

## **Periodontal restorative considerations (II)**

Lecture outline:

Periodontal Restorative Interrelationships :

- Biological considerations.
- Esthetic tissue management.
- Special restorative considerations.

Let's start with biological considerations where we talk about

- Margin placement and biologic width.
- Biologic width evaluation.
- Correcting biologic width violation.
- Clinical procedures in margin placement.
- Provisional restorations.
- Marginal fit.
- Crown contour.
- Sub-gingival debris.
- Hyper-sensitivity to dental materials.

**Marginal placement and biologic width:** The location of the restorative margin has an important aspect between the restorative dentistry and periodontal tissue. So the options that we have for the margin placement are :

**1) Supra-gingival:** (The best option) -The least impact on periodontium. - Unfavorable for aesthetics and retention.

**2)Equi-gingival:** Sometimes we need to go equi-gingival,however,it's historically not desirable because;- -It's thought to retain more plaque and hence induces greater inflammation and the tooth will be more prone to caries(which is not true)

-Minor recession would expose the restoration-tooth margin. So if it's done as equi-gingival then a recession happened,it would be as supra-gingival and this exposes the margin.

Note : It accumulates more plaque if the margin is not properly finished,but if it's well finished then it doesn't retain more plaque.

**3)Sub-gingival:** (The most common): The most risk is on the periodontium ,due to: 1)Inaccessibility for finishing procedures. 2)Risk of invading biologic width, but still we use it for many reasons ,such as : Caries that are extended sub gingivally,a need for retention ,there is a fracture or trauma or even a previously existing restorative margin.

**So, the Indications for sub-gingival margins:**

1.Create adequate retention and resistance form.

2.Allow for significant contour alterations .. e.g: if we have a black triangle and we want to close it by putting two crowns on the centrals, if the finish line was sub-gingival we will have more distance to shape my restoration, so the emergence profile is better .However, if the finish line was equi-gingival the restoration emergence profile is horizontal and theres no room for transition from the narrower neck of the tooth and the wider prosthesis profile i.e I don't have adequate distance to shape the restoration probably.

3.Caries extending sub-gingivally.

4.Mask the interface between the restoration and the tooth."aesthetic".

***Biologic Width***

It's the physiologic dimension of the junctional epithelium and the connective tissue attachment.

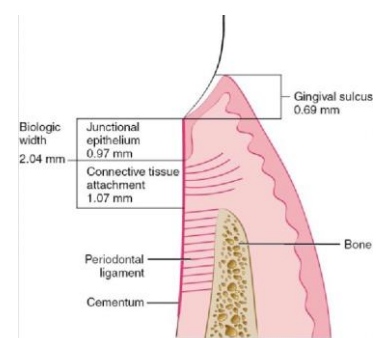
Keep in mind that since your restoration is within the sulcus you're not invading the biologic width, whereas the problem starts when you approximate the most coronal cells of the junctional epithelium.

As we said before, when we put the probe the tip always penetrates in the junctional epithelium "at least" . For example, when you measure the probing depth equals 1mm ,actually, it's less than that (let's say it's about 0.6),so when you go down for further 0.5 mm, you're already invading the biologic width. That's why you have to be conscious and leave a **safety margin**.

So when you have a probing depth of about 1mm,it's very risky to have biologic depth invasion in a such cases .However, The concept here is to stay *around 0.5 mm subgingival* and *not more* than that to minimize the risk of invasion the biologic width. But, as we said before, in some cases we have to go more than 0.5 mm sub-gingivally, such as: when we have a deep sub-gingival caries, fracture line, a need for more tooth length for retention ,...etc.

Note : Almost always remember that when you measure the probing depth the tip of the probe doesn't stop at the most coronal cell of the junctional epithelium, so when we use the probing depth keep in mind that it's a clinical measurement that is done clinically and not histologically. So we have an over-estimation for sulcus depth. That's why, it's important to keep a safety zone which means when we say the probing depth is 1mm for example ,we go maximum .5 mm and not 1 mm (always keep a safety margin to avoid invading the biologic width).Anyways this scenario is only for clarifying what happens to understand the concept,but usually in clinic when we go sub-gingivally we go more than 0.5 mm.

Now let's talk about the **Biologic width Violation** :  
Here we have two scenarios;



**1. Bone loss** of unpredictable pattern with a possibly *resulting pocket formation or gingival recession* “Attachment loss “. Usually we see it when we have a thin facial bone and thin soft tissues.

**2. Bone level remains unchanged but gingival inflammation develops and persists. (*persistent chronic inflammation*)**: When you have a permanent biofilm or a permanent irritant in the junctional epithelium, there would be a persistent chronic inflammation. Usually seen in the thick biotype (soft tissue type).

*Note* : the most common scenario is having a persistent inflammation specially in the interproximal areas.

***Now we already have a biologic width violation, how could we diagnose this violation?!***

*Violation of the biologic width can be assessed by :*

**1) Radiographs:** the problem with them that we can't achieve a parallel angulation specially when we are using bisecting technique in the anterior zone , so we won't have a true representation for the dimensions we either have a foreshortening or a lengthening, so it's ***NOT most reliable***, anyways if you want to use radiographs , *bitewings* are the best to be used here.

**2) Examination of restorative margin:** Where you clinically use the instrument whether it's a probe or an explorer to trace and feel where the finish line of your restoration is. If the patient feels a significant discomfort while you're trying to get to the restorative margin this is an indication that you might have a biologic width violation.

**3) Bone Sounding:** Which means that you're all the way sound where the crest of the bone is, as we said in the last lecture that you give local anesthesia first then you try to establish how far is the distance between the restorative margin and crest of the bone as we do in the radiograph, so clinically you probe to the margin of the restoration to measure the depth. “not the probing depth” but we measure how much the finish line is deep under the gingival margin then we go to the bone and then we subtract to calculate the clearance between the finish line or restorative margin and crest of the bone.

If the result is 2 mm or less, that means the we have a biologic width violation.

Note : Biologic width is not always 2mm, but it's a range that could be from 1 mm up to 4 mm ,so we have to determine what the patient's NORMS ,but how ? By checking a sound tooth (we do bone sounding by measuring the probing depth and the depth up to the bone then abstracting to calculate the the average /norms of the biologic depth in this patient where it might be 1.5 mm ,subsequently if you have a 2mm as a calculated biologic

width in the restored tooth, that means that you're already have an invasion and it's not normal. So biologic width is different from patient to patient.

### **Management :**

*How do we correct the biologic width violation?!*

*We have two options :*

**1) Surgical crown lengthening.**

**2) Orthodontics.**

In both cases the goal is to change the location of the dento- gingival complex not the finish line because it's already cut. In other words we move the biologic width down farther from the restorative margin.

Let's talk about the options in details :

#### **1) Surgical crown lengthening:**

-It's a faster approach than orthodontics option.

-It has a contra-indication in the esthetic zone because there will be a black triangle due to papillary resession or there will be gingival asymmetry, so we can't really do it in the aesthetic zone.

-Establish a distance of a biologic width PLUS 0.5 mm which is a safety margin.

**Question :** Do we need to have a surgical intervention or crown lengthening, when we ONLY have a persistent inflammation scenario? In other words, when

we already have a scenario of bone loss and recession, is the surgical intervention still needed or not necessary any more?

**The answer:** If you notice in the slides ,one of the scenarios of bone loss is a bone loss of unpredictable pattern which means that you might have a *negative architecture*, where you find pockets. So when there is pockets you still have a persistent inflammation as well, specially in the proximal areas. Wherefore, you need to have a surgical intervention *whether the scenario is bone loss or persistent inflammation*.

## 2)Orthodontics :

Mostly used in the anterior area but we can also use it posteriorly.  
We have two forced eruption techniques:

1. **Slow forced eruption followed by surgical crown lengthening:** here we are pulling the tooth also we are pulling the attachments (soft tissue and bone) , the position of the biological width is not changing , so how that will solve the biological width involvement ?

We do a surgical crown lengthening to cut the excess and establish a biologic width to create a room for the restorative procedure ,but here we will get rid of the black triangles problem because we are cutting the **facial bone** only .

In orthodontic extrusion we'll have more coronal bone compared to the the adjacent tooth so when we do crown lengthening later we only have to remove bone from the tooth itself without the adjacent, consequently we don't compromise the papilla.

Keep in mind that if we did a functional crown lengthening without extrusion, we will end up cutting bone interproximally as well (pay attention that we can't remove a bone around the tooth forming a trough then close it, because in this way we would have pockets so we need to reduce from the inter-proximal and even from bone on the adjacent teeth), Consequently, when we reduce from the inter proximal we'll end up with plaque triangles and large embrasures which is *not esthetic*.

**2.Rapid forced eruption with fibrotomy:** by anesthetizing the patient and we keep doing an intrasulcular incision every week all around the tooth and

detaching the gingival fibers from the root and pulling the tooth itself without the attachments ,without investing soft and hard tissue (*We don't change their location*) . However, this does not really happen predictably, and we still have to do crown lengthening afterwards.

How orthodontics can avoid having asymmetry or aesthetically unpleasant appearance?

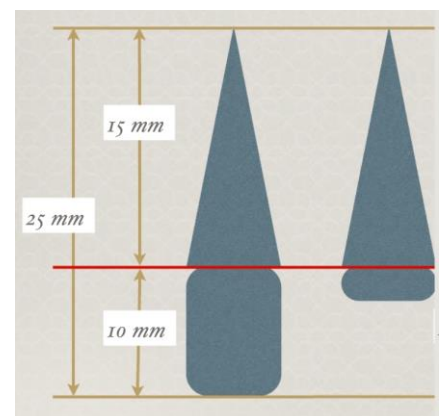
When we extrude the tooth , **we pull the soft tissue and the bone with the tooth**. Then we'll have more coronal bone compared to the adjacent tooth so when we do crown lengthening later we only have to remove bone from the tooth itself without the adjacent, so the original position of the inter-proximal

Bone was not reduced.

**Other important advantage for the forced eruption:**

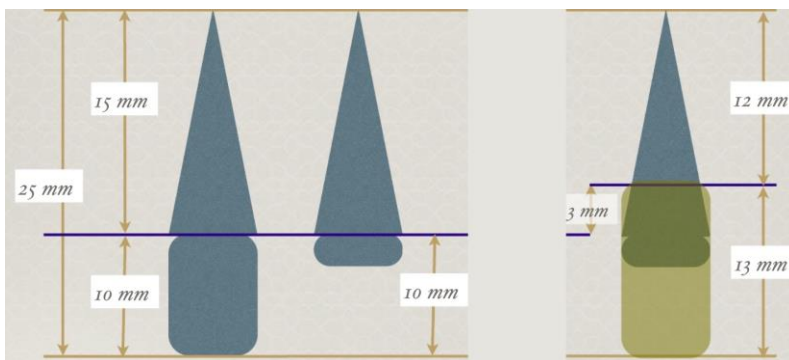
**Ending up with a better crown/root ratio.**

How ? let's say that the original crown length is 10mm and the root length is 15 mm , let's see what happens in both cases (Surgical crown lengthening and orthodontic excursion).



### 1) Surgical crown lengthening:

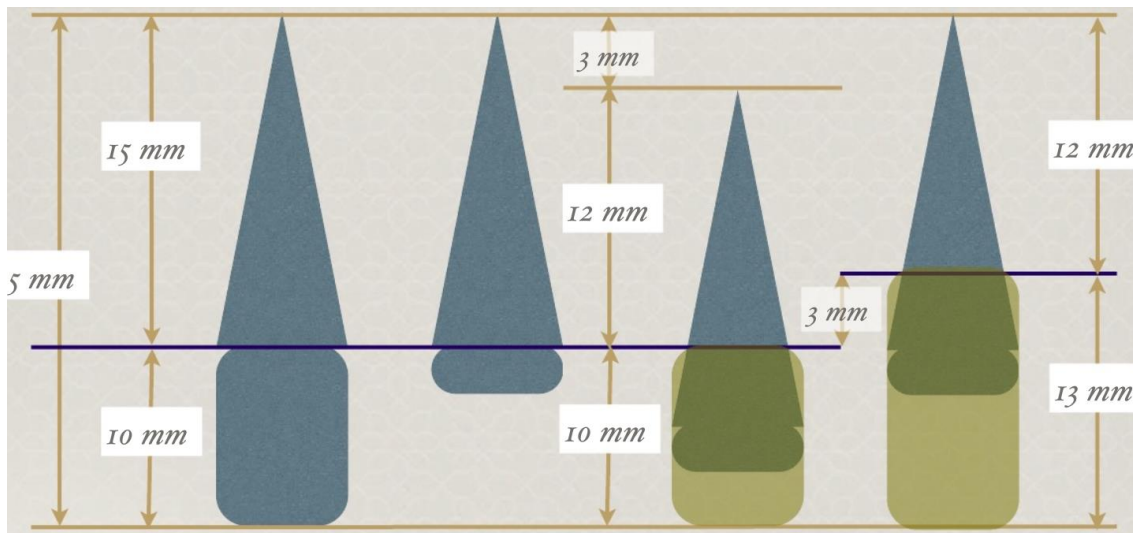
We remove bone all around the tooth and by doing so we increase the crown length by 3mm. So as it's shown in the diagram it will be 13 mm instead of 10 mm on the expense of the root length, which is decreased to be 12 mm. So here the crown to root ratio ( $13/12$ ) has been **increased** and it's not a good result. However, when we want to do surgical crown lengthening we have to accept that the crown will be longer as an esthetic compromise.



### 2) Orthodontic extrusion :

Here, since we're extruding the tooth coronally by 3mm "for example" and not removing bone to lengthen the crown. SO the crown length is the SAME and doesn't increased because the gingival margin stayed the same and it didn't change so it's not esthetic compromise, but the root decreases by 3mm to be 12mm instead of 15 mm .So the ***crown to root ratio is better***.





A point to clarify, what the doctor meant here, that in both cases the root is decreased, but in the surgical approach the crown increases (the C/R ratio is increased to be almost 1 or even a bit more ) and in the second orthodontic approach the crown has the same length and doesn't increase (However, notice that here the C/R ratio is also increased, somehow, by decreasing the root, but it's much less than that in first approach and it's not almost 1, That's why it's a better ratio).

Anyway there is a confusing point: How the crown length in the 2nd approach is the same and doesn't increase ?

logically it's because the crown is fractured for example and its original length, let's say, was 10 mm. So we accomplish the same original length by extruding the tooth itself and not by removing bone all around (It doesn't increase on the expense of the root by exposing the bone all around as happens in the surgical approach).

## CASE I :

Here we need to put a crown on the left central, but its very short so if we push the finish line sub-gingivally we will end up by violating the biological width. So we must do a



forced eruption , then we do crown lengthening by cutting bone around the left central only (which is now considered as excess bone after extrusion) without the need to cut bone on the adjacent teeth.

Here we pulled the gingiva all the way down ( we repositioned the gingival margin to the ideal location).

After that we do the crown.

## CASE II :

Here we don't have enough tooth structure, the biologic width violation has been corrected by a **rapid forced eruption**.

As you notice in this case ; Surgical crown lengthening has been done after the forced eruption although it's rapid eruption because of the gingival discrepancy that occurred between these teeth and the adjacent teeth.



## Case III:

This patient came to clinic complaining of an inflammation around the centrals. This patient has got a new crowns on both upper centrals (two months ago ) and it's not esthetic but the patient is happy with them.



So the **possible reasons of this inflammation** :

- ✓ **Defective restorative margin:** open margin, over hanged.
- ✓ **Biologic width violation.**
- ✓ **Excess cement.**
- ✓ **Allergy** (unlikely cause but still dentists consider it almost as a good excuse).

However, four different possible scenarios, we always start with the simplest and least invasive. So we start by removing the excess cement. In Over-contoured crowns there's not much management that we can do here, we might do some adjustments. Then we go to the other possible reason which invasion of the biologic width correction and the least likely etiology is the sensitivity.

Note : we can't say here,oral hygiene is a possible etiology and this is because when you see the other adjacent teeth,there is no inflammation.

In this case we found that the etiology might be an excess cement. So we did some debridement sub-gingivally and it's got a little bit improved, but we still have some inflammation as you see in the pictures below.





Then we decided to remove the crowns and we found out that there is almost no enough tooth structure !

*Here the dentist went very sub-gingival and this case was then diagnosed as a **biologic width violation**.*

*So as it's shown in the picture there is almost 1 mm distance between the finish line and the bone. The invasion is mostly proximally and that's why the inter-papilla is the most inflamed area in this case.*

*Here we are lucky and we can do crown lengthening alone without having asymmetry nor black triangle because are working on the two centrals*

*So we went to ostectomy and established 3 mm between the finish line and the bone. Why 3 mm?*

*Because we need to establish about 2.5 mm plus .5 mm as a safety margin. However, the minimum corrected biologic width needed is 2.5 but to accommodate the variation in biologic width (which is a range as we said before )it's usually better to go for 3 mm.*





*-Post-operative healing.*

*Note that most of the biological width violation seen in the inter-proximal areas rather than the buccal areas, this is because most of the dentists don't respect the attachment contour which is not circular around the tooth, its more apically positioned in the buccal and palatal areas.*



**\*Clinical procedures in marginal placement:**

As a rule if you went half a mm sub-gingivally most of the times you wont invade the biological width, unless we have caries, previous restoration, trauma , short teeth ..etc.

So first you have to evaluate the sulcus depth and probing depth.

Whether we have a shallow sulcus or a deep sulcus there is some strategies to avoid invading the biological width, you start by equi-gingival preparation (initial finish line), then you back a thin cord , then you start to prepare sub-gingivally almost to the top of the coronal aspect of the retraction cord, by this you are sure that you are away from the attachment, then you pack a second retraction cord.

The advantage of this technique in the shallow sulcus that the retraction cord will act as a buffer and will keep the tissues away from the bur.

*As a tip for having a very nice impression always use the double cord technique and not the single cord technique.*

*Some people says that this way is traumatic. However, if you didn't do it you well end up having an irregular finish line witch has a much harmful effect on the tissues.*

In the deeper sulcus we might need a third retraction cord.

In the cases that we have a deeper sulcus and excessive gingival tissues you can do contouring for the gingiva (its like gingivectomy but inside the sulcus). By cottary.

By this technique the impression material can reach inside the sulcus, and any one can tell easily where the finish line is.

### **- Provisional Restoration:**

It's very important to have a good marginal fit, smooth margins, but unfortunately we do it without paying attention to its importance and then the patient might come back a week later with inflammation and a very bad condition of the gingival tissue, which might be very disruptive to the restorative procedure specially when we use resin cement which is used with the metal free crowns, where this cement needs dryness, etching and bonding just like the composite restorations.

So these gingival tissues with bad conditions would complicate our procedure. That's why the finishing and smoothening of the provisional restorations is very important. However, bigger marginal defects increases the inflammation.

***open margins harbor bacteria increasing the risk for inflammation. Nevertheless, what's worse than open margin are ROUGH margins because its very traumatic to the periodontium.*** So the smoothness of the margin has a great impact on the health of the gingival tissues.

### **- Crown Contour:**

3 possibilities

#### ***1) Over-contoured restorations***

The **MOST harmful** and the most common cause is the **INADEQUATE preparation (under-preparation)**. You don't prepare enough and consequently when the technicians create the thickness of the metal and porcelain, it will be over-contoured and this will cause gingival inflammation. This case is seen most of the times in the furcation area of the lower posterior teeth.

#### ***2) under-contoured restorations***

No adverse effect

#### ***3) Proper contoured restorations***

### **- Sub-gingival Debris:**

Things that you leave; Examples :

- 1) Retraction cord.
- 2) Impression material.
- 3) Provisional material (Acrylic might enter the sulcus).
- 4) Permanent or temporary cement.

### **-Hypersensitivity:**

Most commonly from the nickel, so now we usually use a nickel free alloys, or a precious metals.

In a much lower incidence, some people have allergy to gold.

Surface finish is very important.

### **-Esthetic tissue management :**

We have scalloping in the soft tissues not only in the bone .. so what are the factors that will determine if we have a black triangle or not?

- ❖ Bone loss : we can do extrusion in this case, and the tip of papilla will be pulled down with the teeth.
- ❖ Very large interdental space: if we have a pt with a very wide diastema ,and we tried to close it with a restorative material, we won't have a complete papillary fill because the space is very wide gingiva cannot drop down to fill that gap, so we have to ortho treatment and stripping to allow the gingiva to fill that gap.
- ❖ Position of contact point.

### **1) Managing Inter-proximal embrasures**

Managing a wide inter-proximal embrasures. However, Interproximal papilla is a very important part in creating optimal esthetic results.

For example, when there is asymmetry, large embrasures (Open

Triangles) or you might establish a very squarish restoration that would compromise the esthetics.

### **2) Correcting Open gingival embrasure restoratively.**

### **3) Managing gingival embrasure form.**

#### 4)Pontic design

So again in managing the inter proximal embrasure;

##### **The ideal Inter-proximal papilla:**

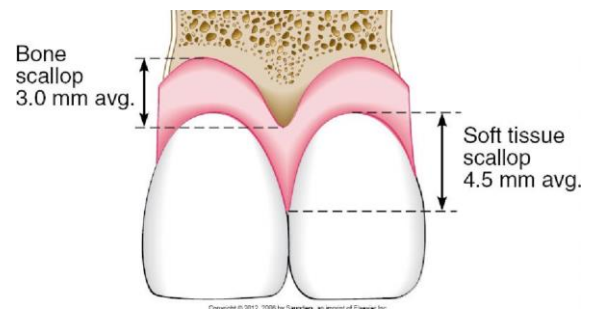
- 1) House the gingival papilla without impinging on it  
Which means that the size of the embrasure shouldn't be too small and not too big,so it could accommodate the gingival papilla without impinging on it and without being too big as well.
- 2) Extend the inter-proximal tooth contact to the top of the papilla avoiding a food trap or unpleasant esthetics.

##### **Papillary height is determined by:**

- 1)The level of the bone.
- 2)The biologic width.
- 3)the form (width) of the gingival embrasure.

These three elements will determine whether there will be a black triangle or not.

So we have three factors and to manage the inter-proximal embrasure we can't do anything about the biologic width, so the factors we can still control here is the level of the bone and the form and shape of the gingival embrasure.



##### **\*The relation between the contact point and the crest of the bone:**

-Usually If this distance is 4.5- 5mm: There will be a complete papilla fill in the embrasure always.

If it's 6mm: The papilla filled the space in 56% of cases.

If it's 7mm: The papilla filled the space in 37% of cases.

Why there is variations?



Because there are different biologic width values between the patients.

To make it more clear: Let's say that we're doing crowns on the two centrals and in the try in stage we find out that there is a space (large embrasure). So we take it to the technician and ask

him to add more porcelain to close the spacing between the teeth.

However, when he adds the porcelain the crowns will be more squarish in shape.



Again, to improve the papilla fill we either control the level of the bone or the shape of the embrasure.

So it might be wide or narrow, however, we can improve the papilla fill by changing the contour of the embrasure and not the location of the contact point to make it narrower.

So if the embrasure is too wide, even though the distance between the contact point and the bone is ideal of 4.5 mm (let's say that we have a congenitally missing lateral incisor and the canine is shifted and tipped mesially, the embrasure would be very wide)

you never going to have a proper papilla fill. That's why the shape and contour of the embrasure is very important.

## **CASE IV:**

Here it's a natural teeth and the patient is bothered by this black triangle, what options do we have to manage this case?

Can we change the bone level here? NO

Can we do a soft tissue graft? No, because it's very unpredictable.

So we change the shape of the embrasure by moving the contact point more apically by adding composite.



**-Correcting the open embrasures,we either have;**

- 1) Bone loss
- 2) The Inter-proximal contact is too coronal, by:
  - I) Root angulation (large embrasure).
  - II) Shape of the tooth(tooth is very cylinder, triangular in shape).

So what options do we have ?

Can we correct it by changing the bone level ?Why not?

No, because if a patient came to clinic having pockets between the lateral and the central and there is already a bone loss and a papillary recession, we can't remove the tooth and do implants because it's useless due to the bone defects so the option is to do forced eruption and crown lengthening.

*Best wishes <3*