

Biologic width: Understanding and its preservation

Malathi K¹, Singh A²

¹Dr K Malathi

Professor & Head, Periodontics
Government Dental college and
Hospital
Tamil Nadu, India

²Dr Arjun Singh

Postgraduate student, Periodontics
Government Dental college and
Hospital
Tamil Nadu, India

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Correspondence to:

Dr K Malathi
09444040620
malsmoni@gmail.com

ABSTRACT

The relationship between the periodontal health and the restoration of teeth is intimate and inseparable. Maintenance of gingival health constitutes one of the keys for tooth and dental restoration longevity. An adequate understanding of relationship between the periodontal tissue and restorative dentistry is essential to ensure adequate form and function of dentition and Esthetics and comfort to the patients. Restoration of fractured (traumatized), severely decayed, partially erupted (delayed passive eruption), worn or poorly restored teeth is often difficult for the dentist without surgical and orthodontic intervention. Surgical crown lengthening of these teeth is necessary to provide adequate tooth structure for restoration or Esthetics enhancement, thus adhering to basic biological principles by preventing impingement on the periodontal attachment apparatus or biological width. Many clinicians have been unable to utilize the concept of biologic width in practical manner. Hence the purpose of this article is to describe the biologic width anatomy, evaluations & correction of its violation by different methods.

Keyword: Biologic width, crown lengthening, orthodontic extrusion

Introduction

Biologic width is the term applied to the dimensional width of dentogingival junction (epithelial attachment and underlying connective tissue). It was first described by Sicher.^[1] The term biological width is based on the work of Gargiuloetal (1961) who described the dimensions and relationship of the dentogingival junction in human. Gargiulo and colleagues studied the anatomy of the dentogingival junction and quantified the average as constant 2.04mm (the epithelial attachment is 0.97 and connective tissue is 1.07mm) with a sulcus depth of 0.69 mm. The dentogingival junction was in fact variable depending on the location or phase of the dentogingival junction attachment.

Nevin and Skurow defined biologic width as the sum of the combined supracrestal fibers, the junctional epithelium and the sulcus. This was over 3mm when measured from the crest of bone. Vacek and colleagues found that

the biological width increased antero-posteriorly (1.07 to 2.08mm) and that 15% of restoration that impinge in the biologic width had a biologic width of less than 2.04 mm. (Table-1)

Interproximally biologic width

Interproximally the biological width is similar to that of the facial surface^[2,3] but the total dentogingival complex is not. Koisand Spear pointed out that the dentogingival complex is 3.0mm facially and 4.5mm to 5.5mm interproximally. They noted that the height of interdental papilla can only be explained by increased scalloping of the bone. Becker and colleagues (1970) defined variation of gingival scalloping as flat scalloped and pronounced scalloped. Spear suggested that additional 1.5 to 2.5mm of interproximal gingival tissue height require the presence of adjacent teeth for maintains of interproximal gingival volume.

Table 1: The dentogingival junction variability depending on the location or phase of the dentogingival junction attachment

	Length of epithelial attachment.(E)	Connective tissue depth(C)	Biological width(E+C)	Sulcus depth (A)	Total attachment (E+C+A)
Composite average average of all phase	0.97	1.07	2.04	0.69	2.73
Phase and environment III Attachment on cementum (at CEJ)	0.74	1.06	1.80	0.61	2.41
Phase and environment IV Attachment on cementum (below CEJ)	0.71	1.06	1.77	1.77	3.54

Without the adjacent tooth the interproximal gingival tissue would flatten out, assuming a normal 3.0mm biologic width. Tarnow and colleagues found that for the gingival tissue to assume complete filling of the interdental space, the distance from the contact point to alveolar crest should not exceeded 5 mm to 5.5mm.Greater distance result in significant loss of alveolar height. [4]

Biologic width and implant

The structure of peri-implant mucosa has many similarities with periodontal tissue. The soft tissue barrier is composed by a sulcus with a non-keratinized sulcular epithelium and a supra crestal connective tissue with an area of dense circular fibers near to the implant surface. [5]The presence of junctional epithelium facing the titanium has also been evidenced by a large number of studies. Connective tissue

fibers orientation represent the most important difference between periodontal and peri-implant tissues, that is while in periodontal structure fibers run perpendicular the long axis of tooth , in implant tissue the fibers from the crest run parallel to implant surface.

The dimension of the soft tissue barrier around the implant seems to be constant, similarly to what has been described around teeth. The dimension has been described as peri-implant biologic width. This is composed of the sulcus and by the supracrestal epithelium and connective tissue component. The influence of five different factors on implant biologic width has been evaluated these are: surgical technique, loading time, abutment material, implant structure and position, immediate post extraction insertion.

On implant: junctional epithelium+connective tissue = biologic width

$$1.88\text{mm}+1.05\text{mm}= 3.08 \text{ mm}$$

Biological consideration

Restorative clinician have a narrow margin of error in order to achieve a good esthetic restoration which is fully functional as well as best suited for patient health. Restorative dentist should know the importance of biological width in preserving the healthy and esthetically good looking gingival form around the tooth and implant.

Effects of biological width violation

The restorative procedure are technique sensitive and involves a great deal of understanding of the anatomy, function and condition of the teeth/implants and their surrounding structure. Placing restorative margin within the biologic width frequently leads to:^[6]

- Gingival Inflammation.
- Clinical Attachment Loss.
- Bone Loss.

Clinically these sign of biological width violation appear as a pain around the restoration margin, bleeding from the inflamed gingival margin area of involved tooth and gingival recession.

Gingival tissue recession:

Attachment loss and bone loss around the defective tooth leads to clinically receded gingival margin or in other term gingival recession. This seems to be the body's response to recreate the space between the alveolar bone and the margin to allow space for the tissue attachment. Overall recession is more in highly scalloped and thin gingiva.^[7]

Other factors which influence the gingival recession are:

- Gingival physiology whether gingiva is thick & fibrotic or thin and fragile.

- Whether the periodontium is scalloped or flat in its gingival form.

Newcomb^[8] analyzed 66 anterior crowns with sub gingival margin and compared them with uncrowned control. The study result shows that a crown margin placed close to biologic width zone result in severe gingival recession. Gunay et al demonstrated that restorative margin placement within the biologic width is detrimental to periodontal health. They studied 116 prepared teeth compared to 82 unrestored teeth and found that papillary bleeding score and probing depths increased at sites with restorative margin was <1mm from the alveolar crest^[10].

Margin placement and biologic width

The primary treatment goal according to many clinicians now a days, are to mask the junction of tooth with restoration margin.

Generally clinicians have 3 options for margin placement.

- Supragingival margin
- Equigingival margin
- Infragingival margin

Supragingival

Supragingival margin means the margin is located away from gingival margin. This has least effect on periodontium; classically this margin is not accepted because of its unaesthetic appearance which is due to difference in color and opacity of restorative material with tooth. Now a day, because of advance in more translucent material and finishing technique this type of margin provide good results both esthetically and maintain the health of periodontium.

Equigingival

As the name suggests, the margin is located at the same level as gingival margin, in the past, this type of margin is not acceptable because it retains more

plaque than other two types of gingival margin and cause greater gingival inflammation. But things had changed now because of advance in new and effective finishing and polishing technique and therefore it can be used for maintaining healthy periodontium.

From periodontal tissue health wise, both the above described restorative margins are well tolerated by periodontal tissue.

Subgingival margin

Subgingival also termed as infragingival, means restorative margin is located below the marginal gingiva. It gives esthetically pleasant result. But it also poses the greatest risk to damage to the periodontium if tissue attachment area is encroached.

Add on to above disadvantage is, that this type of margin is not accessible for finishing and polishing which act as a niche for bacterial growth and cause gingival inflammation.^[10]

Restorative considerations in placing subgingival margin are:

- To create an adequate resistance and retention form.
- To alter the tooth contour because of caries or other structural deficiency.
- Mask the restoration interface by locating it subgingivally.

How to evaluate whether the biological width (tissue attachment area) is encroached or not:

There are two method of evaluating it:

- Radiographic.
- Clinical method.

Radiographic method

Radiographic evaluation is only successful for interproximal violation of biologic width, but the violation of biological width is more common on mesio-facial and disto-facial line angles of tooth. So for this

reason, radiographs are not diagnostic aid because of tooth superimposition.^[11]

Clinical method

After preparing a restorative margin, clinician can assess whether the violation of biologic width occur or not by as follow:

- Clinician should use a sterilized periodontal probe and assess the restorative margin level if patient experience the tissue discomfort during this procedure. Then it is ascertained that the biologic width violation had occurred.
- A more positive assessment can be made clinically by measuring the distance between the bone and the restorative margin using a periodontal probe.

A sterilized periodontal probe is pushed through the anesthetized attachment tissue from the sulcus to the underlying bone, if the distance is less than 2 mm at one or more location a diagnosis of biologic width violation can be confirmed. This assessment should be complete circumferentially around the tooth to evaluate the extent of problem.

The biologic violation can occurred in some patient in whom margins are placed more than 2mm.

This statement is in reference to the fact given by Vacek et al in 1994 who proposed that the biologic width dimensions extend in the range of 0.75mm to 4.3 mm.^[3] Thus according to this information, biologic width assessment should be performed for each patient to determine whether they need additional biological width in excess of 2 mm for restoration to be in harmony with their periodontal health.

Biologic width dimension can be identified for each individual patients by probing under anesthesia to the bone level (refer to as sounding of bone) and

subtracting the sulcus depth from the resulting measurement.^[11]

How we can correct biologic width violation

Biologic width violation occurred during restoration margin placement can be corrected by two methods.^[12]

- Surgically removing bone away from proximity to the restoration margin.
- Orthodontic extrusion of the tooth and then moving the margin away from the bone.

Advantage of surgical process:

- It is a rapid method.
- Gives more pleasant result if the crown lengthening is done.

Crown lengthening procedure

The concept of crown lengthening was first introduced by COHEN (1961). It includes a combination or individual surgical procedure like soft tissue recontouring by gingivectomy/gingivoplasty and osseous recontouring. The indication of each of the above procedure depends on patient related factor.

Type of surgical process can be used for crown lengthening procedure

- Gingivoplasty
- Gingivectomy
- Apical repositioned flap with bone recontouring.

Orthodontic procedure

Indication of orthodontic extrusion:

- When the biologic width violation is on the interproximal surface.
- In condition when biologic width violation is across the facial surface, the gingival level is correct.

Two type of force can be used for orthodontic extrusion.^[13]

- Low orthodontic extrusion force, when used causes the tooth to extrude

slowly bringing alveolar bone and gingival tissue with it up to the ideal bone level by 0.5mm. Over that needs to be removed surgically to correct the attachment violation. The tooth is then stabilized in this new position and then treated with surgery to correct the bone and gingival tissue.

- Rapid extrusion procedure will complete in several weeks period. During this period supracrestal fiberotomy is performed weekly in an effort to prevent the tissue and bone following the tooth. The tooth is then stabilized for at least 12 weeks to confirm the position of the tissue and bone and any coronal creep can be corrected surgically.

Margin Placement Guide Lines^[11]

- When placing restoration margin, sulcus depth can be used as guideline.
- Base of the sulcus can be used as the top of the attachment tissue.
- With sulcus depth of 1-1.5 mm, extending the preparation more than 0.5mm will risk the violating the attachment.

Conclusion

The health of periodontal tissue is dependent on properly designed restoration. Incorrectly placed restorative margin and unadapted restoration violates the biologic width. If the margin must be placed subgingivally, other factors to be taken into account are:

1. Correct crown contour in gingival third.
2. Correct polishing and finishing of the margin.
3. Sufficient zone of attached gingival and no biologic width violation by subgingival margin.

Repeated maintenance visits, patient co-operation and motivation are important factor for improved success of restoration

procedure with positive periodontal health.

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