

# Periodontal and Prosthetic Aspect of Biologic Width Part I: Violation of Biologic Width

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## Summary

*This review gives the wide aspect of the complex question of biologic width and represents an attempt to answer some of the demands in relation to it. First of all, it debates the problems that occur after improper margin placement in the periodontium. Initially, the dimensions of biologic width are contemplated and then margin placement, is discussed and the success of restorative procedures and reasons for failure.*

**Key words:** *biologic width, margin placement.*

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## REVIEW

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## Introduction

A great part of periodontal literature deals with the checking, reconstruction and maintenance of biologic width. This, in Croatian literature, relatively unknown term, deserves to be closely explained. Gargiulo et al (1) reported in 1961 a certain uniformity of the dimension of some components of biologic width:

- mean depth of the histologic sulcus is 0.69 mm,
- mean junctional epithelium measures 0.97 mm (0.71 to 1.35 mm),
- mean supraalveolar connective tissue attachment is 1.07 mm (1.06 to 1.08 mm).

The total of the attachment is therefore 2.04 millimeters (1.77 to 2.43 mm) and is called the biologic width (2,3), essential for preservation of

periodontal health and removal of irritation that might damage the periodontium (prosthetic restorations, for example). The millimeter 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 alveola, varies from tooth to tooth, and also from the aspect of the tooth. Its constancy (is only one - it) can only be found in healthy dentition (4,5,6).

There is a problem in determining biologic width. It does exist, but clinically, it is impossible to define. If the gingiva looks healthy, and does not bleed on probing, one can suspect that the histologic sulcus (which has been destroyed while probed) 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.

There are literature reports of unfavorable effects of restorative therapy on periodontal tissue (7,8,9,10). Prosthetics can lead to greater plaque accumulation; they can incite inflammation as well as add to the progression of periodontal disease. It has been proved that even marginally adapted prosthetic structure can have negative effects on the periodontium, had it been placed subgingivally. Subgingival placement of the crown and preparation margins potentially endanger biologic width and lead to periodontal reaction. If the biologic width is violated during the preparation of the tooth, some authors (11-20) claim that there will be no place left for the attachment and the result in the development of attachment loss and pocketing can be observed. Violated biologic width can result in uncontrolled bone resorption and might grow over the quantity of the bone necessary for the supralimbal insertions of the connective tissue attachment on the tooth root. The result is advanced periodontitis.

Nevins and Skurow (21) have defined the biologic width as the total of supracrestal fibers, junctional epithelium and sulcus. Wagenberg (22) concluded that at least 5 to 5.25 mm of hard tooth substance above the bone margins is necessary for a correctly prepared restoration placement. Such claims have also been substantiated by other authors (6,9,10,20,23,24,25), who proved that 3 mm between the preparation margin and alveolar bone maintains periodontal health for 4 to six months.

### Margin placement and biologic width

Most dentists daily answer a question of great importance: where to place the preparation margin, supragingivally, at the beginning of the gingival sulcus or subgingivally? Two basic factors should be taken into account. First are the shape and the method of preparation, which depends upon the therapist. The second factor is the ultimate success of the restoration, which is influenced by a number of items.

### Preparation

It is desirable to place the margin in a location that will facilitate the following (4):

1. Preparation of the tooth and finishing of the margin (easiest supragingivally)
2. Duplication of the margins with impressions that can be removed past the finish line without tearing or deformation (easiest supragingivally)
3. Fit and finish of the restoration and removal of excess material (easiest supragingivally)
4. Verification of the marginal integrity of the restoration (easiest supragingivally)

### The ultimate success of the restoration

A number of factors hold some importance for the success of a prosthetic restoration.

1. Brushing, flossing, and maintaining the restoration on a daily basis (easiest supragingivally)
2. Removing plaque, calculus and performing periodic inspection of the marginal integrity of the restoration without damaging the marginal fit or scratching the restorative material (easiest supragingivally)
3. Avoiding changes in gingival contour (easiest supragingivally)
4. Improving the esthetics. Esthetic requirements of the patients often call for intracrevicular placement of margins. However, a study published by Watson and Crispin (28) showed that many patients did choose the optimum gingival health offered by supragingival margin placement, over the less healthy, improved esthetic attempt of a subgingival margin, if the patients understood the circumstances and were given a choice. The study also showed that 83% of dentists do not analyze tooth visibility when deciding on margin placement for esthetic appearance, and only 64% of dentists actually assess the patient's desires before deciding where to place the margin (28).
5. Root sensitivity. Subgingival margin placement is only a temporary solution if the gingival recession progresses. Good oral hygiene and local fluoride treatment resolve most root sensitivities.
6. Subgingival extension of caries, restorations, or fractures. In the past, subgingival margin placement was advocated for teeth in which insuf-

ficient or questionable retention could be gained from supragingival margins. This was to give greater length and surface area, and sometimes more parallelism, for increased retention. Today, the best way to achieve this is preprosthetic surgical crownlength tening procedure, which establishes an adequate biologic width and allows correct margin placement.

Research in animals and humans (24,29-34) showed that marginal infection is most commonly connected with subgingivally placed margins, and that supragingival placement has a substantial positive effect on gingival health. Teeth with subgingival margins show higher inflammation index values than sound teeth. There is a clear connection between plaque accumulation, caused by inadequate restorations, and periodontal disease (4).

### ***Reasons for failure***

A problem arises in cases where subgingival placement is absolute necessary. Different parts of this complex (tooth, cementum and crown) can easily become the location of plaque accumulation. There is a special stress on metal-ceramic crowns, whose thin metal margin is usually oxidized, air abraded, but can never be polished, and therefore is rough. Opaque ceramic parts, which are coarse, also become exposed. These factors play a great role in plaque accumulation and periodontal health of a patient (35-41).

Gingival inflammation, as well as periodontitis, can be, caused by improperly finished prosthetic restorations. Such margins, whether they are produced directly or indirectly, are frequent, often everyday findings, especially if it is known that it is almost impossible to ideally finish the margins of crowns and veneers (22). The most frequent reason for incorrect margins is the impossibility to perform proper casting and/or margin finishing when the margin is already located subgingivally (26). The

deeper the margins lie, the greater is the possibility that it is unpolished (42).

It is precisely these places which represent ideal bacteria colonizing areas at which, the moment it becomes too tight, result in localized inflammation and gingivitis. Oral hygiene maintenance in such places is impossible, clinical signs being chronic inflammatory response and progress of attachment loss. These problems can be met halfway by proper casting techniques and polishing of the margins of restorations. It is important to mention that every restoration whose margin lies supragingivally is less potential to be ideal, compared to a restoration whose margin lies subgingivally.

If the biologic width is violated, it is impossible to maintain periodontal health. One or more of the following develops (4):

1. Bone loss under the preparation margin that violated the biologic width. Pocket and progressive periodontal tissue loss (periodontal ligament and bone) develop.
2. Gingival recession and localized bone loss develop. This happens in cases where the labiobuccal bone is thin (43).
3. Localized gingival hyperplasia with minimal bone loss. Although this represents the best prognosis for the tooth, this course of action maximally compromises the esthetic component and is as such unacceptable for the patient. Hyperplasia is most frequently found in altered passive eruption and subgingivally placed restoration margins.

Patients with these findings always end up at a periodontologist. After comprehensive examination, case history and periodontal charting, the periodontologist will start with an intensive oral hygiene programme, and, depending on re-evaluation results, decide on surgical periodontal treatment.

Surgical procedures are described in the second part.