ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 5, Issue – 3, June - 2022, Page No. : 148 - 153

Gingival Phenotype concept for the Esthetic Implant restoration - A Review

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Citation of this Article: Dr. Mohana Satheesh, Dr. Mohan Valia than, Dr. Sajid Hussain, "Gingival Phenotype concept for the Esthetic Implant restoration - A Review", IJDSIR- June - 2022, Vol. – 5, Issue - 3, P. No. 148 – 153.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Gingival Phenotype has a significant impact on the outcome of Implant Placement in the Esthetic zone. The thin Gingival phenotype response differently than thick gingival phenotype[1]. Hence in clinical practice identification of gingival phenotype before placement of implant helps implantologist seek the perfect therapy plan for each patient to achieve long time stability of implant in the Esthetic zone. This review paper highlights general aspects of gingival phenotype describes the various classifications, method of assessment and clinical importance of gingival phenotype during implant placement in Esthetic zone.

Keywords: Gingival Phenotype, Gingival phenotype assessment, Gingival phenotype classification, Implants, Esthetic Zone, Gingival Biotype, Periodontal biotype, Gingival thickness.

Introduction

Gingival phenotypes are described as the thickness of the gingiva in the Facio palate/ Facio lingual dimensions[2]**.** Reduced Gingival thickness is one of the factors that can cause periodontal attachment loss and marginal tissue recession post placement of implant in Esthetic zone[4].

The long-term success of Esthetic restoration depends on gingival phenotype, architecture of the gingival tissues and shape of anterior teeth[4]**.** Therefore, during treatment plan, it is important to recognize differences in gingival tissue as it places important in determining the final Esthetic outcome.

A Normal Thin periodontal biotype is found in and around 75% of the patients, A Thick Biotype is found in 25% of the patients[6]

Clinicians' knowledge in identifying gingival phenotype is paramount in achieving optimal outcome. Various invasive and non-invasive methods were proposed to measure tissue thickness. Tarnow observed that the presence of the papilla depends on the distance between the bone crest and contact point. When the distance is = 5mm the papilla will always mature, when the distance > 5mm the papilla will open shows the classic Black triangle, so its fundamental to keep the contact point as apically as possible[14]. So having a clear knowledge of Phenotype will make the prosthetic restoration Esthetically pleasing.

Gingival Phenotype and their characteristics

Various classifications have been suggested for gingival biotypes. In 2017 world workshop on the classification of periodontal and peri-implant Diseases and Conditions recommended adoption of periodontal phenotypes[5] [9.] Periodontal phenotypes are determined by gingival phenotypes (gingival thickness and keratinized tissue width) and bone morphology type (thickness of buccal bone plate)[3]

Various classification

According to Ochsenbein and Ross [2](1969) Gingival phenotype are of 2 types

1 Scalloped and thin,

2 Flat and Thick.

They Observed that the flat gingival anatomy was found in patients having square teeth while highly scalloped gingiva form is found in patients with a tapered tooth form.

Seibert and Lindhe [3](1989) later used the term periodontal biotype to describe gingival form and classified gingival biotype as Thin, scalloped, or thick flat.

Eger and Muller [10] [11](1997) have classified phenotype into Thick and Thin. They presented an ultrasound system that made it possible to find thickness of mucous membrane of oral cavity and gingiva with accuracy of 0.1mm without any discomfort to the patient.

Becker et al (1997)[5] Flat gingival phenotype 2.1mm, Scalloped Gingival phenotype 2.8mm. They measured the distance between the interproximal and mid facial level of alveolar bone.

Fu et al[13] (2010) Classified phenotype as Thick (when probe not seen) and Thin (Probe seen through gingiva) Egreja et al (2012) Classified as Thin >1mm, Thin <1mm

Gingival Phenotype Assessment [10]

Various methods have been explained below

1. Direct measurement or bone sounding or injection needle technique.
2. Visual Examination
3. Probe transparency
4. Ultrasound devices
5. CBCT
6. Cephalometric readings
7. Histologic sections
8. Convention histology in cadaver jaws

Direct measurement

Gingiva is anesthetized by local anesthetic gel. An endodontic spreader/Probe/ Needle with a rubber stop is inserted at a point at the end of mucogingival junction in a perpendicular direction and measurement is recorded against digital caliper.

Advantage: Easy to perform Convenient Cheap and accurate

Disadvantage: Invasive technique Requires application of local anesthesia Depends on angulation and precision of probing

Visual Examination

It is a technique often used to determine Gingival phenotype. No tools necessary, simple, and forward.

Phenotype is clinically evaluated based on general appearance of gingiva around teeth. Gingiva Phenotype is considered as thick if gingiva appears dense and fibrotic. Gingival phenotype is considered as thin if gingiva appears delicate, febrile, and translucent [10] Though it is non-invasive it has low accuracy and high intra examiner variability.

Probe Transparency

Periodontal probe is placed on the sulcus of mid facial aspects of the tooth and gingival phenotype is categorized on basis of visibility of underlying periodontal probe through gingival tissue.

Fu et all[13] (20101) made classification based on this.

Ultrasonic devices

It is a modern diagnostic tool, a thin and sensitive probe attached to ultrasonic devices that measure gingival phenotype.

Advantage: Accurate measurement Digital display Avoid inter examiner variability Non-invasive

Disadvantage: limited availability Excessive cost makes it less feasible Eger et al and Muller et al presented an ultrasound system to determine gingival thickness with accuracy of 0.1mm. [10 11]

CBCT (Cone Beam Computed Tomography)

With this technique a high accurate result is obtained with no intra examiner variability. Fu et all[13] reported that CBCT measurement of both bone and labial soft tissue thickness are accurate and concluded that CBCT might be a more objective method to decide the thickness of both soft and hard tissues than direct measurement.

After interpreting all the methods of assessing the gingival thickness, one of the simplest and effective methods is transparency gingival probing having accuracy to the nearest of 0.5mm. Though it must be performed under local anesthesia. The validity of visual method it may not be regarded as valid method to identify the gingival biotype as 50% of the high Esthetic risk was overlooked. Considering pros and cons of various assessing Methods Direct measurement and Probe transparency are feasible and good technique to detect gingival phenotype clinically .[15]

Characteristics of Gingival Phenotype [6,8]

Characteristics of thick gingival biotype

1. Thick flat soft tissue and bony architecture.
2. Thick heavy periodontium.
3. Gingival margin usually placed coronal to CEJ.
4. Wide zones of keratinized gingiva, flat gingival contour.
5. Broad apical contact areas in teeth, and square anatomic crowns.
6. Mostly associated with periodontal health.
7. The tissue is dense with a wide zone of attached gingiva.
8. Thick underlying osseous form.
9. Tissue response to thick biotype

Inflammation

a. soft tissue: It results in marginal inflammation, cyanosis, bleeding on probing, and oedema/fibrotic changes.

b. Hard tissue: Bone loss with pocket formation/ intrabony defects seen.

c. Surgery: Predictable soft and hard tissue contour after healing.

d. Extraction: Minimum ridge atrophy reported.

Characteristics of thin gingival biotype

1. Highly scalloped gingival tissue usually may present with slight gingival recession.
2. Highly scalloped osseous contour.
3. Delicate and thin periodontium.
4. Small incisal contact areas in the teeth, and triangular anatomic crowns.

5. Tissue appears friable with a minimal zone of attached gingiva.

6. Soft tissue is highly accentuated and often suggestive of thin or minimal bone over the labial roots.

7. Proves thin labial bone with an increased incidence of fenestration and dehiscence.

8. Tissue response to thin biotype

Inflammation

a. soft tissue: It shows thin marginal redness and gingival recession.

b. Hard tissue: It results in rapid bone loss and with soft tissue recession.

c. Surgery: Difficult to predict where tissue will heal and stabilize. – Tooth

d. Extraction: Ridge resorption in the apical and lingual direction.

Influence of Gingival phenotype on treatment plan and outcome of implant placement in Esthetic zone [8]

During Treatment planning soft tissue biotype should be taken into consideration as it affects the final treatment outcome.

Evidence suggests that the percentage of success rate of immediate implant in anterior region is more in individual with thick phenotypes. [8]

Thick tissues are preferred around dental implants as they conceal titanium of implants better and are more accommodating to different implant positions. [7]

However, in patients with thin phenotypes the frequency of gingival recession is high following implant placement thick phenotypes show great dimensional stability during remodelling compared to thin Phenotype[8]

It is assumed that in thick phenotype a presence of lamina bone adjacent to the cortical plate supplies the foundation for stabilization. [8]

Hence, an immediate can be considered in thick biotype with preferable outcomes. In thin phenotype lamina bone is less or absent [8].

A delayed implant must be considered when there is not enough soft and hard tissue thickness. Additional hard tissue augmentations using various bone grafts and soft tissue augmentation using modified roll technique, split finger technique and acellular dermal matrix may be needed to achieve best Esthetic results [4.]

Tooth extraction in thick phenotype results in minimal ridge atrophy. Thin biotype is associated with thin alveolar plate, therefore placing grafts and membranes in the socket can minimize alveolar bone loss after tooth extraction[6]

It has been suggested that a thick phenotype may enhance the collateral blood supply to the underlying osseous structure, while a thin phenotype may compromise it. [6 12]

A good blood supply is paramount and essential maintenance of implant in Esthetic zone thereby preventing ischemia. [4]

Thich tissue with high blood supply will enhance the revascularization of bone grafts leading to increase healing and graft incorporation. [8]

Thick Gingival Phenotype are more resistance to marginal recession or mechanical irritant. Hence converting position in all dimensions and converting thin phenotypes to thick phenotypes is essential to prevent Esthetic failure as metal shown in thin original phenotype, soft tissue recession, marginal bone loss around implant and loss of interdental papilla [6]

Change of thin Gingival phenotype to Thick Gingival phenotype [6 8]

1. The use of connective tissue grafts, modified roll technique, Finger split technique.

2. Acellular dermal matrix can also be used to enhance the biotype.

3. Use of platelet-rich fibrin (PRF) membrane. Shetty et al. in 2014 showed that placement of PRF membrane over receded root surface in combination with coronally advanced flap resulted in the improvement in the thickness of gingiva [16].

4. Recently, utilization of fetal membranes such as amnion and chorion membrane has been shown to enhance gingival biotype.

Conclusion

Gingival Thickness is the one of the important parameters which predominates Esthetic outcome of the dental implants. A Thick phenotype was significantly associated with maintaining the presence of gingiva papilla in the immediate placement of dental implants in Esthetic zone. For patients with thin biotype the implant body and shoulder must be placed more palatal, with slightly deeper placement, to mask the visibility of titanium and to allow for proper emergence profile. By knowing the nature of the tissue phenotype, a clinician can perform suitable clinical procedures to maintain soft tissue loss and decrease one resorption and supply a more favourable tissue environment during implant restorations.

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