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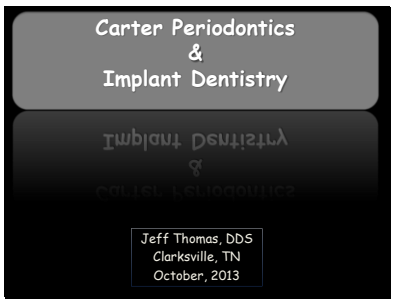

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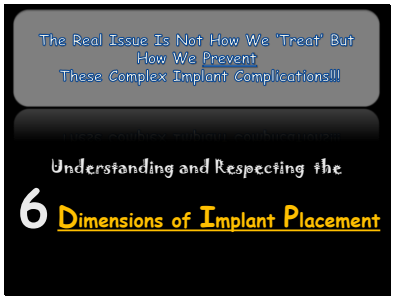

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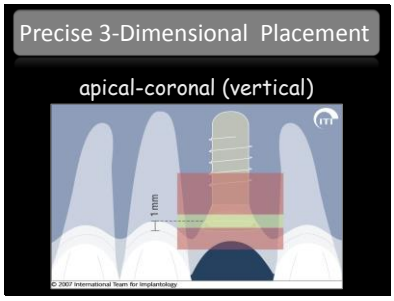

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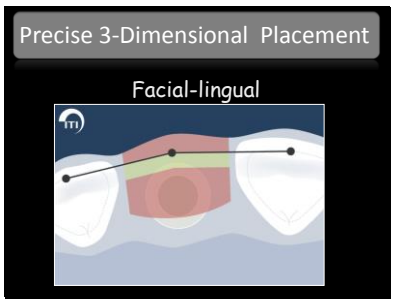

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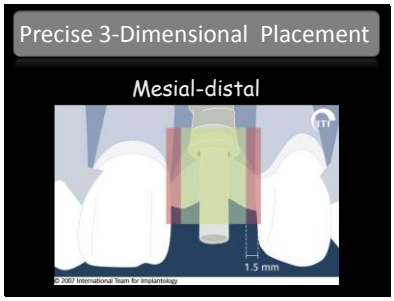

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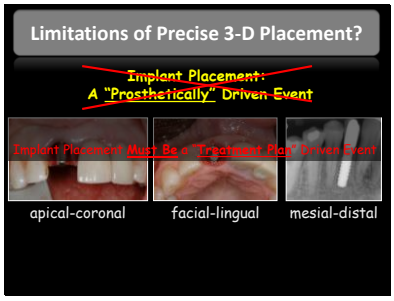


Slide 10

If we are to be truly successful in dental implant placement, esthetics and longevity we must:

Plan Implant Placement Respecting Six Dimensions

Slide 11

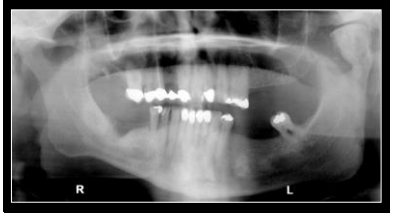
What are the 4th, 5th & 6th Dimensions?

1st, 2nd, and 3rd Dimensions

Slide 12

What are the 4th, 5th & 6th Dimensions?

4th Dimension - TMJ's and condylar head position



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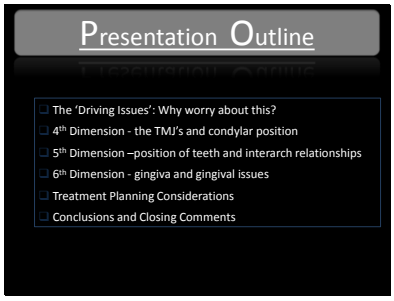

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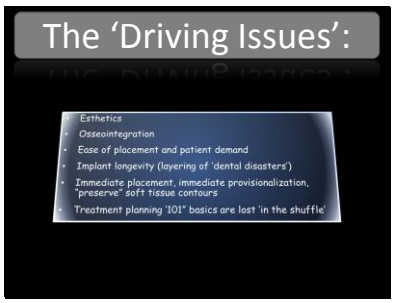

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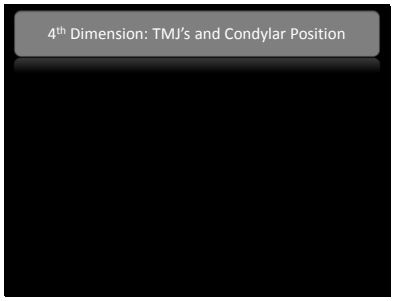

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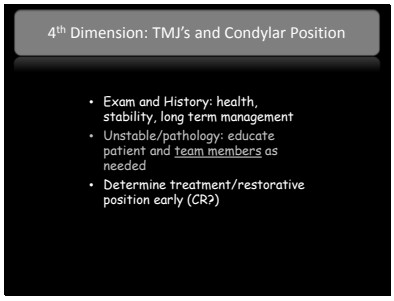
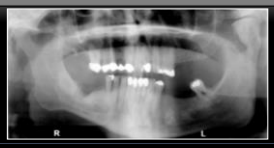


Slide 19

Exam and History: health, stability, long term prognosis



1) History: pain; noises- clicks, pops, grating; trauma (entire life); bite changes; past "TMJ" diagnosis; chronic headaches
2) Exam: normal range of opening and is there deviation; fingers bilaterally over joints- translation (important!), clicks-pops-crepitation, feel the same size?; load test; significant asymmetric dental wear; facial/occlusal asymmetry!

Slide 20

• Unstable/pathology: educate patient and team members as needed

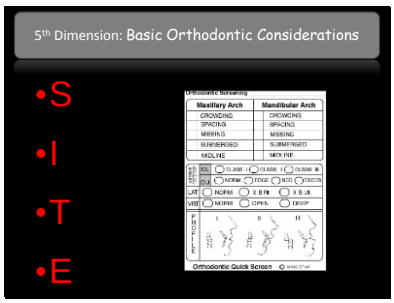
1) History: pain; noises- clicks, pops, grating; trauma (entire life); bite changes; past "TMJ" diagnosis; chronic headaches
2) Exam: normal range of opening and is there deviation; fingers bilaterally over joints- translation (important!), clicks-pops-crepitation, feel the same size?; load test; significant asymmetric dental wear; facial/occlusal symmetry!

Slide 21

Determine treatment/restorative position early (CR?)

- Exam and History: health, stability, long term management
- Unstable/pathology: educate patient and team members as needed
- Determine treatment/restorative position early (CR?)

Slide 22



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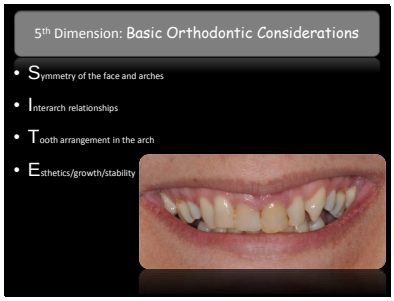

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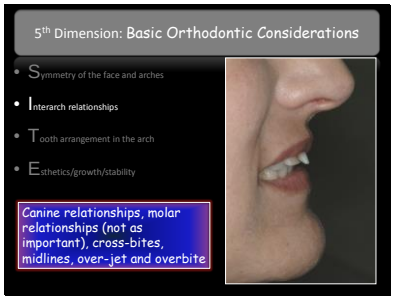

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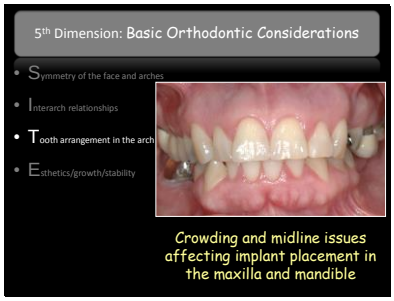

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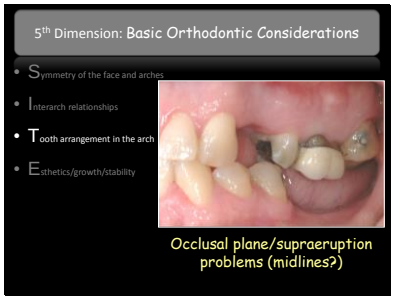


Slide 28

5th Dimension: Basic Orthodontic Considerations

- Symmetry of the face and arches
- Interarch relationships
- Tooth arrangement in the arch
- Esthetics/growth/stability

Anterior crowding, tipped lower molar, Class II canine

Slide 29

6th Dimension: Gingiva!

- Too Much
- Too Little
- Papillae
- Discolorations
- Periodontal disease

Slide 30

6th Dimension: Gingiva!

- Too Much
- Too Little
- Papillae
- Discolorations
- Periodontal disease

1. Gingival grafting
2. Ridge augmentation
3. Implant placement
4. Restoration

Slide 31

6th Dimension: *Gingiva!*

- Too Much
- Too Little
- Papillae
- Discolorations
- Periodontal disease

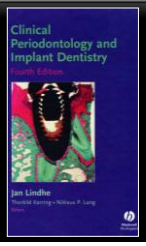
Required: predict **BEFORE** surgery where the papillae will be…**why**? "Just because"??!! NO!!

Slide 32

COMPLICATIONS!!! How about simple prevention!

There is evidence that potential pathogens identified around remaining teeth may colonize implants within 6 months of placement of implants (Apse et al. 1989, Quirynen & Listgarten 1990, Koka et al. 1993, Leonhardt et al. 1993, Kohavi et al. 1994, Mombelli et al. 1995, van Winkelhoff et al. 2000). Proliferation of these opportunistic pathogens results in an inflammatory response and may lead to peri-implant infection. This emphasizes the importance of the establishment of healthy periodontal conditions prior to placement of implants in partially edentulous patients, and the importance of a regular maintenance program thereafter.

Published in 2003 textbook!!!! Where have we been?



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How would you have **predictably** managed this defect?
PREVENTION!
What do we know?

The Frequency of Peri-Implant Diseases: A Systematic Review and Meta-Analysis
Atieh MA, Alsabeeha NH, Faggion CM Jr, Duncan WJ. J Periodontol. 2012 Dec 13.

peri-implant mucositis= BOP/inflammation
peri-implantitis= BOP/inflammation and radiographic evidence of bone loss > than expected

- 9 studies: 1497 participants and 6283 implants
- peri-implant mucositis: 63.4% of participants and 30.7% of implants
- peri-implantitis: 18.8% of participants and 9.6% of implants
- peri-implant diseases for smokers was 36.3% of the implants

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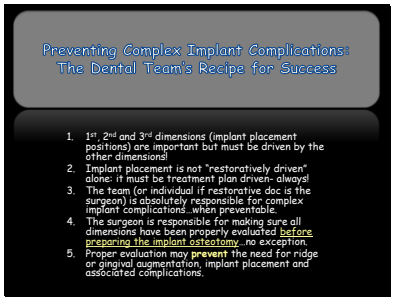
Slide 35



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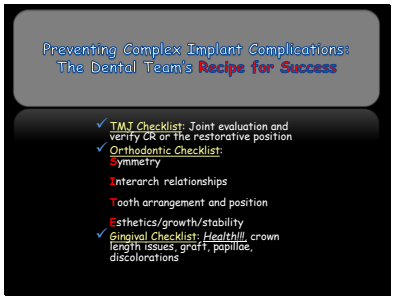

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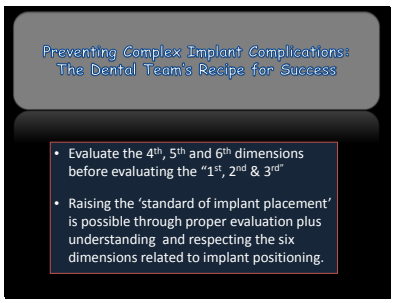

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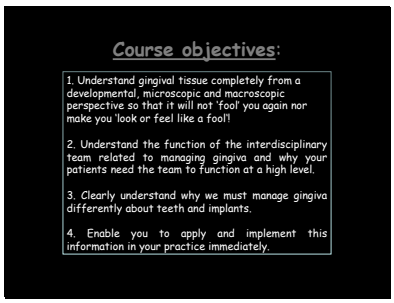

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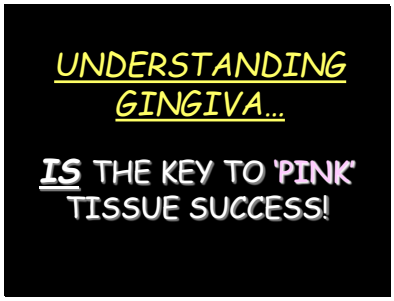

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What is the origin of gingiva and the muco-gingival junction?
What influences gingival width?

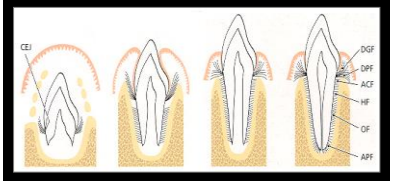
Slide 44

Gingival Development '101'

- Remember the branchial arches, branchial grooves, Meckel's cartilage, etc. ?
- At 10-12 weeks see changes in the fetal epithelium which will become the lining and masticatory mucosa
- Masticatory mucosa has columnar basal cells and connective tissue papilla; lining mucosa has cuboidal basal cells and a flat connective tissue junction (A. R. Ten Cate, Mosby Co.)
- **Bottom line:** there is genetic *determination* to the initial location of the mucogingival junction

Slide 45

Tooth Eruption/Gingival Development



Slide 46

What happens if the eruption 'path' goes facial or lingual?

Multiple causes: retained primary teeth, supernumerary teeth, trauma to primary teeth(including ankylosis), arch length deficiency, hereditary, idiopathic reasons, and possibly others

Slide 47

Important "Development" Conclusions

1. The mucogingival junction(MGJ) location results from hereditary (genetic) and functional influences but it can be surgically altered, however with some muscular limitations.
2. The closer the erupting tooth is to the MGJ the more likely there will be less bone, less gingival height and width, and therefore greater risk of recession.
3. The further the erupting tooth is from the MGJ the more likely there will be more bone, more gingiva and therefore less risk of recession.

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UNDERSTANDING GINGIVA AND THE "DENTO-GINGIVAL COMPLEX"

- Gingival Development
- **Gingival Micro Anatomy**
- Gingival Macro Anatomy

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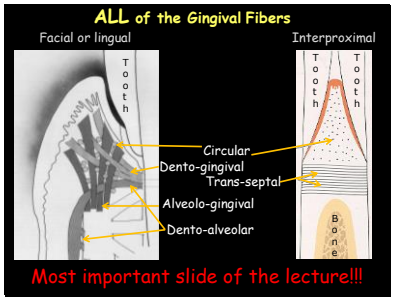

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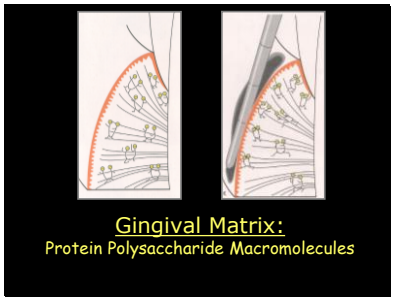

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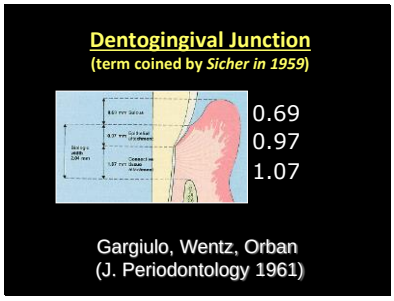

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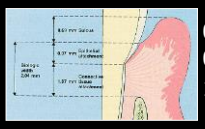
Vacek, J. et al. 1994 IJP&RD
"The Dimensions of the Human Dentogingival Junction"



0.69
0.97 1.14
1.07 0.77

	Measurement(mean)		Range
EA	1.14	1.91	0.32 - 3.27
CT	0.77		0.29 - 1.84

Slide 53

Vacek, J. et al. 1994 IJP&RD
"The Dimensions of the Human Dentogingival Junction"

Biologic Width (EA+CT)

Location	Measurement(mean)	Range
Anterior	1.75	0.75-3.29
Premolar	1.97	0.78-4.33
Molar	2.08	0.84-3.29

Slide 54

Biologic Width and Gingival 'Norms'

1. Connective tissue attachment occupies 1mm height on average. It has the least variability.
2. Junctional epithelium (J.E.) occupies 1mm height on average [also referred to as the epithelial attachment (E.A.)]. It can have great variability.
3. Combined height(biologic width) is about 2mm on average (is likely slightly less). In my opinion, the final biologic width 'position' on root surface (as opposed to enamel), is extremely difficult to predict.
4. Free gingival margin on the anterior facial is on average slightly less than 3mm coronal to the bony crest, given 'normal' bone thickness
5. These numbers are averages and the ranges of these heights vary greatly!!! Check every case!!!

Slide 55

Biologic Width Violation!

*What is it?

*How do we diagnose it?

Slide 56

Biologic Width Violations:

Clinical Findings

1. Inflamed marginal tissue with edema/enlargement
2. Poor tissue tone
3. Poor restorative margin
4. Pain (usually continuous, and can be a deep pain, not just in the gingiva)
5. Recession and/or osseous defect (this may be an 'after the fact' sign)

Slide 57

Biologic width violations: Differential diagnosis

1. Plaque- evaluate hygiene; gentle correction
2. Inadequate Margins- explore for ill-fitting areas
3. Contour- does this impede hygiene and/or is it overcontoured subgingivally
4. Allergic response- check history of metal allergies; check other crown margins (be careful- different alloys)
5. Localized Lichen Planus (and other desquamative lesions)
6. Foreign Body Gingivitis (FBG):
   Foreign body gingivitis associated with a new crown: EDX analysis and review of the literature. Gordon S. Oper Dent. 2000 Jul-Aug;25(4):344-8.

Slide 58

Detecting Violations

1. Slide the probe gently along the restoration to the margin; if there is pain the margin is in the attachment
2. Anesthetize the area; go to the margin then press to bone to determine B.W. and measure other areas to compare B.W.

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Common Locations:

Interproximal areas

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Correcting Biologic Width Violations

- Periodontics- surgical 'crown' lengthening
- Orthodontics- rapid extrusion (eliminates surgical need)
- Combo- ortho then perio (posterior)
  perio then ortho (anterior)

Slide 61

Orthodontic 'Rapid' Extrusion: "non-surgical"

1. Determine the additional distance the margin must be from the bone by sounding
2. Apply the ortho brackets with the bracket on the tooth to the 'erupted positioned' (apically the distance determined in step #1)
3. Apply wire and relieve occlusion
4. Check at weekly intervals; anesthetize at each visit and do fiber release(max. of 4 weeks).
5. Stabilize for three months
6. **Indications??** (avoid adjacent recession/bone loss, surgical competency or availability, $-ortho required anyway)

Slide 62

Surgical Correction of Violations

1. Accurately determine B.W. (remember Vacek findings!)
2. Reflect full thickness flap
3. Remove bone to provide for correct B.W. (***and*** adequate ferrule if new restoration is to be made!)
4. This is simple math, don't 'eye ball' the result. Calculate as follows:

B.W. + ferrule (if needed) + probe depth (~1mm F&L, 1.5-2mm M&D)

=

Distance from bone to final restoration margin
(it will always look too much!)

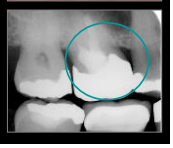
Slide 63

Surgical Correction of Violations

Significant Guideline:

In the esthetic zone I prefer to do orthodontic eruption after surgical crown lengthening.
Why? What might happen?

1. May find additional fracture (implant before removing bone?)
2. Identify final restorative margin then "do the math" (careful in the interproximal to insure papillae return); may find C.L. not a good choice
3. Surgically place gingival margin in correct position on the root then have orthodontist erupt tooth to get gingival margin correct



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UNDERSTANDING GINGIVA AND THE DENTO-GINGIVAL COMPLEX

- Gingival Development
- Gingival Micro Anatomy
- **Gingival Macro Anatomy**

Slide 65

Gingival Anatomy

What about the papillae??!!

Slide 66

Determining Papillae Height

The osseous scallop follows the form of the CEJ circumferentially. This scallop is the greatest for the maxillary anterior teeth, averaging 3.5mm, and flattens out as we progress posteriorly.

Slide 67

In healthy maxillary central incisors, the height of the papilla is about 5mm.

If the B.W. is about the same all around the tooth, then how do we account for this dimension?

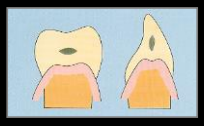
- Bony scallop = 3.5mm
- Sulcus depth= 2.5mm
- Total = 6.0mm

(-)facial sulcus - 1.0mm

Papilla height = 5.0mm

Slide 68

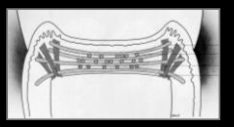
Why is the interproximal probe depth about 2.5mm and why does the "Col" have the 'dipped' shape?



Why is it? (think micro-anatomy)

Slide 69

The gingival fibers ***will*** grow in this interdental area and will 'fan' out facially, lingually and incisally, thus creating the ***'Col'*** Effect (think about a water balloon effect in the embrasure).



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What we know about the papilla

1. Interproximal papilla is about 5mm coronal to the bone, maxillary central incisors.
2. There is a 'predetermined' amount of interdental tissue, based on the B.W., the gingival fibers, and the C.T. matrix (micro-anatomy!).
3. Van-der-Veldon (1982) shows these regenerate if surgically removed (unless you damage the bone or periosteum).
4. The height/shape of the papilla then depends on the volume of the gingival embrasure. The more confined mesio-distally, the more incisal the papilla will move. Generally, the wider the embrasure, the more flat and apically positioned the papilla *may* be.

Slide 71

What we (sort of) know about the papilla from the work and publications of Tarnow(Journal of Perio 1992)

(One of the most quoted yet misquoted articles in the dental literature)

MEASURE THE CREST OF BONE TO THE PROXIMAL CONTACT:

If within 5mm of bone, "no black space"

[Actually 1 out of 72 (2%) did have a black space!!!]

If within 6mm of bone, 44% had black space

If within 7mm of bone, 63% had black space

(Essentially confirmed by Wu 2003, Martegani 2007, Chen 2010)

Slide 72

Always place the apical aspect of the contact at 5mm? ABSOLUTELY NOT!

- What about the patient with a 3-4mm B.W.?
- Sulcus depth is the best predictor for papilla behavior
- If sulcus is 2-3mm = stable papilla
- If sulcus is >3mm = great risk of black triangle (I call this a 'weak' papilla)
- If sulcus is <2mm =embrasure is too large
- Bottomline: check B.W. and proximal probe depth on other teeth; then have the contact the same as the contralateral tooth (similar tooth position) or 2-3mm coronal to the B.W.

Slide 73

Correcting 'Black Triangles'

- Soft tissue grafting- predictability??, may not sustain long term; increases the probe depth??
- Bone grafting(augmentation)- currently do not have technology to grow the entire interproximal bone
- Bottomline: ***surgery typically doesn't fix these problems in most cases!!***

Slide 74

Predictable and *stable* methods to manage 'dark triangles'

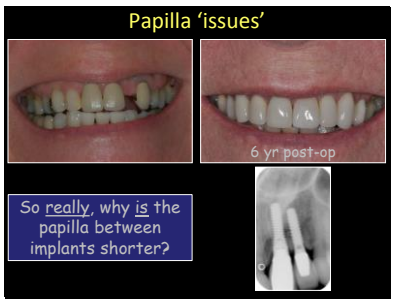
- ✓ Restorative treatment
- ✓ Orthodontic treatment

Slide 75

Correcting 'Black Triangles'

- Orthodontics is an excellent way to manage these spaces
- Align the roots if divergent to decrease the distance between roots(decreases embrasure space)
- Reshape the teeth (stripping) to flatten the proximal contacts, then close the diastema to bring the proximal contact closer to the bone*(get it within 5mm of bone but measure B.W. first!!)*

Slide 76



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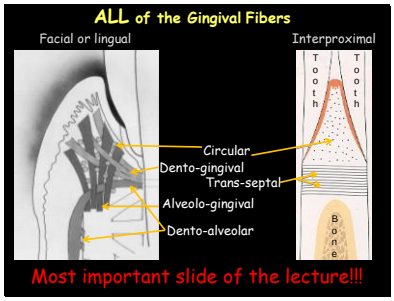

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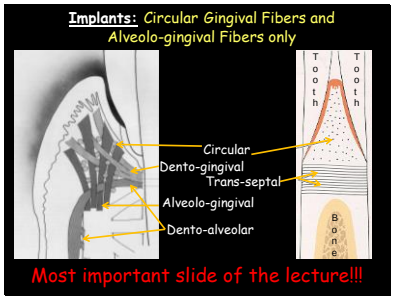

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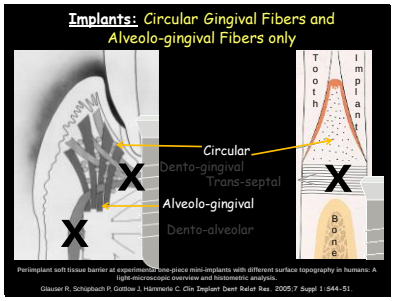

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