



ORIGINAL RESEARCH PAPER

Periodontology

ROLE OF BIOLOGICAL WIDTH IN RESTORATIVE DENTISTRY

KEY WORDS: Biological width, Crown margin, Crown lengthening, Gingival tissue.

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ABSTRACT

An adequate understanding of the relationship between periodontal tissues and restorative dentistry is paramount to ensure adequate form, function, esthetics and comfort of the dentition. The relationship between periodontal health and restoration of teeth is intimate and inseparable. For restoration to survive long term, the periodontium must be healthy so that the teeth are maintained. The establishment of periodontal health is therefore a prerequisite for successful prosthodontic and restorative procedures. To facilitate this collaboration the prosthodontist should give importance to biological width and its implication restoration margin and contour.

Introduction:

Periodontal tissues form the foundation for proper esthetics, function, and comfort of the dentition. All prosthetic and restorative therapies generally require a healthy periodontium as a prerequisite for successful outcome. The interplay between periodontics and restorative dentistry is present at many fronts, including location of restorative margins, crown contours, and response of the gingival tissues to restorative preparations. Maintenance of gingival health constitutes one of the keys for tooth and dental restoration longevity (1). An adequate understanding of relationship between periodontal tissues and restorative dentistry is paramount to ensure adequate form, function and esthetics, and comfort of the dentition.

Biologic Width Anatomy

In the human body, ectodermal tissue serves to protect against invasion from bacteria and other foreign materials. However, both teeth and dental implants must penetrate this defensive barrier. The natural seal that develops around both, protecting the alveolar bone from infection and disease, is known as the biologic width (2). The biological width is defined as the dimension of the soft tissue, which is attached to the portion of the tooth coronal to the crest of the alveolar bone [Figure: 1].

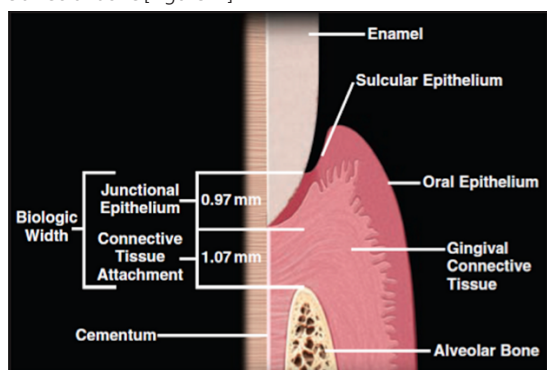


Figure 1: Biological Width.

This 3 mm constitutes for 1 mm supracrestal connective tissue attachment, 1 mm junctional epithelium and 1 mm for gingival sulcus on an average. This allows for adequate biologic width even when the restoration margins are placed 0.5 mm within the gingival sulcus (3). Nevins and Skurow stated that when subgingival margins are indicated, the restorative dentist must not disrupt the junctional epithelium or connective tissue apparatus during preparation and impressing taking. The authors recommended limiting subgingival margin extension to 0.5-1.0 mm because it is impossible for the clinician to detect where the sulcular epithelium

ends and the junctional epithelium begins (4). In natural dentition, gingival morphology is partly related to the tooth shape and form.

Tooth shape is classified in to triangular, ovoid and square; and, the tooth form as long narrow and short wide (5). Individuals with square shaped teeth have more favorable aesthetic outcomes because of long proximal contacts and less of papillary tissue, where as a triangular tooth shape has a proximal tooth contact located more incisally and needs more tissue height to fill in; and hence, is at a high risk of the 'black hole disease' (6).

Margin Placement And Biologic Width

A clinician is presented with three options for margin placement: 1. Supragingival, 2. Equigingival, and 3. Subgingival locations.

Supragingival margin

Restoration margin is placed coronal to the gingival margin. It has the least impact on the periodontium. It makes easy to finish and record the restoration margin with impression.

Equigingival margin

Restoration margin is placed at the level of the gingival margin. There was also the concern that any minor gingival recession would create an unsightly margin display. From a periodontal viewpoint, both supragingival and equigingival margins are well tolerated.

Subgingival margin

Restorative margin placement within the biologic width is detrimental to periodontal health and acts as a plaque retentive factor. When the restoration margin is placed too far below the gingival tissue crest, it will impinge on the gingival attachment apparatus and a constant inflammation is created and made worse by the patient's inability to clean this area. Body attempts to recreate room between the alveolar bone and the margin to allow space for tissue reattachment. This is more likely to occur in areas where the alveolar bone surrounding the tooth is very thin in width. Highly scalloped, thin gingiva is more prone to recession than a flat periodontium with thick fibrous tissue.

Investigators have correlated that sub gingival restorations demonstrated more quantitative and qualitative changes in the micro flora, increased plaque index, gingival index, recession, pocket depth and gingival fluid (7).

Evaluation Of Biologic Width Violation

Clinical method

If a patient experiences tissue discomfort when the restoration margin levels are being assessed with a periodontal probe, it is a good indication that the margin extends into the attachment and that a biologic width violation has occurred. The signs of biologic

width violation are: Chronic progressive gingival inflammation around the restoration, bleeding on probing, localized gingival hyperplasia with minimal bone loss, gingival recession, pocket formation, clinical attachment loss and alveolar bone loss. Gingival hyperplasia is most frequently found in altered passive eruption and subgingivally placed restoration margins⁽⁸⁾.

Bone sounding

The biologic width can be identified by probing under local anesthesia to the bone level (referred to as "sounding to bone") and subtracting the sulcus depth from the resulting measurement. If this distance is less than 2 mm at one or more locations, a diagnosis of biologic width violation can be confirmed.

Radiographic evaluation

Radiographic interpretation can identify interproximal violations of biologic width. However, on the mesiofacial and distofacial line angles of teeth, radiographs are not diagnostic because of tooth superimposition⁽⁹⁾. Sushama and Gouri have described a new innovative parallel profile radiographic (PPR) technique to measure the dimensions of the dento gingival unit (DGU). The authors infer that the PPR technique could be used to measure both length and thickness of the DGU with accuracy, as it was simple, concise, non-invasive, and a reproducible method. Categories of biologic width and margin placement guidelines to prevent biologic width violation Kois proposed three categories of biologic width based on the total dimension of attachment and the sulcus depth following bone sounding measurements, namely: Normal Crest, High Crest and Low Crest⁽¹⁰⁾.

Normal crest patient

In the Normal Crest patient, the mid-facial measurement is 3.0 mm and the proximal measurement is a range from 3.0 mm to 4.5 mm. Normal Crest occurs approximately 85% of time. In these cases, the gingival tissue tends to be stable for a long term. The margin of a crown should generally be placed no closer than 2.5 mm from alveolar bone. Therefore, a crown margin which is placed 0.5 mm subgingivally tends to be well-tolerated by the gingiva, and is stable long term in the Normal Crest patient.

High crest patient

High Crest is an unusual finding in nature and occurs approximately 2% of the time. There is one area where High Crest is seen more often: In a proximal surface adjacent to an edentulous site. In the High Crest patient, the mid-facial measurement is less than 3.0 mm and the proximal measurement is also less than 3.0 mm. In this situation, it is commonly not possible to place an intra-crevicular margin because the margin will be too close to the alveolar bone, resulting in a biologic width impingement and chronic inflammation.

Low crest patient

In the Low Crest patient group, the mid-facial measurement is greater than 3.0 mm and the proximal measurement is greater than 4.5 mm. Low Crest occurs approximately 13% of the time. Traditionally, the Low Crest patient has been described as more susceptible to recession secondary to the placement of an intra-crevicular crown margin. When retraction cord is placed subsequent to the crown preparation; the attachment apparatus is routinely injured. As the injured attachment heals, it tends to heal back to a Normal Crest position, resulting in gingival recession.

Low crest, stable or unstable

In recession cases patient with more sulcus depth with minimum attachment level (i.e., epithelium and connective tissue) are more prone for gingival recession than patient with minimum sulcular depth with more attachment level (i.e., epithelium and connective tissue). The first situation is called as low crest with unstable situation and the second one is low crest with relatively stable situation.

Importance of determining the crest category

When preparing anterior teeth for indirect restorations, it is essential that the dentist should know about the Crest category. This allows the operator to determine the optimal position of

margin placement, as well as inform the patient of the probable long-term effects of the crown margin on gingival health and esthetics. Based on the sulcus depth the following three rules can be used to place intracrevicular margins: 1) If the sulcus probes 1.5 mm or less, the restorative margin could be placed 0.5 mm below the gingival tissue crest. 2) If the sulcus probes more than 1.5 mm, the restorative margin can be placed in half the depth of the sulcus. 3) If the sulcus is greater than 2 mm, gingivectomy could be performed to lengthen the tooth and create a 1.5 mm sulcus. Then the patient can be treated as per rule⁽¹¹⁾.

Methods To Correct Biologic Width Violation

Biologic width violations can be corrected by either surgically removing bone away from proximity to the restoration margin like by surgical crown lengthening or External bevel gingivectomy, internal bevel gingivectomy, or apically positioned flap surgery with osseous reduction or orthodontically extruding the tooth and thus moving the margin away from the bone.

CONCLUSION

The health of the periodontal tissues is dependent on properly designed restorative materials. Overhanging restorations and open inter-proximal contacts should be addressed and remedied during the disease control phase of periodontal therapy. Although individual variations exist in the soft tissue attachment around teeth, there is general agreement that a minimum of 3mm should exist from the restorative margin to the alveolar bone, allowing for 2mm of biologic width space and 1mm for sulcus depth.

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