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Prosthodontic considerations of gingival biotype

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Abstract
In aesthetic dentistry, gingival biotype plays a vital role. For the effective outcome of dental implant placement, ridge augmentation procedures, restorative therapy, assessment of gingival type and form is imperative during the treatment planning. This review article features the gingival biotypes, their assessment through various methods, factors affecting the gingival biotype and their clinical significance in prosthodontic treatment.

Keywords: Dental implant, Gingival Biotype, Prosthesis

Introduction
Gingival biotype, a part of the masticatory mucosa, is the thickness of the gingiva in the facio-palatal dimension that encompasses the cervical portion of the teeth [14]. Gingival thickness influences the treatment result potentially due to difference in the amount of blood supply to the underlying bone and predisposition to resorption [16].
The persistent outcome of esthetic restorations relies upon a few variables like gingival biotype, architecture of the gingival tissue and shape of the anterior teeth. Gingival biotype is a basic factor that determines the outcome of a dental therapy.

History
In 1969, Oschenbein & Ross demonstrated the presence of two fundamental types of gingival anatomy-*scalloped gingiva* and *flat gingiva* [1].
According to the findings of Claffey & Shanley (1986), a gingival thickness of more than 2mm is characterized as a thick biotype while a thin biotype indicates a gingival thickness of less than 1.5mm [2]. Siebert & Lindhe (1989) presented the term *periodontal biotype* and categorized the gingiva into *thick-flat* and *thin-scalloped* biotypes [3].
In 1994, a classification system for the periodontal biotype in relation to the restorative margin was proposed by Kois. Crestal bone levels were analysed and categorised as *high*, *normal* and *low* [4].

Table 1

Periodontal Biotype	Crestal bone level in relation to CEJ
High crest	< 3 mm apical to CEJ
Normal crest	3 mm apical to CEJ
Low crest	>3 mm apical to CEJ

Gingival or *Periodontal phenotype* term was coined by Muller H in 1997 [6].
Flat, *scalloped* and *pronounced scalloped* gingiva were the three different periodontal biotypes introduced by Becker *et al*. (1997) [5].

Table 2

Periodontal Biotype	Measurement from height of bone inter proximally to height at the direct mid facial
Flat	2.1 mm
Scalloped	2.8 mm
Pronounced scalloped	4.1 mm

As indicated by the data acquired from an investigation done by De Rouck *et al*. in 2009, prevalence of thick gingival biotype was found to exist in 85%of population, prevalently in women and thin biotype was observed in 15% of population, predominantly in men [10].
With the emergence of dental implants, *soft tissue biotype* term was introduced to surround the tissue around both teeth and implants.

Gingival Biotypes & Their Characterisitics
The contour of gingiva follows the contour of underlying bone. The characteristics of the thin and thick gingival biotypes have been summarised in the table [11-13, 14-17].

Table 3

Thin-scalloped Gingival Biotype	Thick-flat Gingival Biotype
Gingival thickness < 1.5 mm, width-3.5-5 mm	Gingival thickness > 2.0 mm, width-5-6 mm
Long papillae	Short papillae
Pronounced scalloped soft tissue and bony architecture	Flat soft tissue and bony architecture
Delicate friable soft tissue	Dense fibrotic soft tissue
Usually slight gingival recession	Gingival margins coronal to CEJ
Small incisal contact areas	Broad apical contact areas
Thin underlying bone characterized by bony dehiscence and fenestration	Relatively resistant to acute trauma
Tapered facial form	Squared facial form
Subtle cervical convexity	Marked cervical convexity
Gingival recession, following a disease	Formation of a deep pocket and in Fra bony defect, following a disease

In ceramic fused to metal crowns or implant abutment, metal substructure is visible due to presence of thin gingival margin. This predisposes to compromised aesthetics in the anterior tooth region. For better results, all-ceramic crowns or ceramic implant abutments are recommended [11].
For implant placement, a thick biotype is more favourable for better esthetics.

Assessment of Gingival Biotype
Various invasive and non-invasive techniques have been introduced to examine the thickness of facial gingiva and other parts of masticatory mucosa [12-15].

Visual inspection
Merits-simple, straightforward, non-invasive, highly expensive
Demerits-subjective, highly variable, not a reliable method

Probe transparency
Metal periodontal probe is used to evaluate the gingival tissue thickness. The tip of the probe is visible through the gingiva in case of thin gingival biotype.
Merits-most accepted**,** simple, minimally invasive *Demerits*-subjective, difficult in identifying in pigmented gingiva

Tension-free caliper
Only applicable during surgery, not for pre-treatment examination.

Transgingival probing
Merits-simple, convenient *Demerits*-invasive, angulation of probe, probing force, distortion of gingival tissues

Ultrasonic device
Kydd *et al*. (1971) first utilised the ultrasonic device to examine the thickness of palatal mucosa.
Merits-simple, convenient, non-invasive
Demerits-expensive, difficult to examine clinically in limited access areas (due to large probe diameter), moisture may affect the accuracy

Radiography
Cone beam computed topography (CBCT) produces an image of the tooth, gingiva and other periodontal structures.
Merits-non-invasive, convenient, can provide quantitative measurements *Demerits*-expensive, technical expertise needed, relatibely higher radiation exposure than conventional radiographs Fu *et al.* evaluated the thickness of labial gingiva and bone and stated that the values were accurate and CBCT may be a more objective method than direct measurements.

Prosthodontic Considerations of Gingival Biotype
Implant Treatment Planning
The esthetic outcome of an implant primarily depends upon the gingival biotype. Stability of the osseous crest and soft tissue are in direct relation to the thickness of the bone and gingival tissue [9].

Thin gingival biotype
- Berglundh & Lindhe (1996)-stated that during the formation of the peri-implant biologic width, marginal bone loss may be observed in the presence of a thin gingival tissue [16].
- Huang *et al*. (2005)-concluded that angular bone defects were reported in implant sites comprising of thin mucosa [7].
- Palatal placement of the implant body and shoulder to hide the titanium outline.
- Thin bony plates with probability for fenestrations and dehiscence are correlated to the thin biotype.
- More alveolar resorption in the apical and lingual direction is observed in the thin biotype ridges during the post-operative healing period.

Thick gingival biotype
- Huang *et al*. (2005)-reported that implants enclosed by thick mucosa presented a stable crestal bone [7].
- Abrahamsson *et al*. (1996)-concluded that significant crestal bone recession may not be observed in thick tissues.

Single anterior tooth implant placement
- Evans & Chen (2008)-proposed that in single implant restorations, thin gingival biotypes predispose to increased gingival recession [8].
- Loss of peri-implant tissue leads to
- Loss of facial plate
- Grayish discoloration of the implant

Immediate-loading implants provide predictable outcome in a thick gingival biotype [12] it has certain advantages over thin gingival biotype-prohibits the recession of mucosa, envelops the restorative margins and masks the titanium implant shadows [16]. Thick biotype is more resistant to mechanical

and surgical insult [15]. Whereas in thin gingival biotype, significant resorption is possible. Peri-implant structures may be lost leading to grayish appearance of the thin tissue.

Ridge Preservation/Augmentation

Atraumatic extraction and ridge preservation are the necessary factors for the successful outcome of an implant [9].

The preservation of the socket/ridge cases of thin gingival biotype is critical for accomplishing ideal esthetic outcome. The quality of success relates to the amount of graft material retained in the extraction socket [11].

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