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# Clinical significance of biological width in crown lengthening

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***Abstract*---**The biologic width is defined as the physiologic dimension of the junctional epithelium and connective tissue attachment. This article reviews clinical Significance of Biological Width in Crown Lengthening.

***Keywords*---** biological width, crown.

## Introduction

Crown lengthening is a surgical procedure designed to increase the extent of the supragingival tooth structure for restorative or aesthetic purposes by apically positioning the gingival margin, removing supporting bone or both.[1] Crown lengthening involves the surgical removal of hard and soft periodontal tissues to gain supracrestal tooth length allowing for longer clinical crowns and re-establishment of biological width.[2] The concept of biological width stems from the classic histologic study by Gargiuolo et al. measured the average dimension of the epithelial junction (0.97 mm) and connective tissue attachment (1.07mm) in humans. These values were summed to provide the biologic width, yielding an average dimension of 2.04mm [3] The biologic width is defined as the physiologic dimension of the junctional epithelium and connective tissue attachment.

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**Clinical significance**

For the periodontium to remain healthy, restorations must be critically managed in several areas so that they are in harmony with their surrounding periodontal tissues. To maintain or enhance the patient aesthetic appearance, the tooth interface must present a healthy natural appearance, with gingival tissue framing the restored teeth in harmonious manner.[13] The term biologic width is familiar to most clinicians, yet there still exists confusion regarding its meaning and relevance to clinical procedures.[7] The concept of biologic width is widely utilized as a clinical guideline during the evaluation of periodontal restorative interrelationships. This concept presupposes the existence of a constant vertical proportion of healthy supra-alveolar soft tissues, with a mean dimension of approximately 2 mm, measured from the bottom of the gingival sulcus to the alveolar crest. The biologic width encompasses the junctional epithelium and the connective tissue attachment. According to early investigators, the average dimension of the epithelial attachment was 0.97 mm and the average dimension of the connective tissue attachment was measured at 1.07 mm yielding the combined dimension of 2.04 mm known as the biologic width. The biologic width dimension appears to constitute a constant feature in the human periodontium, and it has therefore been suggested that it be considered an immutable therapeutic parameter. Clinical observation indicates that impingement of the biologic width will result in attempts by the gingival tissue to re-establish its original dimension through bone resorption or, in the presence of thick alveolar bone, chronic gingival inflammation.[2]

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. The biologic width is essential for preservation of periodontal health and removal of irritation that might damage the periodontium. The millimetre that is needed from the bottom of the junctional epithelium to the tip of the alveolar bone is held responsible for the lack of inflammation and bone resorption, and as such the development of periodontitis. The dimension of biologic width is not constant, it depends on the location of the tooth in the alveolus, varies from tooth to tooth, and also from the aspect of the tooth. It has been shown that 3 mm between the preparation margin and alveolar bone maintains periodontal health for 4 to 6 months. 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.[15]

It has been shown that biologic width is approximately 2mm in 85 percent of population. In approximately 13 percent of the population, the distance exceeds 2mm while the same distance is less than 2mm in 2 percent of the individuals examined. The physiologic location of the biologic width can vary with age, tooth migration due to loss of arch or occlusal integrity, or orthodontic treatment.[16] The science behind biologic width "Biologic width: the means of the means of the means of the various measurements" *Biologic* width is the term applied to the dimensional width of the dentogingival junction. It was first described by Sicher

in 1959 as dentogingival junction in which he conceived of a physiologic division of labor of supporting tissues[17]. This established the concept of the dentogingival junction as a functional unit composed of two parts:

- the connective tissue fibrous attachment of the gingiva
- the epithelial attachment.

The two separate components share a division of function. The biologic protection of the dentogingival junction is the function of the epithelial attachment. The epithelium attaches to the circumference of the tooth as a broad band the "attached epithelial cuff." The epithelial attachment to the tooth is not firmly attached in spite of the fact that it is stronger than the individual cohesiveness of the epithelial cells. The firmness of the gingival attachment to the tooth is derived by the fibrous connective tissue bound to the cementum, alveolar bone and gingiva. Because of the dynamic alterations in the component parts of the dentogingival junction it is important to know their positions in all phases of eruption under normal conditions. The importance of this relation is enhanced when one considers the imbalance of these components in periodontal disease. Thus, these dimensions can serve as a base line for future studies involving the pathologic status of the dentogingival junction and serve as "the physiologic dentogingival junction".[5]

The importance of the biologic width of attachment and development of restorations that are placed within a healthy gingival sulcus and in harmony with the health of the periodontal tissues have been stressed.[18] Placing restorative margins within the biologic width frequently leads to gingival inflammation, clinical attachment loss, and bone loss.[7] Gingival inflammation associated with restorations that impinge on the gingival attachment is not from a physical insult, but from a bacterial insult. Crown margins are inherently imperfect and will eventually collect bacterial plaque.[8] The most common causes involve placing restorative margins too close to the alveolar bone. This can result from dental fracture, cervical root resorption, primary or secondary caries, endodontic perforation, or cavity over-preparation. In the past, many of these situations were treated by dental extraction. Other more conservative treatment methods are available which include surgical crown lengthening and tooth extrusion. These treatment modalities require knowledge and planning in order to obtain maximum longevity.[19]

A band of 2-3 mm of attached gingiva is preferable to maintain the restored tooth successfully. Since the resecting nature of this procedure, there is a risk of reducing the width of attached gingiva. For this reason, it is important to diagnose and to evaluate the attached gingiva when planning surgical crown lengthening procedure[20]. Encroachment of the biologic width becomes of particular concern when considering the restoration of a tooth that has fractured or been caries near the alveolar crest. Also, aesthetic demands often require “burying” of restorative margins subgingivally, which can lead to violation of this space. Various authors have recommended minimal distances restorative margins must be from the bone crest to avoid deleterious effects.[7] The subgingival placement of crown margins may therefore affect the homeostasis of the periodontal tissues. However, several views and data exist concerning the ideal

dimensions of the biologic width, leading to difficulties with respect to the development of clinical recommendations.[21]

In 1977, Ingber et al., described Biologic Width and credited D.Walter Cohen for first coining the term and suggested that a minimum of 3 mm was required from the restorative margin to the alveolar crest to permit adequate healing and restoration of the tooth. Maynard & Wilson (1979) divided the periodontium into three dimensions; superficial physiologic, crevicular physiologic and subcrevicular physiologic. The superficial physiologic dimension represents 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, consisting of the junctional epithelium and connective tissue attachnment. Maynard & 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.

Margin placement into the subcrevicular physiologic space should be avoided to prevent the placement of 'permanent calculus' beyond the crevice[7]. The common consensus is that, when the biologic width is violated, the body will attempt to redefine it by a process of osseous resorption. It is theorized that process frequently leads to chronic inflammation and periodontitis. Supporting this hypothesis is the fact that subgingival margins cause greater gingival inflammation and bone loss than margins placed in more coronal position. It appears that crown lengthening surgery may alter the dimensions of the biologic width. It has been noted that following osseous surgery and apically positioned flaps, there is reduced distance from the gingival margin to the apical end of the junctional epithelium.[22] The biologic width functions as a barrier against the entrance of microorganisms into the internal medium of the periodontal ligament and into the gingival and osseous connective tissue.[23]

The biologic width dimensions represent anatomical and physiologic tissues where the host responds to physical and environmental challenges through the initiation of inflammation and, under pathologic conditions, tissue change.[24] If the gingiva looks healthy, and does not bleed on probing, one can suspect that the histologic sulcus of such a healthy or treated tooth was approximately 0.5 mm deep. This means that the margin of a restoration may not be put more than 0.5 mm subgingivally. With this in mind, all requirements for the maintenance of periodontal health can be established.[25] It is also likely that the location of the biologic width migrates apically along the tooth surface throughout life, even in the absence of attachment due to continuous eruption of teeth, which happens as a consequence of occlusal wear.[26] Understanding and clinically managing the concept of biological width and the level of the osseous crest is key to maintaining periodontal health in the presence of dental restorations. The location of a restorative margin relative to the crest of the alveolar bone is more critical for preserving gingival health than its distance below the free gingival margin. The restorative dentist must be able to determine the height of the osseous crest and width of the gingival attachment before placing intracrevicular margins. This is done to prevent impingement of the soft tissue attachment, otherwise referred to as violation of the biologic width.[8]

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. Individuals with square shaped teeth have more favourable 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'.[15]

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