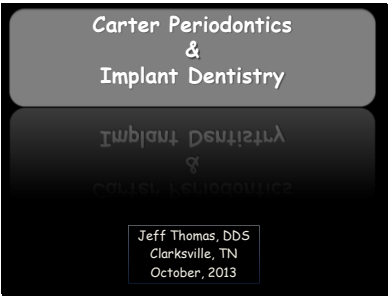


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Slide 2



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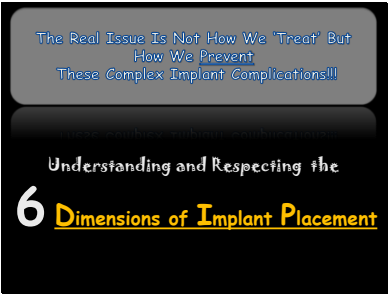
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Slide 3



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Slide 4



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Slide 5



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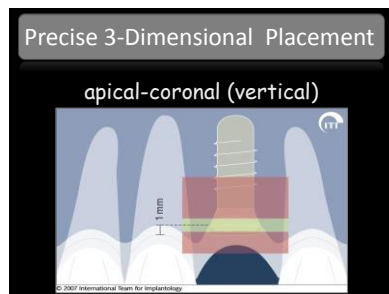
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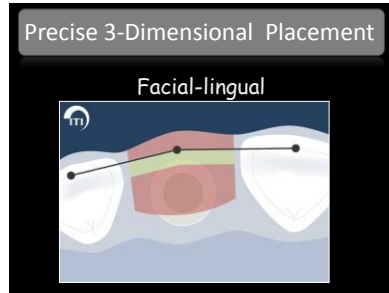
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Slide 7



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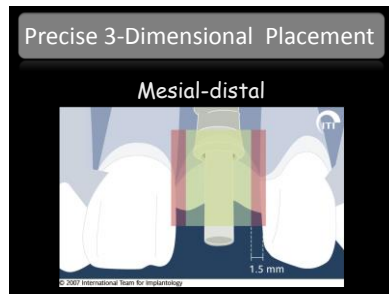
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Slide 8



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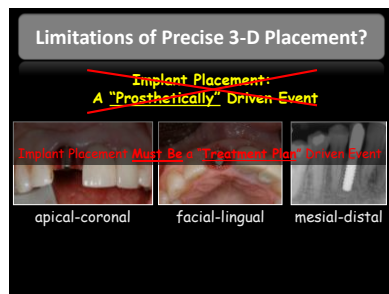
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Slide 9



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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**

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Slide 11

What are the 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> Dimensions?

1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Dimensions

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Slide 12

What are the 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> Dimensions?

4<sup>th</sup> Dimension - TMJ's and condylar head position



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Slide 13

What are the 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> Dimensions?

5<sup>th</sup> Dimension - Position of teeth in the arch and inter-arch relationships (ortho)



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Slide 14

What are the 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> Dimensions?

6<sup>th</sup> Dimension - Gingiva and gingival issues



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Slide 15

Presentation Outline

INTERIMATIVE PHASE

- ❑ The 'Driving Issues': Why worry about this?
- ❑ 4<sup>th</sup> Dimension - the TMJ's and condylar position
- ❑ 5<sup>th</sup> Dimension - position of teeth and interarch relationships
- ❑ 6<sup>th</sup> Dimension - gingiva and gingival issues
- ❑ Treatment Planning Considerations
- ❑ Conclusions and Closing Comments

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Slide 16

The 'Driving Issues':

Ethetics

- Osseointegration
- Ease of placement and patient demand
- Implant longevity (layering of 'dental disasters')
- Immediate placement, immediate provisionalization, 'preserve' soft tissue contours
- Treatment planning '101' basics are lost 'in the shuffle'

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Slide 17

4<sup>th</sup> Dimension: TMJ's and Condylar Position

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Slide 18

4<sup>th</sup> Dimension: TMJ's and Condylar Position

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

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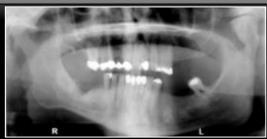
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Slide 19

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!

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Slide 20

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



(Great Lakes Ortho \$320)

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!

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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?)

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Slide 22

## 5th Dimension: Basic Orthodontic Considerations

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Slide 23

- **S**ymmetry of the face and arches
- Interarch relationships
- **T**ooth arrangement in the arch
- **E**sthetics/growth/stability

A close-up photograph of a patient's teeth, showing significant malocclusion. The upper teeth are crowded and rotated, while the lower teeth are also crowded and show a deep bite relationship with the upper teeth. The gums appear slightly inflamed.

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Slide 24

- 5<sup>th</sup> Dimension: Basic Orthodontic Considerations
- Symmetry of the face and arches
- Interarch relationships
- Tooth arrangement in the arch
- Esthetics/growth/stability

Canine relationships, molar relationships (not as important), cross-bites, midlines, over-jet and overbite

A close-up photograph of a person's mouth, showing the upper and lower teeth. The upper teeth are noticeably inside the lower teeth, which is a clinical sign of a cross-bite relationship. The image is cropped to focus on the teeth and the bite.

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Slide 25

5<sup>th</sup> Dimension: Basic Orthodontic Considerations

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



Crowding, spacing, missing, submerged, midline location, rotations, tooth angulations, occlusal plane, supra-eruption, etc.

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Slide 26

5<sup>th</sup> Dimension: Basic Orthodontic Considerations

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



Crowding and midline issues affecting implant placement in the maxilla and mandible

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Slide 27

5<sup>th</sup> Dimension: Basic Orthodontic Considerations

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



Occlusal plane/supraeruption problems (midlines?)

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Slide 28

5<sup>th</sup> 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

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Slide 29

6<sup>th</sup> Dimension: *Gingiva!*

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

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Slide 30

6<sup>th</sup> Dimension: *Gingiva!*

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



- Gingival grafting
- Ridge augmentation
- Implant placement
- Restoration

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Slide 31

## 6<sup>th</sup> Dimension: Gingiva!

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



A close-up photograph of a person's mouth showing orthodontic braces. The gingiva (gums) appear inflamed and swollen, particularly around the brackets, which is a common side effect of orthodontic treatment. The teeth are visible with metal brackets and wires.

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

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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 & Lögtersen 1990, Koka et al. 1993, Leemhuis et al. 1993, Kishner et al. 1994, Monbelli et al. 1995, van Winkelhoff et al. 2000). Proliferation of these opportunistic pathogens results in an inflammatory response any way leading to periodontal 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?**



**Clinical  
Periodontology  
and  
Implant Dentistry**

**Jan Lindhe**  
Editor: Lars Egermark & Lennart J. Lång

**WILEY**

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Slide 33

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  
Aliieh MA, Alsaabeeha 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 34



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Slide 35

- ### Preventing Complex Implant Complications: The Dental Team's Recipe for Success
1. 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> dimensions (implant placement positions) are important but must be driven by the other dimensions!
  2. Implant placement is not "restoratively driven" alone: it must be treatment plan driven- always!
  3. The team (or individual if restorative doc is the surgeon) is absolutely responsible for complex implant complications...when preventable.
  4. The surgeon is responsible for making sure all dimensions have been properly evaluated before preparing the implant osteotomy...no exception.
  5. Proper evaluation may prevent the need for ridge or gingival augmentation, implant placement and associated complications.

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Slide 36

- ### Preventing Complex Implant Complications: The Dental Team's Recipe for Success
- ✓ **TMJ Checklist:** Joint evaluation and verify CR or the restorative position
  - ✓ **Orthodontic Checklist:**
    - Symmetry
    - Interarch relationships
    - Tooth arrangement and position
  - ✓ **Esthetics/growth/stability**
  - ✓ **Gingival Checklist:** Health!!!, crown length issues, graft, papillae, discolorations

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Slide 37

Preventing Complex Implant Complications:  
The Dental Team's Recipe for Success

- Evaluate the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> dimensions before evaluating the "1<sup>st</sup>, 2<sup>nd</sup> & 3<sup>rd</sup>"
- Raising the 'standard of implant placement' is possible through proper evaluation plus understanding and respecting the six dimensions related to implant positioning.

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Slide 38



Part Two

Reaching New Heights in Dental Implant Placement

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Slide 39

Preventing Complex Implant Complications:  
The Dental Team's Recipe for Success

Understanding Gingiva: the Secret for Creating  
Successful Outcomes in Restorative, Esthetic  
and Surgical Therapies

Today's agenda

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Slide 40

Course objectives:

1. Understand gingival tissue completely from a developmental, microscopic and macroscopic perspective so that it will not 'fool' you again nor make you 'look or feel like a fool'!
2. Understand the function of the interdisciplinary team related to managing gingiva and why your patients need the team to function at a high level.
3. Clearly understand why we must manage gingiva differently about teeth and implants.
4. Enable you to apply and implement this information in your practice immediately.

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Slide 41

UNDERSTANDING  
GINGIVA...

IS THE KEY TO 'PINK'  
TISSUE SUCCESS!

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Slide 42

UNDERSTANDING GINGIVA  
AND THE  
"DENTO-GINGIVAL COMPLEX"

- Gingival Development
- Gingival Micro Anatomy
- Gingival Macro Anatomy

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Slide 43

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



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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

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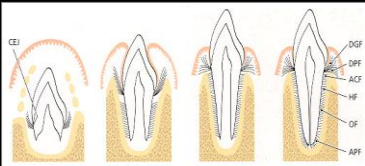
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Slide 45

Tooth Eruption/Gingival Development



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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

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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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Slide 48

UNDERSTANDING GINGIVA  
AND THE  
"DENTO-GINGIVAL COMPLEX"

- Gingival Development
- Gingival Micro Anatomy
- Gingival Macro Anatomy

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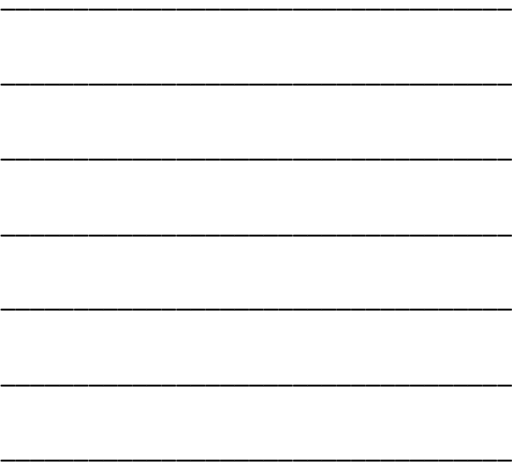
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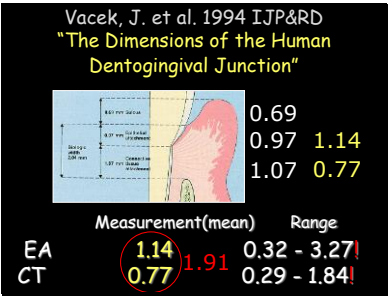
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[illegible][illegible][illegible]

Slide 52



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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

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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!!

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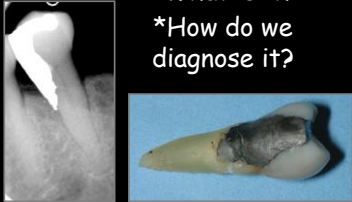
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Slide 55

**Biologic Width Violation!**

\*What is it?  
\*How do we diagnose it?



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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)



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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. [Glickel et al. J Prosthet Dent. 2000 Jul-Aug;83\(4\):344-8.](#)

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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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Slide 59

Common Locations:

Interproximal areas



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Slide 60

Correcting Biologic Width Violations

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

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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)

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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)

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



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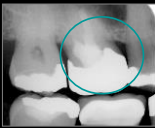

Slide 63

**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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Slide 64

UNDERSTANDING GINGIVA  
AND THE DENTO-GINGIVAL  
COMPLEX

- › Gingival Development
- › Gingival Micro Anatomy
- › Gingival Macro Anatomy

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Slide 65

Gingival Anatomy



What about the papillae??!!

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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.



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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

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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)

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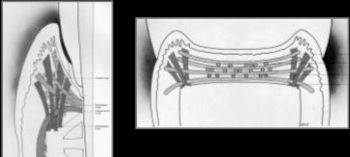
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Slide 69

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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Slide 70

**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-Velden (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.

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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)

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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.

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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!!*

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Slide 74

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

- ✓ Restorative treatment
- ✓ Orthodontic treatment

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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!!*)

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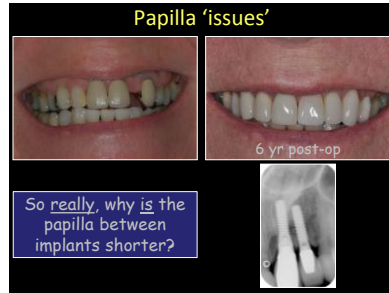
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Slide 76



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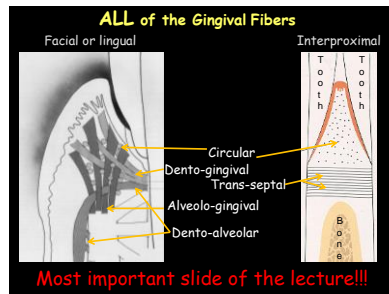
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Slide 77



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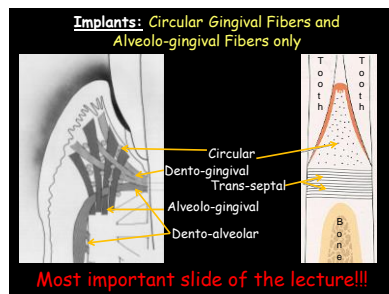
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Slide 78



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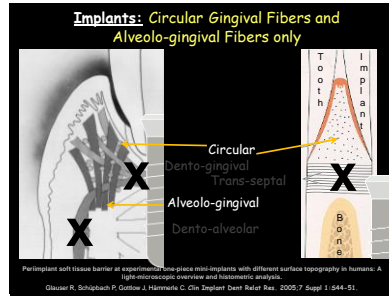
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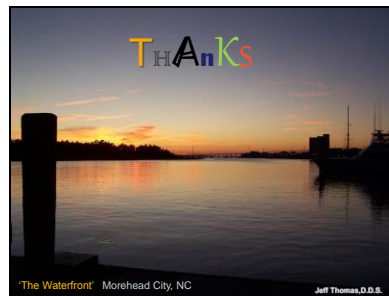
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Slide 79



Slide 80

[illegible]