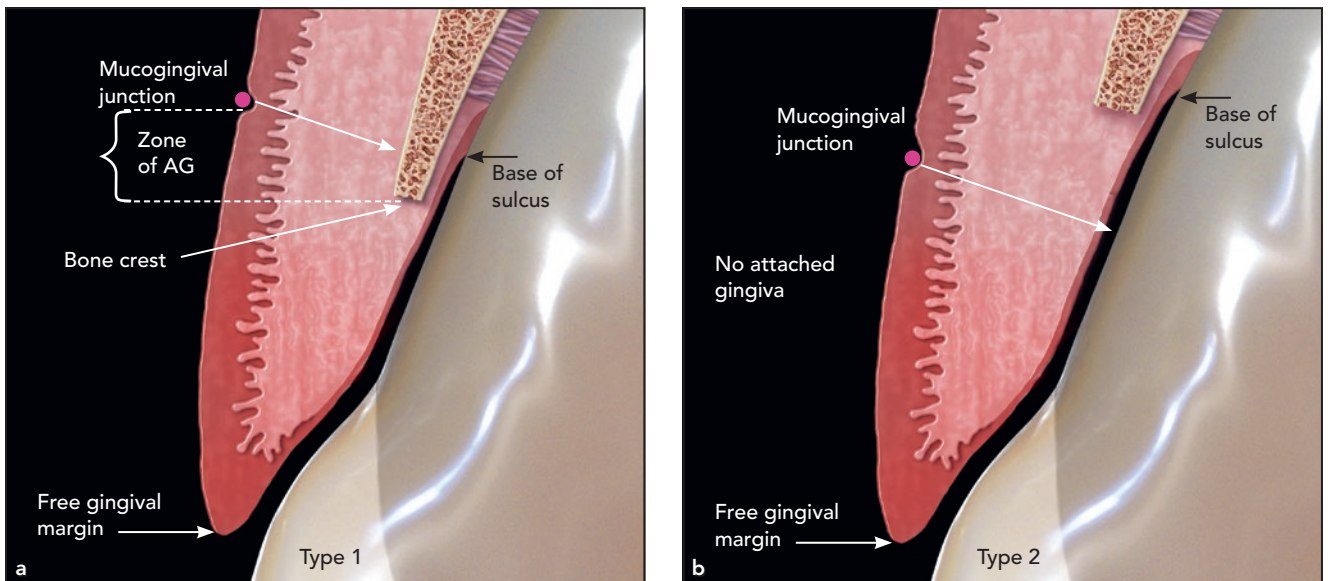


Fig 3 Infrabony defect on a tooth. The MGJ is apical to the bone crest. (a) Type 1. The zone of AG is from the crest of the bone to the MJG, attached only to the bone and not to the tooth. (b) Type 2. There is no AG, only a zone of keratinized tissue.

of the MGJ in relation to the bone crest, the AG’s apical aspect may be bound to bone or may be bound only to the tooth or implant (and not to the bone at all; Figs 1b and 2b).

Hochman et al⁴ identified two scenarios, Type 1 and Type 2 (Table 2). In Type 1, the MGJ is apical to the bone crest (Figs 1a, 2a, 3a, 4a, 5a, and 6a). The zone of AG is bound

to the tooth or implant coronally by a junctional epithelial adherence, with perpendicular or parallel connective tissue fibers beneath (Figs 1a and 2a). It connects apically to

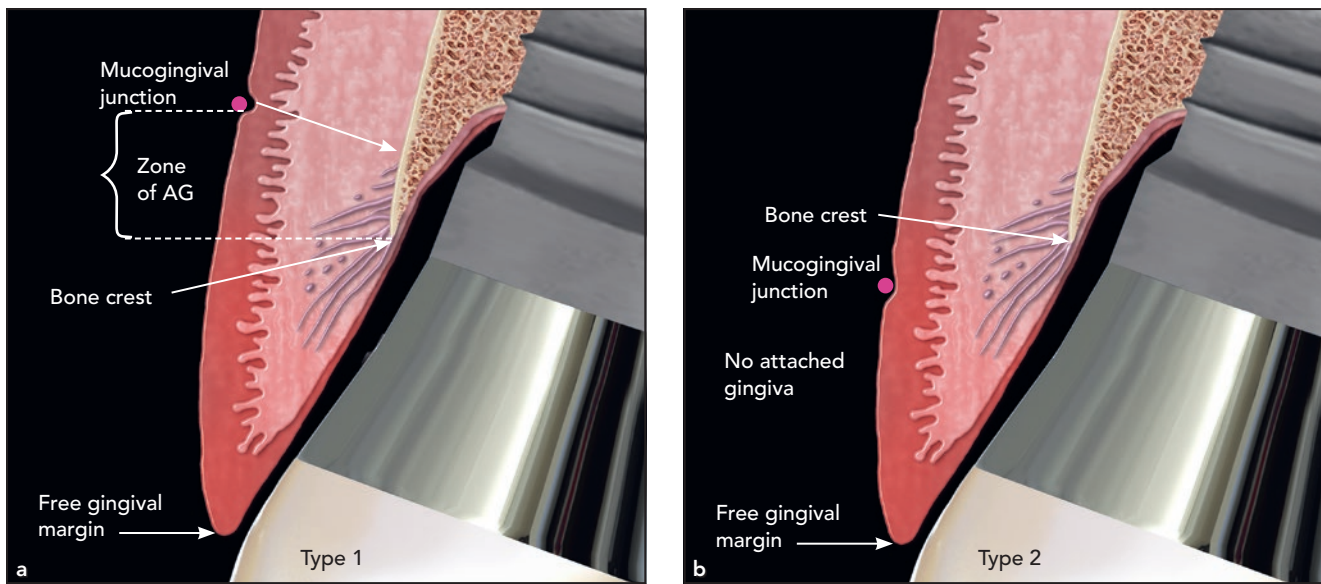


Fig 4 Peri-implantitis on a tissue-level implant. The MGJ is apical to the bone crest. (a) Type 1. The zone of AG is measured from the crest of the bone to the MGJ, attached only to the bone and not to the tooth. (b) Type 2. There is no AG, only a zone of keratinized tissue.

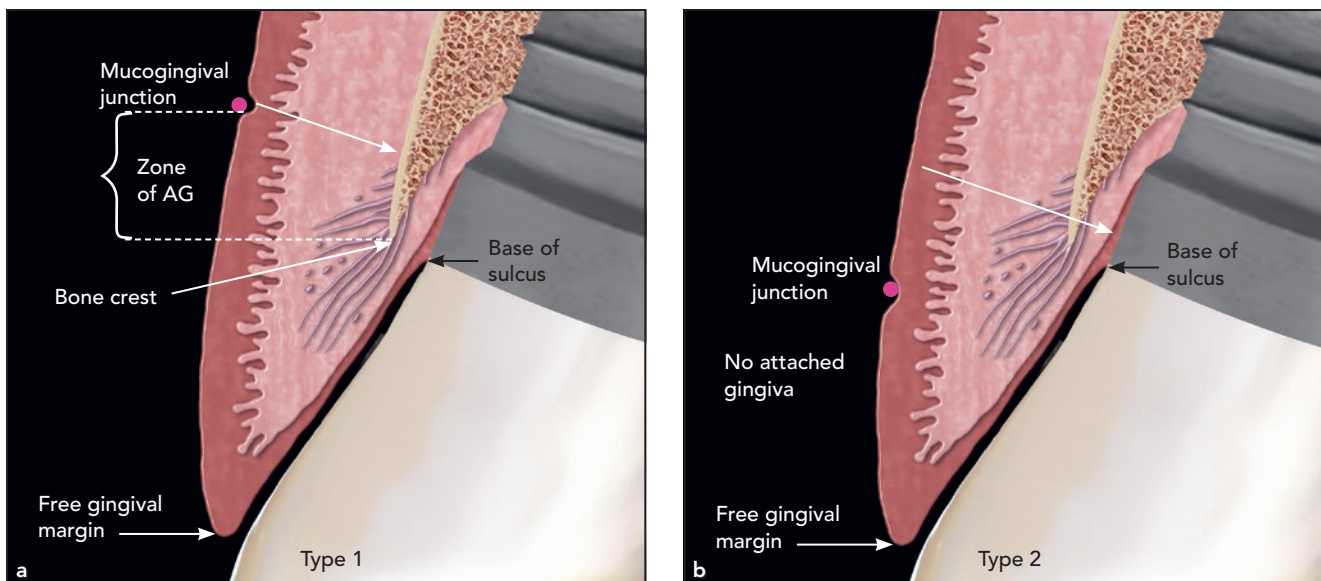


Fig 5 Healthy bone-level implants. The MGJ is apical to the bone crest. (a) Type 1. The zone of AG is measured from the bone crest to the MGJ, attached only to the bone and not to the tooth. (b) Type 2. There is no AG, only a zone of keratinized tissue.

bone by the insertion of connective tissue fibers into the periosteum. In Type 2, the MGJ is coronal to the bone crest (Figs 1b, 2b, 3b, 4b, 5b, and 6b). The zone of AG is bound

to the tooth or implant coronally by junctional epithelial adherence with perpendicular or parallel connective tissue fibers beneath. As the MGJ is positioned coronal to the bone

crest, the apical aspect of the zone of AG, if present, will end on a tooth or implant surface and not attach to bone at all (Figs 1b and 2b).

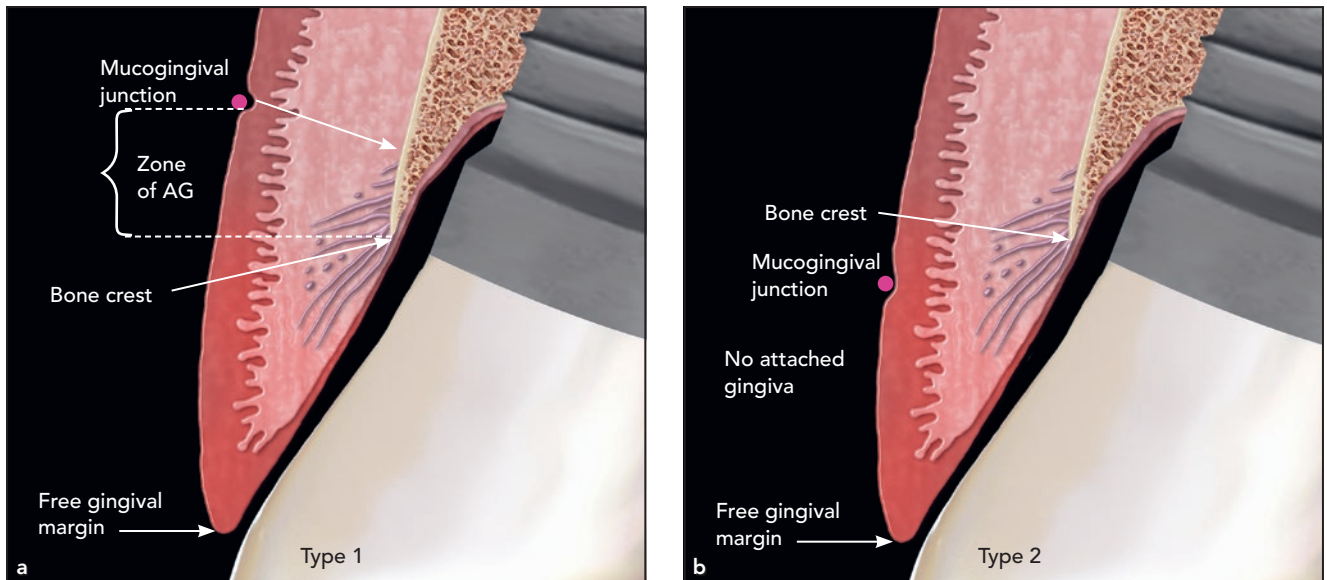


Fig 6 Peri-implantitis on bone-level implants. (a) Type 1. The MGJ is apical to the bone crest. AG is measured from the bone crest to the MGJ, attached only to the bone and not to the tooth. (b) Type 2. The MGJ is coronal to the bone crest, and therefore there is no AG, only a zone of keratinized tissue.

Clinical Significance

The clinical implications of this new definition include the following:

The amount of AG on bone-level implants should be measured from the bone crest (not from the base of the sulcus) to the MGJ (Figs 5a and 6a), as the biologic width is usually subcrestal unless the implant is placed in a supracrestal position (like a tissue-level implant).

The zone of AG on the facial aspect of both teeth and tissue-level implants with infrabony defects should be measured from the bone crest (not from the base of the sulcus) to the MGJ (Figs 3a, 4a, 5a, 6a, and 7). It is for this reason that most articles dealing with measurements of the tissue response around implants use the zone of keratinized tissue and avoid measuring or even discussing what the AG is attached to or if it is present.⁵⁻¹⁵

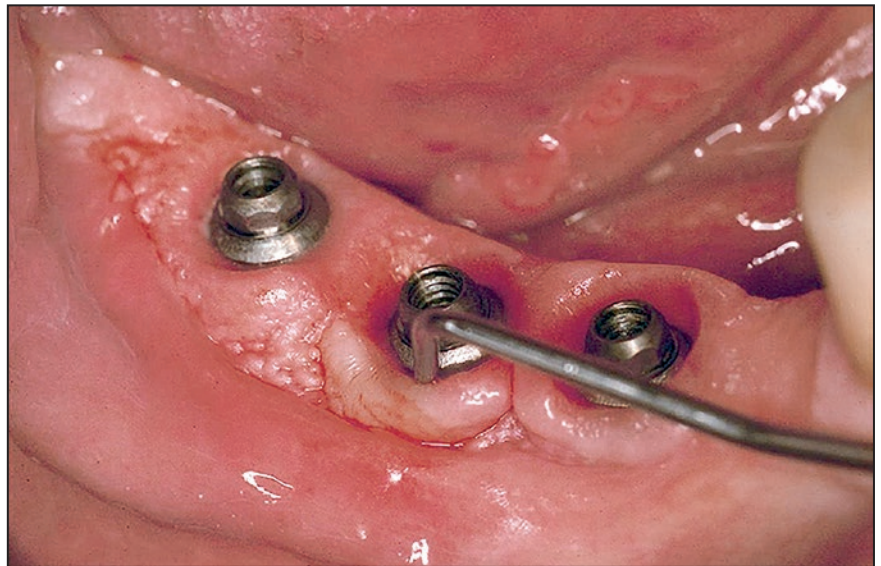


Fig 7 Example of Part B of the new definition. There is a zone of AG, but it is only attached to the bone where, due to the pocket present around the implant, the biologic width is subcrestal. In this situation, the zone of AG would be measured from the bone crest to the MJG, not from the base of the sulcus. See also Figs 4a and 6a.

When the MGJ is apical to the bone crest, AG is bound coronally to healthy teeth and tissue-level implants via the junctional epi-

thelium and gingival connective tissue fibers, and apically to bone via the periosteum (Figs 1a and 2a).

Table 2 What Is the AG Attached To?

	Healthy tooth	Tooth with infrabony lesion on the facial aspect	Healthy tissue-level implant	Tissue-level implant with infrabony lesion on the facial aspect	Healthy bone-level implant	Bone-level implant with infrabony lesion on the facial aspect
Type 1	1) Junctional epithelium 2) Connective tissue fibers inserted into cementum 3) Periosteum/bone (Fig 1a)	Buccal periosteum over the bone crest (Fig 3a)	1) Junctional epithelium 2) Parallel connective tissue fibers 3) Periosteum/bone (Fig 2a)	Buccal periosteum over the facial aspect of the bone crest (Fig 4a)	Buccal periosteum over the facial aspect of the bone crest (Fig 5a)	Buccal periosteum over the facial aspect of the bone crest (Fig 6a)
Type 2	1) Junctional epithelium 2) Connective tissue fibers inserted into cementum (Fig 1b)	No attached gingiva (Fig 3b)	1) Junctional epithelium 2) Parallel connective tissue fibers (Fig 2b)	No attached gingiva (Fig 4b)	No attached gingiva (Fig 5b)	No attached gingiva (Fig 6b)

AG = attached gingiva; MGJ = mucogingival junction.

In Type 1 scenarios, the MGJ is apical to the bone crest. In Type 2 scenarios, the MGJ is coronal to the bone crest. Notice that in Type 2 scenarios, many of these cases may not have AG, instead having only a zone of keratinized tissue.

When the MGJ is coronal to the bone crest, AG around healthy teeth and tissue-level implants is bound coronally via the junctional epithelium and gingival connective tissue fibers (Figs 1b and 2b). It is not in contact with bone.

In Type 2 scenarios^{4,16} where the MGJ is coronal to the bone crest (Figs 1b and 3b), forced eruption of a tooth may not increase the zone of AG. Rather, the zone of keratinized tissue will move coronally with the tooth, as the attachment is not bound to bone and is only attached to the tooth.

In Type 1 scenarios (Figs 1a and 3a) where the MGJ is apical to the bone crest, forced eruption of a

tooth will lead to an increase in the zone of keratinized tissue and AG.^{3,4} This occurs because the MGJ is bound to bone and remains at the same level as the tooth is erupted.

To assure AG is present around a bone-level implant, the keratinized tissue must be positioned so that the MGJ is apical to the bony crest. If this is not accomplished, a zone of keratinized tissue may be visible, but it will not be attached.

In Type 2 scenarios on teeth with infrabony defects, or with bone-level implants where the biologic width is subcrestal, a zone of unattached keratinized tissue may be visible, but there is no AG (Figs 3b, 4b, 5b, and 6b).

Conclusions

Given the shortcomings of the definition of AG, there is a need to modify how it applies to healthy and diseased teeth and implants. The new definition will allow clinicians and researchers to determine how much AG there is in various clinical situations, such as healthy and diseased sites.

When the biologic width is supracrestal (epithelial attachment and gingival fibers) and attached to a healthy tooth or tissue-level implant, the zone of AG is measured from the base of the sulcus to the MGJ. It could also be attached to the tooth and/or bone depending

on where the MGJ is in relation to the bone crest (Type 1 vs Type 2 scenarios).

When the biologic width is subcrestal (as with an infrabony defect on a periodontally involved tooth or peri-implantitis-involved tissue-level implant or around a bone-level implant), the zone of AG is measured from the bone crest to the MGJ in Type 1 scenarios. If the MGJ is coronal to the bone crest, as in a Type 2 scenario, there is no AG, only a zone of unattached keratinized tissue.

Acknowledgments

The authors declare no conflicts of interest.

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