Influence of Tissue Biotype on Implant Esthetics

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Implant dentistry has come a long way since 1981, with great improvements made to achieve primary implant stability and improve bone-to-implant contact. The focus has since shifted toward creating an esthetic restoration that is indistinguishable from natural teeth and is stable over time. This paper proposes a management triad that enhances soft tissue thickness around implant-supported restorations while discussing distinct differences between thin and thick tissue biotypes. In addition, the effect of tissue biotype on implant esthetics is highlighted. Int J Oral Maxillofac Implants 2011;26:499–508

Key words: *biologic width, implant esthetics, interproximal papilla, peri-implant mucosa*

Since the incidental finding of osseointegration by Brånemark et al,[1] implant dentistry has evolved into a multibillion-dollar business fueled by new creations and innovations in bone grafting materials,[2] growth factors,[3,4] hard and soft tissue management,[5] and esthetic restorative components.[6] Previously, much emphasis was placed on the macroscopic and microscopic design of the implant in attaining primary stability, and osseointegration was fundamental to the survival and success of the implant.[7] Today, with the high survival and success rates of implant therapy, the focus has shifted toward creating an esthetic restoration that is indistinguishable from natural teeth and is stable over time.

Construction of an esthetically pleasing restoration involves not only harmonizing the size, shape, position, and color of each prosthetic tooth with the adjacent teeth[8]; establishing peri-implant soft tissue compatibility with the surrounding gingiva and mucosa is also essential.[9] This is particularly important in the anterior maxilla, also known as the "esthetic zone" of the oral environment.[10] Therefore, the task of an esthetic dentist is to carefully assess each patient, bearing in mind society's standards of beauty, and provide all treatment options available to achieve an enhanced smile and self-esteem.[11] The aim of this paper is to present a management triad that will facilitate soft tissue enhancement around implants and to discuss critical concepts in implant dentistry and peri-implant tissue characteristics that greatly influence implant esthetics.

MANAGEMENT TRIAD TO INCREASE SOFT TISSUE THICKNESS

The authors propose a management triad to help clinicians better understand the significance of soft tissue on implant esthetics. Based on the available literature, the rationale behind this concept will be discussed throughout this manuscript. The current understanding is geared toward establishing a thick tissue biotype around implants because of its contributions to the esthetic result of an implant-supported restoration.[12] A thick biotype is more resistant to recession,[13,14] is better at concealing titanium,[15] and is more accommodating to different implant positions.[16] Therefore, compared to a thin biotype, it is preferred around dental implants.

Numerous methods, such as the modified roll technique, the split finger technique, and the use of acellular dermal matrix, are available to augment the soft tissue around implants to achieve better esthetics.[17–19] In spite of the available surgical techniques, the authors would like to propose a guideline that demonstrates possible ways to increase soft tissue thickness around implants, ie, the "PDP management triad": implant position (P), implant design (D), and prosthetic design (P) (Fig 1). First, implant position (P) and angulation are key

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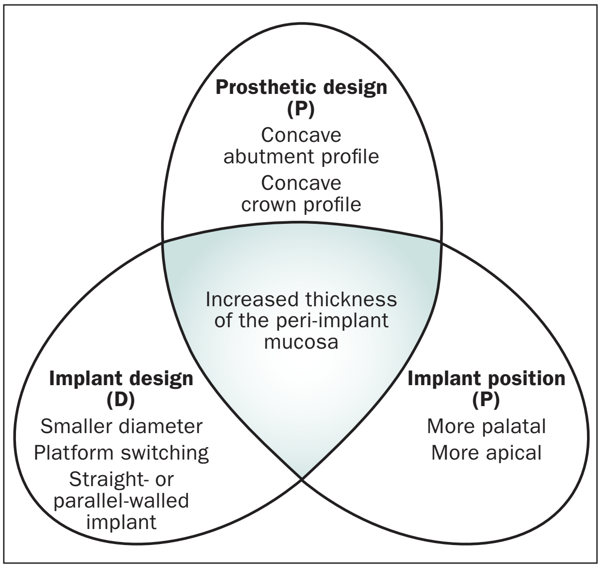

Fig 1 The esthetic management triad: PDP implant position (P), implant design (D), and prosthetic design (P).

determinants in ensuring that an implant-supported restoration has functional and esthetic success through an ideal emergence profile. Second, implant diameter and platform design (D) can help prevent crestal bone resorption, which is a great asset in preserving esthetics. Third, the prosthetic design (P) can provide the additional space for soft tissue ingrowth to create a fuller soft tissue profile.

The restorative, functional, and esthetic success of an implant-supported restoration stems from the position of the implant in bone. The restorability of the implant body, the emergence profile, and the stability of the definitive esthetic outcome are determined by the three-dimensional placement of the implant. Bashutski and Wang[20] proposed a straightforward surgical guideline for clinicians to refer to when treatment planning implant placement surgery. The implant should be placed in a position with at least 2 mm of buccal bone, approximately 3 mm apical to the cementoenamel junction of the adjacent teeth, and about 1.5 mm from the adjacent tooth root or 3 mm from the adjacent implant.[20] However, in situations where more soft tissue growth on the facial surface of the implant is needed, a more palatal and apical position of the implant is advocated. It has been recommended that for every millimeter of palatal angulation, the implant should be placed apically by an additional millimeter.[21]

The appropriate choice of implant design can help increase soft tissue thickness on the facial aspect of the implant. As mentioned, the thickness of the facial bone plate provides bony support for the soft tissue. If it is less than 1.8 mm, there will be bone resorption at the crestal margins after the implant is placed.[22] Smaller-diameter implants can be used in the maxillary anterior area to maintain the facial bone thickness, thereby minimizing peri-implant mucosal recession. Additional soft tissue augmentation can be derived through the use of an implant with a straight or parallel-walled platform instead of a conical or tapered platform. The advantage of a straight platform over a conical platform is that there is less outward pressure on the peri-implant mucosa; this reduces potential gingival recession and/or remodeling after implant placement.

Platform switching, a term introduced by Lazzara and Porter, involves connecting a narrower-diameter abutment to a wider implant platform.[23] This subsequently leads to a horizontal shifting of the implant-abutment microgap toward the center of the implants, thus preventing crestal bone resorption and allowing soft tissue ingrowth. This will thicken the tissue and facilitate papillae formation. As the implant platform is placed at the level of the crestal bone, connecting a concave abutment and/or crown to the implant will create additional space in which the peri-implant mucosa can proliferate and occupy. Remodeling of soft tissue at the abutment connection level will enhance the emergence profile of the restoration, henceforth giving rise to a better esthetic outcome.[24]

The proposed management triad (PDP) uses basic concepts behind implant position (P), implant design (D), and prosthetic design (P) to mount a three-prong attack on implant esthetics by increasing soft tissue thickness. Modification of the implant position, such as a more palatal and apical placement, will facilitate a more esthetic emergence profile. On the other hand, alterations to the implant and to the prosthetic design will promote soft tissue remodeling and fullness, thus creating a more esthetic restoration.

RATIONALE FOR THE MANAGEMENT TRIAD

From this point, the authors will take a step further into understanding the rationale behind the PDP management triad by presenting a discussion of the literature to date.

Defining Tissue Biotypes

To better appreciate the PDP management triad, one must be aware of the differences between the soft tissue biotypes. Historically, thin gingival tissues were thought to cover thin marginal alveolar bone around teeth.[25] It was later suggested that the underlying bone contour dictated the gingival contour, which was subsequently described as being flat or having a

Table 1 Characteristics of Thin and Thick Tissue Biotypes

Characteristics	Thin	Thick
Profile	Highly scalloped soft tissue and bone contours	Relatively flat soft tissue and bone contours
Soft tissue texture	Delicate and friable	Dense and fibrotic
Width of keratinized and attached gingiva	Narrow	Wide
Bone thickness	Thin with bony dehiscences and fenestrations	Thick with ledges
Reaction to insults	Reacts readily with gingival recession	Relatively resistant to gingival recession; reacts with formation of pocket or infrabony defect

Table 2 Comparison of the Different Techniques Available to Measure Soft Tissue Thickness

Technique	Advantages	Disadvantages
Visual inspection	Simple, straightforward, noninvasive, and inexpensive	Subjective and highly variable
Transgingival probing	Simple, straightforward, and inexpensive	Invasive; requires local anesthesia; and affected by probe diameter, angulation, probing force, and distortion of gingival tissues
Probe transparency	Simple, straightforward, and inexpensive	Subjective and invasive
Ultrasonic device	Simple, straightforward, and noninvasive	Additional cost involved, large probe diameter may hinder its use in areas of limited access, accuracy might be affected by moisture
CBCT imaging	Noninvasive, can provide quantitative measurements, images can be manipulated for better visualization of the hard and soft tissues	Expensive, requires technical expertise, and higher radiation exposure compared to conventional radiographs

pronounced scallop.[26] Seibert and Lindhe coined the term *periodontal biotype* to describe different gingival architecture types based on buccolingual thickness. It was proposed that a *thick* gingival biotype was flat, whereas a *thin* gingival biotype was scalloped. Thereafter, gingival and alveolar bone contours were often described as *flat-thick* or *scalloped-thin*.[27] This early description, though informative, was highly subjective. Since then, other authors have attempted to quantify the gingival thickness and bone contours.[20,28–30]

In dry skull specimens, Becker et al measured the vertical distance from the midfacial alveolar crests to the interdental bone crests. When the mean vertical distances were 2.1 mm, 2.8 mm and 4.1 mm, the bone morphology was classified as *flat*, *scalloped*, and *pronounced scalloped*, respectively.[28] Claffey and Shanley investigated the effect of gingival thickness on periodontal inflammation, and they defined a gingival thickness of no more than 1.5 mm as a thin biotype and 2.0 mm or more as a thick biotype.[29] De Rouck et al used papillary height to categorize patients into thin and thick biotypes.[30] Extrapolating this notion to implant dentistry, Bashutski and Wang highlighted the importance of tissue thickness in implant treatment planning.[20]

From the available literature, one can gather that there are primarily two tissue biotypes: thin and thick. Unfortunately, there is no clear criterion that objectively defines both biotypes, and a consensus on the definition of tissue biotype has not been agreed upon for implant esthetics.

Methods of Measuring Soft Tissue Thickness

The lack of agreement on the definition of tissue biotype is partly a result of the varied approaches available to measure the thickness of soft tissue. Different methodologies have been employed to determine the thickness of the soft tissue (Table 1). Visual inspection, as the simplest method available, is commonly used, since a thin gingival biotype has features that are distinctly different from a thick gingival biotype (Table 2).[14] Regrettably, a recent cluster analysis revealed that clinicians, irrespective of their clinical experience, managed to accurately identify the gingival biotype only half of the time. Fifty percent of patients with high esthetic risk—that is, those with a thin scalloped gingival biotype—were misidentified. Therefore, although straightforward and noninvasive, this method is not a useful tool, as, in this study, half of the high-esthetic-risk patients were overlooked.[31]

Visualization of a probe through the sulcular margin can be used to rate tissue as thin if the outline of the periodontal probe is visible through the sulcus and thick if it is not visible.[32] This method was found to be highly reproducible, with 85% intraexaminer repeatability (kappa = 0.7; $P = .002$) in a clinical trial of 100 periodontally healthy subjects.[30]

Direct measurements using a periodontal probe or an endodontic file/reamer have been frequently used to determine thickness of the gingiva.[29,33] Transgingival probing, although simple and straightforward, is an invasive procedure that requires local anesthesia and may result in distortion of gingival tissues during probing.

Eger et al and Müller et al used an ultrasonic measurement device (SDM, Austenal Medizintechnik) to determine the thickness of facial gingiva and masticatory mucosa in numerous cadaver and human studies.[34–38] The validity and repeatability of this device have been tested; it was found that, in measuring gingival thickness, an overall repeatability coefficient of 1.20 mm was found. This meant that 95% of repeated measurements were within a limit of more than 1 mm.[39] Therefore, although the device is noninvasive, it cannot detect minor differences in gingival tissue.

With the rapid progression of implant dentistry, radiographic imaging techniques have also advanced tremendously. Because of its ability to visualize three-dimensional anatomical structures, the use of cone beam computed tomography (CBCT) is increasing. Challenging implant treatment cases, such as those with anatomical limitations, those in need of advanced bone grafting, and those with complex restorative reconstructions, most frequently require CBCT scans during the treatment planning phase. CBCT scans had been used primarily for hard tissue measurements and were found to be comparable to clinical measurements in accuracy.[40,41] Recently, CBCT images have been used to determine soft tissue thickness.[42] It has been suggested that lip retractors and tongue depressors could be used during the acquisition of the CBCT images to increase the visibility of soft tissue margins.[43,44] Although soft tissue dimensions can be determined with imaging, the accuracy and reproducibility of CBCT have not been verified.

In summary, the methodologies used to measure soft tissue thickness include visual inspection, direct probe measurements, ultrasonic measurement devices, and CBCT scans. Because each technique has its advantages and disadvantages, there is no one perfect tool; nonetheless, determination of soft tissue thickness is still essential in implant esthetics.

Influence of Tissue Biotype on Crestal Bone and Soft Tissue Dimensions

In addition to soft tissue thickness, facial bone thickness is also an influential parameter in the PDP management triad. The ability of the soft tissue to camouflage a bony defect is limited without the support of underlying bone. Several authors have attempted to measure the thickness of the buccal plate, and a wide range of measurements (0.71 to 3.88 mm) was found.[45,46] Variations in buccal bone thickness were speculated to be a result of differences in tooth positions, patient populations, and study methodologies. Sammartino et al found that the thickness of the facial alveolar bone after implant placement was an important prognostic factor for implant esthetics.[47] In a clinical trial of 30 predominantly white men with a mean age of 62.9 years, Spray et al found that bone loss decreased significantly and some bone gain was observed as the buccal bone thickness approached 1.8 to 2.0 mm after implant placement.[22] Buser et al[48] and Bashutski and Wang[20] also proposed a minimum of 2.0 mm of buccal bone thickness for an acceptable esthetic outcome.[20,48] Unfortunately, to date, no consensus has been reached with regard to the optimal thickness of buccal bone needed to ensure an esthetic implant restoration.[49] The PDP management triad thus suggests the use of implants with a platform-switching configuration as another way to prevent crestal bone resorption and preserve buccal bone thickness.

Some recent studies have attempted to correlate tissue thickness and crestal bone stability after implant placement. It was observed that within the first year of function, a maximum of 1.45 mm of crestal bone loss was associated with an initial tissue thickness of < 2.5 mm (thin biotype). Therefore, thickening of thin mucosa prior to implant placement was suggested.[50,51] Evans and Chen performed a study of immediate implants and defined biotype by probe transparency. The authors reported 1.8 mm of marginal mucosal recession in thin-biotype sites, compared to 0.6 mm in thick-biotype sites, when implants were placed slightly buccally.[16] The study found that the stability of the peri-implant mucosal margin was dependent on the baseline tissue thickness. For this reason, the PDP management triad suggests the use of parallel-walled implant designs to allow for soft tissue ingrowth around the abutment level, thus increasing soft tissue thickness and minimizing the potential for peri-implant mucosal recession.

Studies have shown that thin biotypes were associated with bony dehiscences and fenestrations[28] and that thin cancellous bone was more susceptible to bone resorption.[52] Therefore, during tooth extraction, a thin buccal bone plate was at a greater risk of fracturing and alveolar bone resorption during healing was more significant in the vertical and horizontal dimensions.[53] This resorption was also observed after implant placement through remodeling of the peri-implant mucosa and bone over time. As a result, the esthetic outcome of the implant therapy was affected.[14] To combat the significant bone loss experienced after tooth extraction,[54–58] socket grafting techniques were introduced and found to be clinically effective.[59–61] Thus, in the PDP management triad, the authors recommend the use of smaller-diameter implants to preserve buccal bone thickness and minimize crestal bone loss and mucosal recession. Alternatively, positioning an implant more palatally and apically will also achieve this purpose.

A criterion for success entails the construction of a healthy peri-implant mucosa, which has a contour that is harmonious with adjacent structures and is accompanied by an intact interproximal papilla.[62] Therefore, it is important to understand that the soft tissue around an implant behaves differently from that around a tooth. Around a tooth, the biologic width is the epithelial and connective tissue attachment that serves to protect the periodontium from bacterial invasion.[63,64] One key difference between natural teeth and implants is the dimension and position of the biologic width. Human and animal studies have shown that the biologic width around an implant is approximately 1 mm longer than that around a natural tooth.[63,65–68] In addition, the implant platform is commonly placed at the crestal level, resulting in the interproximal biologic width of healthy peri-implant mucosa being subcrestal, compared to the supracrestal biologic width around a natural tooth.[64] Furthermore, the implant platform as well as the interproximal bone profile is flat; hence, papillary tissues lack bony support. Bone remodeling after implant placement also results in the bone level settling down to the first thread, creating a bony "saucerization" around the implant and a loss of interproximal bone.[69] Consequently, a subcrestal location of the biologic width, a flat interproximal profile, and the unavoidable remodeling of bone around an implant complicate the recreation of interproximal papillae, which can lead to an unesthetic outcome.

The volume of the gingival embrasure and the presence of the adjacent tooth attachments influence the existence of the interproximal papillae.[70] The boundaries of the gingival embrasure are determined coronally by the anatomical or restorative contact point and apically by the interproximal horizontal distance. From the evidence available, it can be gathered that 100% papilla fill is possible if the vertical distance from the contact point to the bone crest is less than 5 mm and the horizontal distance between the implants and/or a tooth and an implant is at least 3 mm.[62,71–81] Table 3 provides a summary of the available literature on favorable horizontal and vertical distances for regeneration of the interproximal papilla. In addition, keeping the "critical" dimensions in mind, the use of a concave abutment or crown profile, as mentioned in the PDP management triad, creates a space where soft tissue ingrowth is welcomed, giving rise to a more esthetic result.

Reconstruction of an esthetic implant-supported restoration involves the preservation and maintenance of the crestal bone and also the recreation of the interproximal papillae. Therefore, the PDP management triad offers recommendations such as the use of platform switching or parallel-walled implants, more palatal and apical implant placement, and concave prosthetic designs to combat peri-implant bone and soft tissue loss.

The Value of Thick Peri-Implant Tissue

In the early 1990s, machined-surface implants were often used, and studies found that a lack of keratinized or attached tissue around an implant was not an absolute contraindication; it was believed to be compatible with health in the presence of good oral hygiene and its absence did not lead to an increase in implant failure.[82–85] Later studies of roughened-surface implants found that the keratinized tissue provides a soft tissue seal around the implant, preventing bacterial invasion, early crestal bone loss, and mucosal recession.[86,87] A recent 5-year longitudinal study clearly showed that a minimum of 2 mm of keratinized mucosa was beneficial in reducing lingual plaque accumulation, bleeding, and buccal soft tissue recession in patients with good oral hygiene and who were enrolled in a regular implant maintenance program.[88] Current research seems to indicate that keratinized mucosa may be useful in preventing mucosal recession,[89] facilitating oral hygiene practices, hiding restorative margins, and camouflaging the shadow from the titanium implant platform.[15]

In implant therapy, advanced bone grafting is required in complex cases where the residual bone volume is inadequate for housing the dental implant. A thick tissue biotype is important in this context because thick tissues have an increased blood supply that will enhance the revascularization of bone grafts, leading to increased healing and graft incorporation. Thin tissues may actually compromise the collateral blood supply to the surgical site.[90,91] Another advantage of thick tissues is the ability to attain and maintain primary wound closure. The adequacy of soft tissue coverage is one of the prime factors in ensuring periodontal regeneration.[92] This is because flap exposure results in a reduction of the bone regenerated in grafting procedures, primarily because of bacterial colonization.[93–95]

Table 3 Summary of Literature Examining the Dimensions Favorable for Regeneration of the Interproximal Papilla

						Results			
Study	**Sample size**	**Site**	**Follow-up**	**Papilla determination method**	**Study design**	**Distance of contact point to bone crest**	**% papilla fill**	**Distance between teeth and/ or implants**	**% papilla fill**
Tooth to tooth relationship									
Tarnow et al (1992)[71]	30 patients with 288 sites	Anteriors, premolars, and molars	Unknown	Present = complete papilla fill; absent = incomplete papilla fill	Cross-sectional; bone sounding	< 5 mm 5 mm 6 mm 7 mm 8 mm	100% 98% 56% 27% 10%		
Cho et al (2006)[77]	80 patients with 206 sites	Anteriors, premolars, and molars	Unknown	Present = complete papilla fill; absent = incomplete papilla fill	Cross-sectional; surgical entry	4 mm 5 mm 6 mm 7 mm 8 mm 9 mm	89.7% 58.5% 35.2% 7.5% 5.9% 0%	1 mm 1.5 mm 2 mm 2.5 mm 3 mm 3.5 mm 4 mm	77.8% 72.4% 53.7% 35% 23.5% 6.3% 0%
Tooth to implant relationship									
Choquet et al (2001)[62]	26 patients with 27 implants	Maxillary anterior teeth, first and second premolars	6 mo	Papilla Index[81]: 0 = no papilla 1 = < 50% papilla 2 = ≥ 50% papilla 3 = papilla fill 4 = hyperplastic papilla	Cross-sectional; bone sounding, radiographs	< 5 mm 5 mm 6 mm	100% 88% 50%		
Gastaldo et al (2004)[75]	48 patients with 80 sites	Unknown	1.5–6 y	Present = complete or partial papilla fill; absent = no papilla	Cross-sectional; bone sounding, radiographs	< 5 mm 5 mm 6 mm 8 mm 10 mm	100% 80% 40% 40% 25%	2–2.5 mm 3 mm 3.5 mm 4 mm 4.5 mm	0% 88% 83% 75% 56%
Ryser et al (2005)[76]	41 patients	Maxillary teeth, mandibular premolars and molars	2 y	Papilla Index[81]: 0 = no papilla 1 = < 50% papilla 2 = ≥ papilla 3 = papilla fill 4 = hyperplastic papilla	Prospective; bone sounding, radio-graphs, clinical photos	< 5 mm 5–5.9 mm 6 mm 7 mm	86.7% 73.3% 45.5% 0%		
Lops et al (2008)[78]	46 patients with 46 immediate implants	Maxillary and mandibular teeth	1 y	Present = complete papilla fill; absent = incomplete papilla fill	Prospective; radiographs	3–5 mm 6–7 mm > 7 mm	79.6% 51.6% 58%	1–2.5 mm 3–4 mm > 4 mm	32% 84.2% 70%
Romeo et al (2008)[79]	48 patients with 48 immediate implants	Incisors, canines, and premolars	1 y	Present = complete papilla fill; absent = incomplete papilla fill	Prospective; radiographs			< 2 mm 2.01–3 mm 3.01–4 mm > 4 mm	80.6% 88.2% 88.5% 72.7%
Implant to implant relationship									
Gastaldo et al (2004)[75]	48 patients with 96 sites	Unknown	1.5–6 y	Present = complete or partial papilla fill; absent = no papilla	Retro-spective; bone sounding	3 mm 4 mm 6 mm 8 mm 10 mm	100% 50% 26% 40% 25%	2–2.5 mm 3 mm 3.5 mm 4 mm 4.5 mm	0% 82% 81% 71% 48%
Degidi et al (2008)[80]	49 patients with 152 immediate implants	Unknown	2 y	Papilla Index[81]: 0 = no papilla 1 = < 50% papilla 2 = ≥ 50% papilla 3 = papilla fill 4 = hyperplastic papilla	Prospective; radiographs	< 2 mm	80.6%	2.01–3 mm 3.01– 4 mm > 4 mm	88.2% 88.5% 72.7%

Table 4 Summary of Literature Examining the Relationship Between Tissue Biotype and Implant Esthetics

Study	Study site	Sample size	Definition of tissue biotype	Follow-up period	Results
Kan et al (2003)[32]	Maxillary anterior region	45 patients, 45 implants	Thin = probe visible through gingival margin; thick = probe not visible through gingival margin	1 y	Dimension of peri-implant mucosa was related to the peri-implant biotype
Cardaropoli et al (2006)[97]	Maxillary anterior region	11 patients, 11 implants	Ultrasonic device	1 y	Mean bone loss of 1.6 mm from time of implant placement to crown placement; mean peri-implant mucosa recession of 0.6 mm; ratio of mucosal thickness: height of free peri-implant marginal tissue = 1:1.5
Linkevicius et al (2009)[50]	Unknown	26 patients, 64 implants	Thin = < 2 mm; medium = 2.1–3 mm; thick = > 3.1 mm	1 y	Mean peri-implant bone loss was inversely correlated with peri-implant mucosal thickness
Linkevicius et al (2009)[51]	Unknown	19 patients, 46 implants	Thin = < 2 mm; thick = > 2.5 mm	1 y	Initial gingival thickness ≤ 2 mm would have crestal bone loss of up to 1.45 mm; significantly more peri-implant bone loss in sites with thin tissue compared to those with thick tissue
Chen et al (2007)[98]	Maxillary anterior and premolar regions	30 patients, 30 implants	Unknown	3–4 y	Mucosal recession significantly related to buccally placed implants instead of tissue biotype
Evans and Chen (2008)[16]	Maxillary and mandibular anterior and premolar regions	42 patients, 42 implants	Thin = probe visible through gingival margin; thick = probe not visible through gingival margin	19 mo (6–50 mo)	Thin tissue biotype showed greater peri-implant mucosal recession than thick tissue biotype, though not statistically significant
Romeo et al (2008)[79]	Maxillary and mandibular anterior and premolar regions	48 patients, 48 implants	Thin = probe visible through gingival margin; thick = probe not visible through gingival margin	1 y	A thick tissue biotype was associated with papilla fill
Chen et al (2009)[99]	Maxillary incisors	85 patients, 85 implants	Thin = ≤ 1 mm; thick = ≥ 1 mm	1 y	Mucosal recession of more than 10% occurred at 24% of sites with thin tissue biotype sites, compared to 10.5% of sites with thick tissue biotype
Nisapakultorn et al (2010)[96]	Maxillary incisors	40 patients, 40 implants	Thin = probe visible through gingival margin; thick = probe not visible through gingival margin	–	Facial marginal mucosal level was significantly associated with peri-implant tissue biotype; a thin biotype was significantly associated with an increased risk of facial marginal mucosal recession

Henceforth, the true value of having a thick tissue biotype can be divided into two purposes. First, it enhances primary wound coverage, providing vascularity, site protection, and stability for regeneration around the implant. Second, it is more resistant to mucosal recession or mechanical irritation and is capable of creating a barricade to conceal restorative margins.

A recent study by Nisapakultorn et al found that peri-implant tissue biotype was significantly associated with facial marginal mucosal level. Also, patients with a thin biotype had less papilla fill and an increased risk of peri-implant facial mucosal recession.[96] Sadly, despite a rigorous search of the available literature, a limited number of clinical trials were found to have investigated the relationship between tissue biotype and implant esthetics (Table 4). Although no definitive clinical trial has been conducted to thoroughly examine the influence of peri-implant tissue biotype on implant esthetics, it can inferred from the available literature that tissue biotype does play a crucial role in creating an esthetic implant-supported restoration. Therefore, the use of the PDP management triad to increase peri-implant soft tissue thickness will help clinicians attain esthetic implant restorations and achieve patient satisfaction.

CONCLUSION

A thick soft tissue biotype is a desirable characteristic that will positively affect the esthetic outcome of an implant-supported restoration because thick soft tissue is more resistant to mechanical and surgical insults, is less susceptible to mucosal recession, and has more tissue volume for prosthetic manipulation. Therefore, although tissue biotype is an inherent trait that varies from patient to patient, it can be transformed through precise management of the implant position, implant design, and prosthetic design (PDP triad) such that a desired esthetic outcome is achieved.

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