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"A comprehensive guide to the Biologic Width"

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ABSTRACT:
The concept of Biologic Width has been widely described by periodontists and restorative dentists. 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. While most clinicians are aware of this important relationship, uncertainty remains regarding specific concepts such as biologic width and indications and applications of surgical crown lengthening. These violations lead to complications like gingival inflammation, alveolar boneloss and improper fit of the restorative component. An attempt hasbeen made in this article to discuss the concept of biologic width, its importance in maintaining a long term dental restoration includingcrown & bridge and implants, and the implications of biologic width violation. Lastly, we discuss the possible methods to assess biologic widthand surgical & non-surgical corrective procedures.

Key Words: Biologic, width, Dentogingival unit, Periodontics,restorations, Gingival inflammation, Bone loss, Crown lengthening

I. INTRODUCTION

Periodontal health and restoration of teeth maintains an inseparable and functional relationship. Dimension of space occupied by soft tissue attachment to portion of tooth above crest of alveolar bone known as biologic width. Main idea of biologic width is understanding the relationship between the periodontal tissue and restorative dentistry is to have appropriate aesthetics, adequate form, comfort and function of dentition. The term 'biologic width' was first introduced by Walter Cohen in 1962 to describe about the space which is formed on the surface of tooth, with various epithelial and connective tissue attachments and this parameter is exactly equal to major distance formed between base of gingival sulcus and crest of alveolar bone. (1) If the biologic width is not considered during restoration of tooth, this will lead to poor response in periodontium and failure of restoration. Certain treatment measures were advised for the clinical shortening of the crown are the crown lengthening given by cohen which includes an apically repositioned flap or apically repositioned flap with osseous recontouring, gingivectomy etc. Hence forced tooth eruption is done in this procedure. (2)

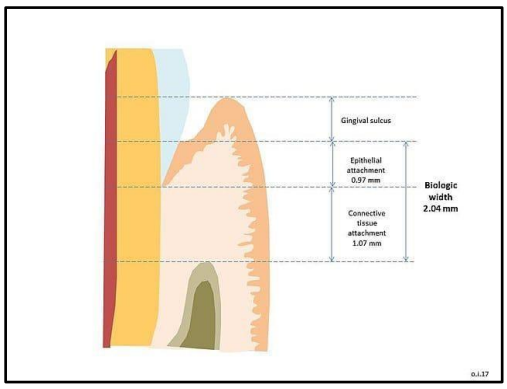

Figure1: Biologic Width dimensions

BIOLOGIC WIDTH

Dimension of space occupied by soft tissue attachment to portion of tooth above crest of alveolar bone known as biologic width. Gargiulo et al described about dimensions and relationship of dento-gingival junction in humans. (3) Average measurement of depth of sulcus is 0.69mm while dimension of epithelial attachment is 0.97mm. While connective tissue attachment ranges around 1.07mm. Combination of these dimensions together constitutes around 2.04mm from both epithelial tissue and connective tissue attachment and hence the term biologic width(Figure:1). Biologic width is essential for preservation of periodontium from

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damage caused by irritation due to prosthetic restoration. (3) Biologic width is measured by probing. Biologic width existence is fundamental for adhesion of junctional epithelium and insertion of connective fibres to the dental structures.(4)

EVALUATION OF BIOLOGIC WIDTH

Clinical method:

Biologic width violation occurs when margin extends to attachment. It is due to assessment of restoration margin levels with periodontal probe which causes the patient to experience tissue discomfort.

Bone sounding:

By probing under local anaesthesia to bone level and subtracting the sulcus depth, biologic width can be identified. If the distance is less than 2mm at more than one locations, diagnosis of biologic width violation can be confirmed.

Radiographic evaluation:

In the evaluation of biologic width, radiographs are useful, non-invasive tools. Interproximal biologic width violation can identified by radiographic interpretation.(5) However because of tooth superimposition, radiographs are not diagnostic on mesiolabial and distofacial line angles of teeth. Gouri and Sushama described a new simple, reproductive and innovative method known as parallel profile radiographic(PPR) technique which is used to measure length and thickness of dentogingival unit with accuracy.

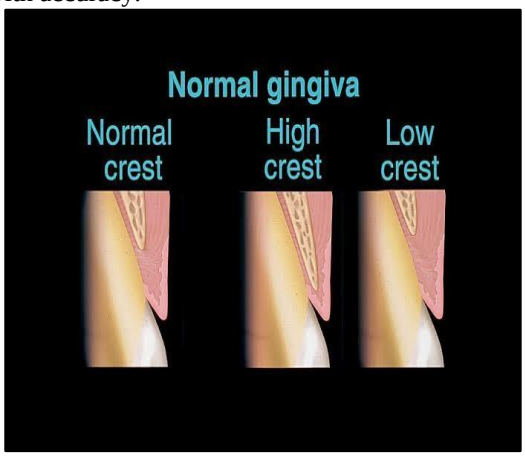

Figure2: Categories of Biologic Width

CATEGORIES OF BIOLOGIC WIDTH

There are 3 categories of biologic width proposed by Kois which is based on total dimension of attachment and sulcus depth following bone surrounding measurements (Figure:2).(6)

Normal crest patient

Normal crest occurs nearly 85% of time. In normal patient, margin of crown should be placed not closer than 2.5mm from alveolar bone.

High crest patient

High crest occurs nearly 2%of time, which is also an unusual findings in nature. It is seen in proximal surface adjacent to edentulous site oftenly. In this case, because of closeness between margin and alveolar bone, it is not possible to place an intracrevicular margin which results in biologic width impingement and chronic inflammation.

Low crest patient

Low crest occurs nearly 13%of time. Low crest patient are more vulnerable to recession secondary to placement of intracrevicular crown margin.(6) The attachment apparatus is frequently injured when retraction cord is placed succeeding to crown preparation. Followed by healing of injured apparatus, it will reduced to normal crest position which results in gingival recession. Besides normal crest patients which prone to gingival recession, other have a stable apparatus depending on depth of sulcus.(7)

MARGIN PLACEMENT

There must be 3 options for margin placement that is supragingival, equigingival(with tissue), subgingival locations. The supragingival margin shows less impact to the periodontium. Therefore, the restorations chosen mainly depends on the esthetic purpose as well as for a periodontal impact. Orkin et al (1987) demonstrated that the subgingival restorations had much greater chance of causing bleeding and producing gingival recession when compared to supragingival restorations.(8) Waerhaug(1978) states that the scalling instruments were inaccessible to the plague-retentive area in subgingival restorations.(9) Stetler and Bisoda(1987)evaluated the width of subgingival restorations as well as keratinized gingival based on the periodontal health.(10) Location of crown margin were studied Flores de je cobyetal(1989) on bacterial morphotypes and

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health of the periodontium in humans prior to 6-8 weeks and 1 year post insertion. (11)

Rules/steps in margin placement (8)

In order to preserve the gingival health the first step is that the sulcus depth must be used as a guide in margin placement. That is 3 rules are implied when placing intracrevicular margins.

1. If the sulcus probes less than or it is 1.5mm, the restorative margin placement can be done 0.5mm below the gingival tissue crest.
2. While of the sulcus probes greater than 1.5mm, the restorative margin can be placed half the depth of the sulcus below the crest of tissue.
3. If the sulcus is greater than 2mm, then gingivectomy can be performed in order to increase the length of the teeth thereby creating a 1.5mm sulcus. Then the patient is treated by following rule 1.

Supragingival margin

Have least impact on periodontium. Supragingival margins can be placed in esthetic areas by using more translucent restorative materials, like resin cements and adhesive dentistry etc. (9)

Equigingival margin

The equigingival margin was not traditionally desirable or they were thought to favours more plaque formation and greater inflammation of the gingiva than seen in the supragingival and subgingival margins. It would have also created an Insightly margin display due to any minor gingival recession. These concerns were not valid as of today as the restorative margins were well adapted aesthetically with the teeth but also these restorations when finished gives a much more polished, smooth interface at the gingival margin.

Subgingival margin

Due to dental caries or tooth deficiencies the restorative considerations will tell us about the placement of these restorative margins beneath the crest of the gingival tissues. If it is placed too far below the gingival crest, it will impinge the gingival apparatus and thereby creating a constant inflammation and the problem gets worse as the patient is unable to clean this desired area.

VIOLATION OF BIOLOGIC WIDTH

Violation leads bleeding or recession of gingival tissue and failure of restoration. Restorative margins push the gingival sulcus down which leads to violation of biologic width, so aesthetics considered to hide restorative margins below gingival margins.

Sign of biologic width violation are:

- Localized gingival hyperplasia with minimal bone loss
- Chronic progressive gingival inflammation around restoration
- Bleeding on probing
- Clinical attachment loss
- Alveolar loss
- Pocket formation
- Gingival recession
- Gingival hyperplasia

Escaping biologic width violation

Maynard and Wilson(12) claimed that each one of those dimensions (Superficial physiologic,crevicular physiologic, and subcrevicular physiologic) affect restorative remedy selections and the clinician should "conceptualize" all 3 regions and the interplay among them and restorative margins. It's is said via many researchers that margin placement into the subcrevicular physiologic area ought to be prevented to prevent the placement of an "everlasting calculus" beyond the crevice. In 1984, Nevins and Skurow(1) stated that after subgingival margins are indicated, the restorative dentist must not disrupt the junctional epithelium or connective tissue equipment in the course of coaching and affect taking. The researchers recommended limiting subgingival margin extension to 0.5-1.0mm because it's not possible for the clinician to hit upon where the sulcular epithelium ends and the junctional epithelium starts. They also emphasized permitting a minimum 3.0mm distance from the alveolar crest to the crown margin.(3)

CORRECTION OF BIOLOGIC WIDTH VIOLATIONS

Biologic width violations can be corrected by surgical methods such as removing the bone away from its boundary restorative margin or extruding the tooth orthodontically by moving the margin away from the bone. The reason why the margin should be moved is because the distance measured of the ideal biologic width for that particular patient should have an additional 0.5mm of bone removed as a safe zone.

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A. Surgical crown lengthening

In order to increase the clinical length of the crown, crown-lengthening surgeries were designed by the American Academy of Periodontology in 1992 as the crown showed a portion of the tooth which extends occlusally or incisal from the investing soft tissues mainly the gingiva.(13)

Factors affecting crown lengthening /contraindications

- Too much reliability on post and core restorations.
- Deep subgingival margin placement
- Root fractures in post and core restorations.
- Violations of the biologic width in deep subgingival margins.
- Non-restorative teeth.
- Undesirable compromise of aesthetics.

Indications

- Short clinical crowns.
- Teeth with excessive incisal wear or occlusal wear.
- Restorations that violate biologic width.
- Unequal, or unesthetic gingival levels for aesthetics.

Gingivectomy can be performed in a variety of cases that is ,

- External level gingivectomy: It is one of the most successful surgical procedures which involve,Hyperplasia or pseudopocketry and Adequate amount of keratinized tissue
- Internal level gingivectomy: Reduction of pocket depth and Exposure of coronal structure of tooth in its absence of a sufficient zone of attached gingiva
- Apical repositioned flap surgery

1. Without osseous reduction: The procedure is performed when biologic width of more than 3mm is seen on multiple teeth due to the absence of adequate width on the attached gingiva.
2. With osseous reduction : The alveolar bone gets reduced by osteoplasty and ostectomy inorder to expose the reg tooth length in a well functional fashion. Atleast 4mm of sound tooth structure must be exposed such that the soft tissue proliferates coronally and covers 2-3mm of the root and thereby leaving 1-2mm of supragingivally located tooth structure.

Healing after crown lengthening

Until a new gingival crevice develops, the restorative procedures must be held or delayed after the periodontal surgery.

- In non-aesthetic areas - site must be re-evaluated atleast 6weeks post-surgery.
- In aesthetic areas - A much longer healing period is recommended in order to prevent recession.

Complications after crown lengthening

- Root hypersensitivity and root resorption
- Transient mobility
- Due to poor aesthetics (black triangles)

B. Orthodontic procedures

It is performed in 2 ways :
1)Slow
2)Rapid

Slow: When less orthodontic force is applied, the tooth starts erupting slowly thereby bringing the alveolar bone,gingival tissue along with it. The tooth is then treated with surgery while it is stabilized in a suitable position. Such that it will be easier to correct the gingival tissue and bone levels.

Rapid: The tooth is stabilized for atleast 12 weeks after the surgical correction has taken place.

Orthodontic methods

- Forced eruption:

In forced eruption, enamel is deliberately moved in a coronal route using gentle non-stop pressure. The force stretches the gingival and periodontal fibers resulting in a coronal shift of gingiva and bone.(13) It becomes first endorsed by using Heithersay(13) for enamel with horizontal fractures. Orthodontic extrusion turned into recommended in anterior place wherein surgical crown lengthening can't be carried out. It minimizes gingival recession and loss of bone help on adjoining enamel.(14,15) Orthodontic extrusion requires an activation length of 4-6 weeks and 6-8 weeks retention duration for tooth to become stabilized in its new role. Additional surgical crown lengthening may be required after forced eruption. The contraindications are insufficient crown-to-root ratio, loss of occlusal clearance and periodontal headaches.

- Forced eruption with fiberotomy:

Aggregate of orthodontic extrusion and severance of supracrestal fibers,termed supracrestal

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fiberotomy is likewise used for crown lengthening. If fiberotomy is complicated during the forced teeth eruption process, the crestal bone, and the gingival margin are retrieved at their pretreatment area. Consequently, the tooth gingiva interface at adjacent teeth is unaltered. Fiberotomy is carried out as soon as each 7-10 days all through the segment of pressured tooth eruption.(16)

- Orthodontic Extrusion associated with supracrestal Fiberotomy and Root Planning(OEFRP):

It is a flapless approach for crown lengthening after orthodontic extrusion. The OEFRP manner ought to be finished every 2 weeks during the whole extrusive orthodontic section.(17)

RECENT CONCEPTS

BW has been defined as the cumulative apical–coronal dimensions of the junctional epithelium (JE) and supracrestal connective tissue attachment (SCTA). In a cadaver study, variable supracrestal tissue dimensions (i.e., histologic gingival sulcus [GS], JE, and SCTA) were recorded, with the SCTA exhibiting the most constant average dimension. While JE and SCTA exhibited average dimensions within 0.5 to 1 mm, when examined on different tooth surfaces, it showed that dimensions of JE and SCTA can vary considerably, regardless of the association with other factors such as tooth type, surface,biotype,loss of attachment,presence of restorations, and crown elongation, so that it is impossible to clearly define a "fixed" biologic width dimension.

Biologic width dimensions (JE and SCTA) can only be assessed by histology. Other methods, such as transgingival probing and parallel profile radiography, can be used to clinically measure the dimensions of the dentogingival unit, but are not appropriate to measure the true biologic width. Buccal crown margins placed within the junctional epithelium and supracrestal connective tissue attachment have been associated with recession, and histologic evaluation of these sites demonstrated crestal bone loss and supracrestal connective tissue remodeling within 0 to 8 weeks**.** Given the limited available evidence in humans, it is not possible to determine if the negative effects on the periodontium associated with restoration margins located within the supracrestal tissue attachment is caused by bacterial plaque, trauma, or a combination of these factors.(20)

II. CONCLUSION

We can say that the connection between the periodontal health and restoration of enamel is intimate and inseparable. The biologic width is essential for maintenance of periodontal fitness, which itself dependent on the properly designed recuperation. Restorations with supragingival or equigingival margins ought to be preferred. If restorative margins need to be positioned close to the alveolar crest, crown-lengthening surgery or orthodontic extrusion have to be considered to offer proper tooth shape at the same time as concurrently assuring the integrity of the biologic width.(18)

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