Biologic Width Demystified

Information from John Kois’s research predicts the final positions of esthetic gingival margins

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**Biologic Width Demystified:**

Much fuss is justifiably made by many clinician speakers over violating the biologic width in crown margin placement. We've all seen seminar slides of chronically inflamed tissue around a crown in violation of this sacred region. But what exactly is this so-called biologic width? Why when despite your best efforts to esthetically hide a crown margin in the sulcus, it comes peeking back at you at the next prophy visit? John Kois answered these questions recently¹ much more clearly than I have ever heard in a presentation and here are the highlights.

Some healthy dimensions of the gingival area are needed in order to compare to what is abnormal. As you can see on the diagram at left, a kind of symmetry exists in normal healthy gingiva: 1mm sulcular depth, 1mm attached epithelium and 1mm connective tissue before the crest of the bone is reached. This is the biologic width. 85% of healthy patients will exhibit this 3mm dimension, while 2% will be less than 3mm and 13% will be greater than 3mm. Also, the distance between the CEJ and the crest of bone is 2mm on average. When this CEJ to crestal bone distance is less than 2mm, the gingiva ride up the clinical crown making the tooth appear submerged and short. If the CEJ to crestal bone distance is greater than 2mm, the CEJ may be exposed and the tooth will appear too long.

To summarize then, the biologic width is equal to **3mm**: 1mm sulcular depth, 1mm attachment epithelium and 1mm connective tissue above the crestal bone. This is true on the broad facial surface. In the proximal papillae area, the correct biologic width increases to **4mm**. This can be measured on any tooth using the "sounding" technique.

**Bone Sounding and Gingival Position:**

Most of us do not use "sounding" of the crestal bone on everyday cases but in anterior esthetic cases where it is desired that the margin remain subgingival, this "sounding" procedure will insure your success if long term subgingival margins are your goal.

Anesthetize the area to be sounded. Using a narrow tipped perio probe, place it in the sulcus and lean it away from the tooth while keeping the tip against the enamel. Push through the attachment apparatus until the crest of bone is felt. Record three measurements per facial tooth surface.

The crest of bone follows the scallop of the CEJ but DOES NOT always follow the scallop of the gingival margin. Once the measurements are obtained for the teeth to be restored (proximals and center of facial), you can predict how the tissue will respond post-cementation. OK, so how do you predict what's going to happen? RELAX, and read on.

¹Kois, J: AGD Annual Meeting 2001
Predicting Post-Op Gingival Position

The rules of what's going to happen to the final gingival position after you've skinned it with the diamond, burned it with the electrosurg or left it, "Plain, slap tore up!" (as we say down South) depend on what the numbers were during your pre-op exam. In a nutshell, they are:

1. Tissue depth measurements (to the crestal bone via bone sounding) which are GREATER than 3mm on the facial surfaces and GREATER than 4mm in the proximal areas have the GREATEST chance of shrinkage and recession post-op. The simplistic answer may be that our hacking around the attachment area triggers it to return to the normal biologic width (3mm & 4mm). To put it another way, if you prepped to or slightly into the gingival crest in a 4+mm (facial surface), retracted and or otherwise irritated the gingiva there, the chances of gingival recession and exposure of your margins are EXCELLENT.

2. If you prep subgingivally in cases where the sounding measurements are LESS than 3mm on facial surface and LESS than 4 mm interproximally, then you risk being in dreaded violation of the BIOLOGIC WIDTH (expect a visit from the Perio Police). Chronic redness and inflammation which is NOT due to allergies, open margins or oral hygiene may then be the result. It is thought by some that violation of biologic width with gingival inflammation will lead to bone loss and thus be self-correcting but it is NOT. Kois has stated that most patients are resistant to bone loss and the patient will continue to look inflamed for life!

3. If the gingival architecture numbers are normal (3mm & 4 mm), then RELAX. No matter how bad you beat up the tissue (within reason), it will grow back to these levels if you have not violated the previously mentioned biologic width. Before you've placed the cord but after you've prepped to slightly subgingival (if desired) DO NOT RE-PREP the tooth on facial to cord-retracted gingival levels as you will now be in violation of biologic width. The cord rips junctional epithelium 100% of the time. Rest assured, the tissue will come back to its original level.

4. If the sounding values again are NORMAL (3 & 4mm) and you need crown lengthening for esthetic reasons, a gingivectomy IS NOT indicated as violation of biologic width will again occur once the tissue is removed. In this case a full flap osseous surgery is indicated in which the scalloped crestal bone is carefully removed (maintaining the scallop) so that the crestal bone is 3 & 4 mm (facial and proximal) from the desired gingival margins of the crown.

5. If the numbers are GREATER than 3 & 4 mm and there is enough attached gingiva and crown lengthening is desired then a simple gingivectomy IS indicated so long as the tissue removed does not leave the remainder in violation of biologic width.

6. If crown lengthening procedures or other treatment causes the tissue to be temporarily LESS than the ideal 3 & 4mm, RELAX. It will grow back to those levels PREDICTABLY (Kois) as long as the crown margins do not impinge on it.

7. What is done to the tooth as far as POSITION of the crown margins relative to the crestal bone is MORE IMPORTANT than what you do to the tissue. The goal is to leave enough untouched tooth structure from the margin to the bone to allow the tissue to heal. It will.

8. "Black holes" interproximally may result in the final restorations if prepping and retracting interproximal tissue GREATER than 4mm as, once again, numbers larger than the norms tend to shrink and recede. Also, since tissue scallop may NOT follow bony scallop, if the tissue scallop is much GREATER (from papillae crest to facial trough) than the bony scallop, a black hole
interproximally is more likely post-op. If the case is seated and a black hole is observed but the proximal readings are LESS THAN OR EQUAL to 3mm, relax -- the tissue will re-grow to 4mm and fill in the black triangle. At left is a veneer case of mine (5-12) in which there was a slight "black hole" immediately post-cementation. We reassured the patient that it would fill in (as the measurements predicted) and the lower picture is one month later.

9. Readings of LESS than 3&4mm (facial & proximal) are often seen in early post-op perio surgery due to the fact that the tissue has not fully rebounded yet. Low numbers are also found next to extraction sites. These two scenarios are HIGH RISK for violation of biologic width. Use of a small cord (000 Ultradent) is recommended to avoid traumatizing tissue.

10. When redoing crowns with decay at the margins, removing the decay may put margin in violation of biologic width. Therefore, it may be wise to inform the patient of the possibility of a crown lengthening procedure.

There is no mystery to biologic width and long term gingival tissue position. If one understands the requirements of biologic width then predicting the long term tissue positions around restorations is not only possible but should be a required procedure for subgingival restorations in the esthetic zone.