



Biologic Width and Its Importance in Dentistry

Author

Preetha Selvan

Saveetha Dental College

Email id: preetha.greenlantern@gmail.com

Abstract

Biological width and the health of the periodontium are inseparable. Any violation of the biological width impairs the normal periodontium. This article gives a brief overview about the concept of biological width and its importance in implants and restorative dentistry.

Key words: Biological width, periodontium, margin placement, violation of biological width, periodontitis

INTRODUCTION

Biological width is defined as the dimension of soft tissue which is attached to the portion of the tooth coronal to the crest of alveolar bone. (Gargiulo et al 1961) Gargiulo et al described the dimensions and relationships of the dentogingival junction in humans. Following his work, the biological width was found to be 2.044 which represents: a sulcus depth of 0.6mm, an epithelial attachment of 0.97mm and connective tissue attachment of 1.07mm. [1]

A similar study performed by Vacek et al 1994 [2] by evaluating cadaver tooth surfaces concluded that the connective tissue attachment was the most consistent measurement based on the mean measurements of 1.34 mm for sulcus depth, 1.14 mm for epithelial attachment and 0.77 mm for connective tissue attachment.

Further studies by Newcomb (1974) [3], Gunay et al (2000), [4] Maynard and Wilson (1979) [5], Tal et al (1986) [6] and Nevins and Skurow (1984) [7] suggest that violation of biological width must be prevented.

CONCEPT OF BIOLOGICAL WIDTH

Encroachment of the biological width becomes of particular concern when considering the restoration of a tooth that has fractured or been caries near the alveolar crest. [8]

Maynard and Wilson (1979) divided the periodontium into 3 dimensions: superficial physiologic, crevicular physiologic and subcrevicular physiologic. [5]

The superficial physiologic dimension represent the free and attached gingival surrounding the tooth, while the crevicular physiologic dimension represents the gingival dimension from the gingival margin to the junctional epithelium. The subcrevicular physiologic space is analogous to the biologic width described (Gargiuloetal 1961) , consisting of the junctional epithelium and connective tissue attachment. [9]

Maynard and Wilson claimed that all three of these dimensions affect restorative treatment decisions and the clinician should conceptualize all three areas and the interplay between them and restorative margins. [5]

In particular, authors claimed that to prevent the placement of 'permanent calculus',margin placement into the subcrevicular physiological space should be avoided.

CLINICAL EVALUATION OF BIOLOGICAL WIDTH-

Biological width is determined in clinics using periodontal probe. The biological width can be identified by probing under local anesthesia (referred to as 'sounding to bone')subtracting the sulcus depth from the surrounding measurements.

If this distance is less than 2mm at one or more locations, a diagnosis of biological width violation can be confirmed. This measurement must be performed on teeth with healthy gingiva and should be repeated on more than one tooth to ensure accurate assessment and reduce individual and site variations. [10]

In 2000,Kois proposed three categories of biological width based on total dimension of attachment and the sulcus depth following bone sounding measurements. They are normal crest,high crest,low crest. [11]

Normal crest patients: The midfacial measurement is 3mm and the proximal measurement range from 3mm to 4.5mm . It occurs approximately 85% of the time. The gingival tissues tend to be stable in patients.

High crest patients:It occurs in approximately 2% of the time. There is one area where the crest is seen more often, in a proximal surface adjacent to an edentulous site. In these patients, the mid-facial measurement is less than 3mm.

Low crest patients:It occurs approximately 13% of the time. The mid-facial measurement is greater than 3mm and the proximal measurement is greater than 4.5mm. [10]

Radiographic interpretation can also be used for identification of inter proximal violations of biological width but they are not diagnostic because of tooth superimposition . [12]

MARGIN PLACEMENT

There are three options available for the placement of margins:supra gingival,equigingival and sub gingival.

1. Supragingival

It has the least impact on the periodontium. This margin has been applied in non-esthetic areas due to the marked contrast in color and opacity of traditional restorative materials against the tooth.

[8]

Advantages

1. Preparation of the tooth and finishing of the margin is easiest.
2. Duplication of the margins with impressions that can be removed past the finish line without tearing
3. Fit and finish of the restoration and removal of excess material is easiest.
4. Verification of the marginal integrity of restoration is easiest.
5. The Supragingival margins are least irritating to the gingival tissues . [13]

2. Equigingival Margin

It was thought that placement of equigingival margins caused more plaque accumulation than supragingival or sub gingival margin resulting in gingival inflammation. But, today the restorative margins can be esthetically blended with the tooth and finished to provide a smooth, polished interface at the gingival margin.

3. Subgingival Margin

Authors have correlated that subgingival restoration demonstrated more quantitative and qualitative changes in the micro flora, increased plaque index, gingival index, recession, pocket depth and gingival fluid. ([14], [15])

VIOLATION OF BIOLOGICAL WIDTH

Authors have compared Bermuda triangle to biological width. Like the Bermuda triangle where a number of aircraft and sea vessels are said to have disappeared, the margins of the prosthetic crowns are extended so much that the dentist loses the access and vision where the margin is actually located, in the sulcus region. This leads to periodontal complications and eventually leading to prosthetic failure. [16]

Signs of biological width biological width violation:

1. Chronic progressive gingival inflammation around the restoration.
2. Bleeding on probing.
3. Localized gingival hyperplasia with minimal bone loss.
4. Gingival recession
5. Pocket formation
6. Clinical attachment loss.
7. Alveolar bone loss. [1]

BIOLOGICAL WIDTH IN IMPLANTS

In an investigation [17] to determine the position of the implant-abutment interface relative to the crest of the bone and peri-implant tissues, it was revealed that when the implant-abutment connection was placed at the gingival level supracrestal to the alveolar bone, the biologic width measurement was similar to natural dentition.

When the interface was placed at deeper level, the biologic width increased accordingly. When the restoration margin is placed far below the gingival tissue crest, it will impinge on the gingiva and

constant inflammation is created. Highly scalloped, thin gingiva is more prone to recession than a flat periodontium with thick fibrous tissue. However, the implant level should always be placed subgingivally to allow development of desired profile and aesthetics. ([18]- [23])

BIOLOGICAL WIDTH IN RESTORATIVE DENTISTRY

The relationship between restorative dentistry and periodontics is interdependent. Restorative procedures must be based not only on mechanical specification but also fulfill biologic requirement. [24]

If there are no signs of inflammation before the restoration, then the following rules can be followed:

1. If gingival sulcus is 1.5mm or less, then place the margin one half the depth of the sulcus below the tissue crest. Thus, the margin is far enough below the tissue so that it is still covered if the patient is at higher risk of recession
2. If gingiva sulcus is greater than 2mm, then the margins of restoration is prepared 0.7mm subgingivally. This places the margin far enough below the tissue so that it is still covered if the patient is at higher risk of recession,
3. If gingival sulcus is more than 2mm, especially in an esthetically zone from vestibular side then gingivectomy is recommended and margins of restoration is prepared 0.5mm subgingivally. ([25]- [27])

Restoration overhangs

Restorative overhangs pose a significant concern as their prevalence has been estimated at 25-76% for all restored surfaces. (Brunsvold & Lane 1990) Studies by Gilmore and Sheikam (1971), Highfield and Powell (1978), Jeffcoat and Howell (1980), Lang et al (1983), Chen et al (1987), Pack et al (1990) indicated that bacterial accumulations with overhanging restorations contributed to gingivitis and periodontal attachment loss.

Instead of curettes and sonic scalers, motor driven diamond tips can be used to remove overhanging restorations. [28]

Surgical crown lengthening

Teeth with subgingival caries or shortened by extensive caries, short clinical crowns with or without esthetic deficiencies and teeth shortened by incomplete exposure of the anatomic crowns are indicated for surgical crown lengthening.

Surgical crown lengthening procedures:

1. External Bevel Gingivectomy

It eliminates excessive pocket depth and exposure of additional coronal tooth structure. It is indicated in crown lengthening of multiple teeth in a quadrant and contraindicated in crown lengthening of single teeth in esthetically zone.

2. Apically Displaced Tooth

When the tooth is apically displaced, osteotomy is done. The osseous contour and height of supra gingival crest is estimated by "sounding" to bone.

3. Forced Tooth Eruption

Orthodontic tooth movement will cause the entire attachment apparatus and dentogingival junction to move with the root of the tooth coronally. It is indicated in sites where removal of attachment of bone from adjacent teeth must be avoided. It is contraindicated in individuals who have only a few teeth remaining.

3. Forced Tooth Eruption With Fibrotomy

When fibrotomy is performed the crestal bone and gingival margin are retained at the pretreatment location. It is indicated where the location of gingival margin should be unchanged. It is contraindicated in teeth associated with angular bone defects and ectopically erupting tooth.

If the margins of the final restoration will be <3mm from the alveolar bone crest, crown lengthening is recommended. [29]

Artificial crown contour Yuodelis et al (1973) demonstrated that the greater the amount of facial and lingual bulge of an artificial crown, the more the plaque retained at cervical margin.

CONCLUSION

The health of the periodontium is necessary for maintenance of the stability of the teeth. Any jeopardy to the periodontium can cause instability of the teeth and cause exfoliation. Biological width is a key aspect in maintaining the periodontium. Any encroachment of biological width would affect the healthy status of the periodontium. Meticulous care must be taken in designing the margin of the restorations to maintain the periodontium.

REFERENCES

- 1) Garguilo AW, Wentz FM, Orban B. Mitotic activity of human oral epithelium exposed to 30 percent hydrogen peroxide. Oral Surg Oral Med Oral Path 1961;14:474-92.
- 2) Vacek JS, Gher ME, Assad DA, Richardson AC, Giambarresi LI. The dimensions of the human dentogingival junction. Int J Periodontics Restorative Dent 1994;14(2):154-65.
- 3) Newcomb GM. The relationship between the location of subgingival crown margins and gingival inflammation. J Periodontol 1974;45(3):151-4.
- 4) Gunay H, Seeger A, Tschernitschek H, Geurtsen W. Placement of Preparation Line and Periodontal Health- A Prospective 2 Year, Clinical Study. Int J Perio Rest Dent 2000;20:173-81.
- 5) Maynard JG Jr, Wilson RD. Physiologic dimensions of the periodontium significant to the restorative dentist. J Periodontol 1979;50(4):170-4
- 6) Tal H, Soldinger M, Dreiangel A, Pitarus. Periodontal response to long term abuse of the gingival attachment by supracrestal amalgam restorations. J Clin Periodontol 1989;16(10):654-9
- 7) Nevins M, Skurow HM. The intracrevicular restorative margin, the biologic width, and the maintenance of gingival margin. Int J Periodontics Restorative Dent 1984;4(3):30-49

- 8) Nitin Khuller , Nikhil Sharma, Biologic width: Evaluation and correction of its violation, J Oral Health Comm Dent 2009;3(1):20-25
- 9) Maynard JG Jr, Wilson RD. Physiologic dimensions of the periodontium significant to the restorative dentist. J Periodontol 1979;50(4):170-174
- 10) Nugala B, Kumar BS, Sahitya S, Krishna PM. Biologic width and its importance in periodontal and restorative dentistry. J Conserv Dent 2012;15:12-7
- 11) Kois JC. The restorative-periodontal interface: Biological parameter. Periodontol 2000. 1996;11:29-38
- 12) Galgi SR, Gontiya G. Evaluation of an innovative radiographic technique -parallel profile radiography to determine the dimensions of the dentogingival unit. Indian J Dent Res 2011;22:237-41. Jorgic-Srdjak K, Placak D
- 13) Maricevic T, Dragoo MR, Bosnjak A. Periodontal and prosthetic aspect of biological width part 1- Violation of biologic width. Acts Stomatology Croat. 2000;34:195-7
- 14) Valderhaug J, Birkeland JM. Periodontal conditions in patients 5 years following insertion of fixed prostheses. Pocket depth and loss of attachment. J Oral Rehabil. 1976;3:237-43.
- 15) Newman, Takei, Klokkevold Carranza's Clinical Periodontology. 10th ed. Philadelphia: Saunders, Elsevier Publishing; 2006. pp. 1050-69.
- 16) Sharma A, Rahul GR, Gupta B, Hafeez M. Biological width: No violation zone. Eur J Dent 2012;1:137-41
- 17) Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the inter proximal dental papilla. J Periodontol 1992;63(12):995-996
- 18) Waerhaug J. Healing of the dento epithelial junction following subgingival plaque control 2: As observed on extracted teeth. J Periodontol 1978;49:119-34
- 19) Saadoun AP, LeGall M, Touati B. Selection and ideal tridimensional implant position for soft tissue aesthetics. Pract Periodont Aesthet Dent 1999;11(9):1063-1072.
- 20) Grunder U. Stability of the mucosal topography around single- tooth implants and adjacent teeth: 1-year results. Int J Periodont Rest Dent 2000;20(1):11-17.
- 21) Small PN, Tarnow DP. Gingival recession around implants: A 1-year longitudinal prospective study. Int J Oral Maxillofac Impl 2000;15(4):527-532.
- 22) Holt RL, Rosenberg MM, Zinser PJ, Ganeles J. A concept for a biologically derived, parabolic implant design. Int J Periodont Rest Dent 2002;22(5):473-481.
- 23) Choquet V, Hermans M, Adriaenssens P, et al. Clinical and radiographic evaluation

of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. J Periodontol 2001;72(10):1364-1371.

- 24) Ivancied GP. Interrelationship between restorative dentistry and periodontics .J Prosth Dent.1958;8:819-830.doi 10.1016/0022-3913(58)90102-1
- 25) Newman MG, Takei H, Carranza FA. Carranza's Clinical Periodontology 9, Philadelphia ; Saunders;2003
- 26) Planciunas L, Puriene A, Mackeviciene G. Surgical lengthening of the clinical tooth crown stomatologija. Baltic Dental Maxillofac J.2006;8:88-95
- 27) Padbury A Jr, Eber R , Wang HL. Interaction between the gingival and the margins of restorations. J Clin Periodontl 2003;30:379-385.doi:10.1034/j1600-051 X 2003.01277 x
- 28) Spinks G.C. Carson R.E, Hancock E.B and Pelleu, G.B.Jr (1986) . An SEM study of overhang removal methods. Journal of Periodontology 57,632-636
- 29) Hari Krishna Reddy and Chetan Kumar . Biologic width- The no encroachment zone. IJDA,2(4) October-December 2010.