



Limiting Implant Restorative Complications

*“Defeating the restorative
Limiting Implant Restorative
most frequent type of implant
restorative complication”*

Two Categories of Implant Complications:

Prosthetically Driven

- Early failures
- Peri-mucositis
- Peri-implantitis
- Vital structure injury
- Bone Necrosis

Implant Treatment Planning

Two Categories of Implant Complications:

II. Technical (Biomechanical):

- Loss of pre-load
- Prostheses failure
- Screw fracture
- Implant fracture

“Factors in Implant Treatment Planning”

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“Factors in Implant Treatment Planning”

- *Implant site assessment*
- *Inter-arch, inter-proximal and inter-implant space limitations*
- *Number, size and location*
- *3D Implant planning and positioning*
- *Maintenance*



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“Implant Treatment Planning Questions”

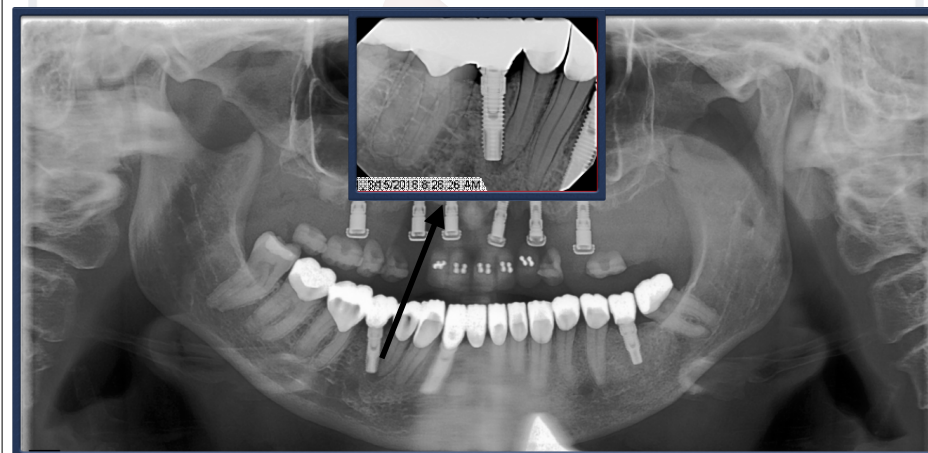
Implant Site Assessment

- **Tooth or root proximity to the implant site¹**
- **Adjacent tooth with a periapical lesion¹**
- **Insufficient width → implant fenestration or dishiscence²**
- **Proximity to vital structures (IA canal, mental foramen, sinus, nasal floor...etc)**
- **CBCT's...standard of care?**
- **Evaluate the keratinized tissue²**



1. Shabahang S, Bohsali K, Boyne PJ et al. Effect of teeth with periapical lesions on adjacent dental implants. Oral Surg Oral Med 2003;96:321-6
2. Kalpidis CD, Setayesh RM. Hemorrhaging associated with endosseous implant placement in the anterior mandible: a review of the literature. J Periodontal 2004;75:631-45

7



8

“Implant Treatment Planning Questions”

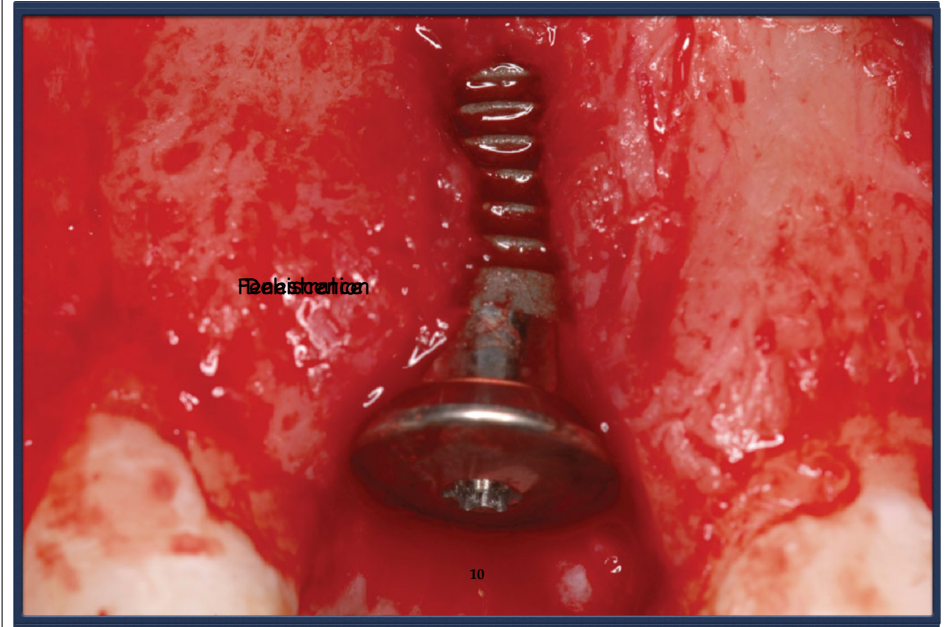
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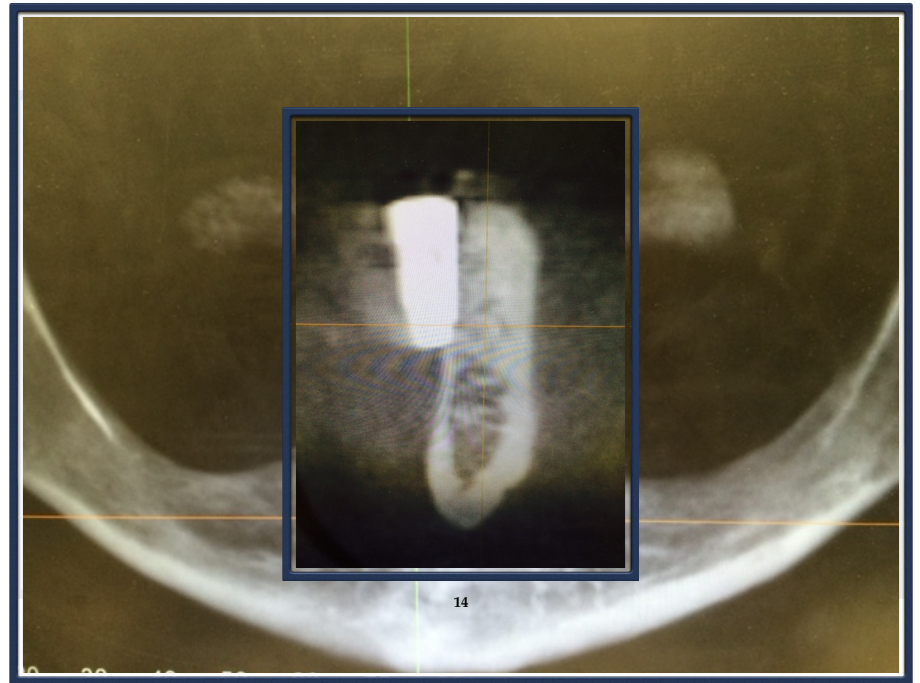
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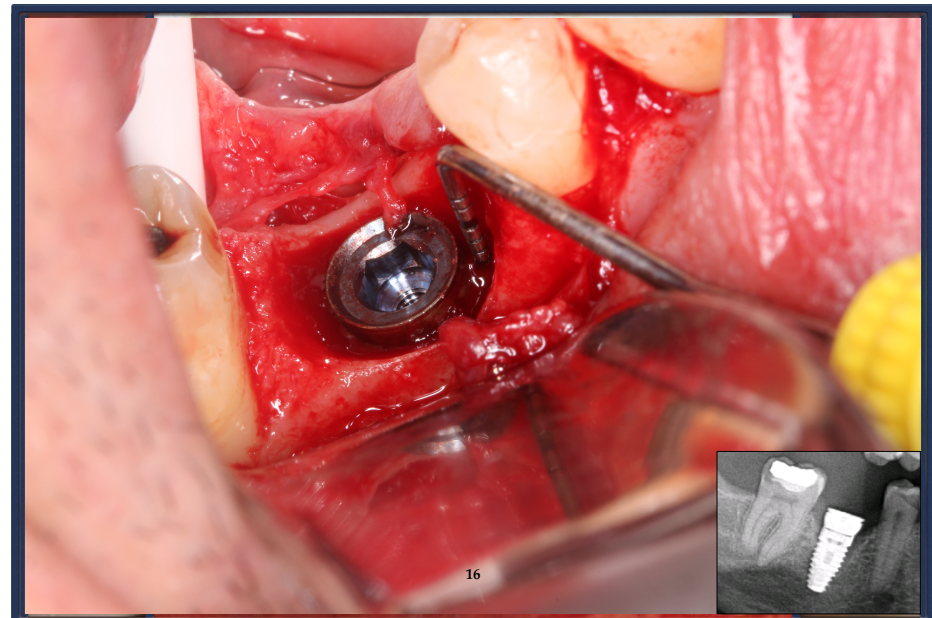
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How do you evaluate restorative space for partially dentate cases requiring implants?

Accurately Mounted Casts!!!

QUESTION?



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“Factors in Implant Treatment Planning”

Interarch, Interproximal and Inter-implant Space Limitations/Dentate

- Occlusal clearance?¹ (Cement retained >8mm) (Screw retained >4mm)
- Inter-Implant space limitations?² (3mm/implants) (1.5mm/teeth)
- Mesial/Distal space limitations?¹ (Standard 4.3mm platform→ (7.3mm)
- Multiple adjacent implants in the aesthetic zone?^{2,3} Papilla? Black Triangles?



1. Teugheuls W et al. Critical horizontal dimensions of interproximal and buccal bone around implants for optimal esthetic outcomes: a systematic review. Clin Oral Implants Res 2009;20:134-45
2. Tarnow DP, Cho SC, Wallace SS. The effect of inter-implant distance on the height of inter-implant bone crest. J Periodontol 2000;71:546-9
3. Salama H, Salama MA, Garber D, Adar P. The interproximal bone height: a guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. Pract Periodontics Aesthet Dent 1998;10:1131-41

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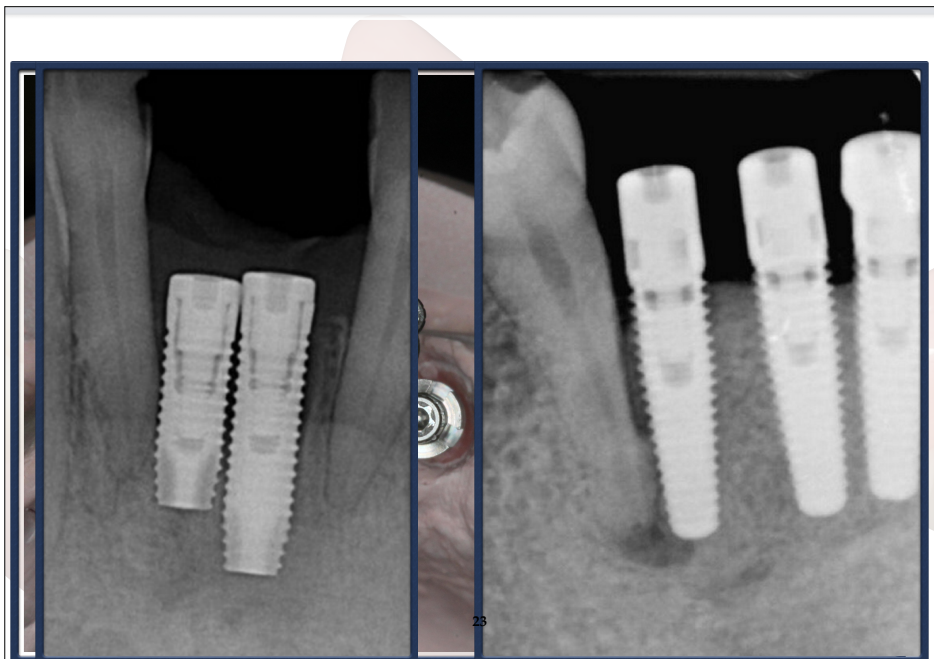
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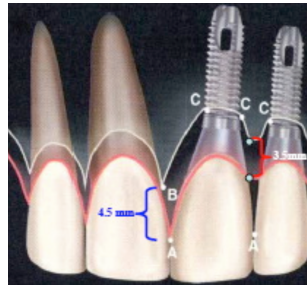
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Class	Restorative Environment	Proximity Limitations	Vertical Soft tissue imitations
1	Tooth-Tooth	1	5.0 mm
2	Tooth-Pontic	N/A	6.5 mm
3	Pontic-Pontic	N/A	6.0 mm
4	Tooth-Implant	1.5 mm	4.5 mm
6	Implant-Pontic	N/A	5.5 mm
6	Implant-Implant	3 mm	3.5 mm



What type of implant retained
QUESTION?

**Cement
Retained**



**Screw
Retained**

VS

Pros
Esthetic
Malposition*
Control Occlusion
Cons
Retrievable
**Cement
Retained**

Cons
Unesthetic
Malposition
Control Occlusion
Pros
Retrievable
**Screw
Retained**

& Peri-Implantitis

- **Bacterial colonization**
- **Foreign body reaction**
- **Allergic reaction**
- **Titanium corrosion**

Cement!!!



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Cement & Peri-Implantitis

Bacterial Colonization

A. actinomycetemcomitans

P. gingivalis

F. nucleatum

1. Wadhvani CP. Peri-implant disease and cemented implant restorations; a multifactorial etiology. *Compend Contin Educ Dent* 2013;34:32-37
2. Raval et al. The interaction of luting cements and oral bacteria linked to peri-implant disease. *Clin Implant Dent Relat Res* 2014



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Cement & Peri-Implantitis

Bacterial Colonization

TempBond

TempBond NE

Zinc Phosphate

Premier IC

Multilink IC

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Cement & Peri-Implantitis

- **Bacterial colonization**
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Cement & Peri-Implantitis

Foreign Body Reaction

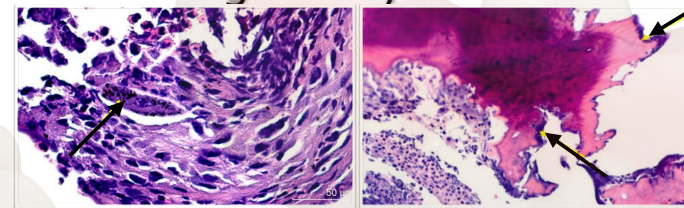
Cement particles were found in peri-implant tissues associated with failing implants

1. Ramer N et al. Histologic findings within peri-implant soft tissues in failed implants secondary to excess cement; report of two cases. NY State Dent J 2014;80(2):43-46
2. Wilson TG et al. Foreign bodies associated with peri-implantitis human biopsies. J Periodontal 2015; 86(1):9-15

33

Cement & Peri-Implantitis

Foreign Body Reaction

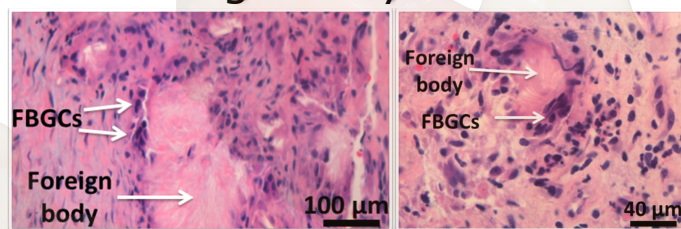


1. Tatullo M et al. Bone inflammation, Bone infection and dental implants failure: histological and cytological aspects related to cement. J Bone Joint Infect 2017; 2(2): 84-89
2. Ramer N et al. Histologic findings within peri-implant soft tissues in failed implants secondary to excess cement; report of two cases. NY State Dent J 2014;80(2):43-46
3. Wilson TG et al. Foreign bodies associated with peri-implantitis human biopsies. J Periodontal 2015; 86(1):9-15

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Cement & Peri-Implantitis

Foreign Body Reaction



1. Sheikh Z et al. Macrophages, foreign body giant cells and their response to implantable biomaterials. Materials 2015; 8:5671-5701

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Cement & Peri-Implantitis

Foreign Body Reaction

- Ultrasonic cleaning instruments
- Cementation (Retraction cord?)
- Cement film thickness

1. Ramer N et al. Histologic findings within peri-implant soft tissues in failed implants secondary to excess cement; report of two cases. NY State Dent J 2014;80(2):43-46
2. Wilson TG et al. Foreign bodies associated with peri-implantitis human biopsies. J Periodontal 2015; 86(1):9-15

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Cement & Peri-Implantitis

- *Bacterial colonization*
- *Foreign body reaction*
- *Allergic reaction*
- *Titanium corrosion*



37

Cement & Peri-Implantitis

Allergic Reaction

“Resin modified glass ionomers are the most widely used dental cement on the market today”

1. Nicholson JW et al. The biocompatibility of resin modified glass ionomer cements in dentistry. Dent Mater 2008;24(12):1702-8

38

Cement & Peri-Implantitis

Allergic Reaction

HEMA

(2-hydroxyethyl methacrylate)

1. Nicholson JW et al. The biocompatibility of resin modified glass ionomer cements in dentistry. Dent Mater 2008;24(12):1702-8

39

Cement & Peri-Implantitis

Allergic Reaction

HEMA is cytotoxic up to 48-72 hours following cementation

1. Nicholson JW et al. The biocompatibility of resin modified glass ionomer cements in dentistry. Dent Mater 2008;24(12):1702-8

40

Cement & Peri-Implantitis

- *Bacterial colonization*
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Cement & Peri-Implantitis

Titanium Corrosion

“Cements containing fluoride should be avoided with dental implants”

1. Rodrigues DC et al. Titanium corrosion mechanisms in the oral environment: a retrieval study. Materials 2013,6(11):5258-74

42

Cement & Peri-Implantitis

Titanium Corrosion

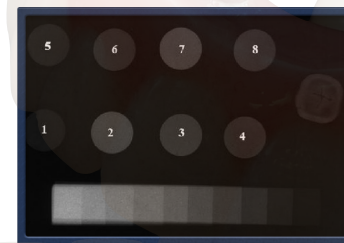
“Hydrofluoric acid is released under acidic conditions causing corrosion”

1. Rodrigues DC et al. Titanium corrosion mechanisms in the oral environment: a retrieval study. Materials 2013,6(11):5258-74

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Implant Cement

ISO 13116: Opacity of dental cements



Implant Cement

ISO 13116: Opacity of dental cements

Detectable

Non-Detectable

Rely X Luting Plus
Rely X Unicem
Tempbond
Tempbond/NE
Zinc Phosphate
Improv IC
Premier IC

1. Wadhvani CP et al. Radiographic detection and characteristic patterns of residual excess cement associated with cement-retained implant restorations: a clinical report. J Prosthet Dent 2012;107(3):151-7

45

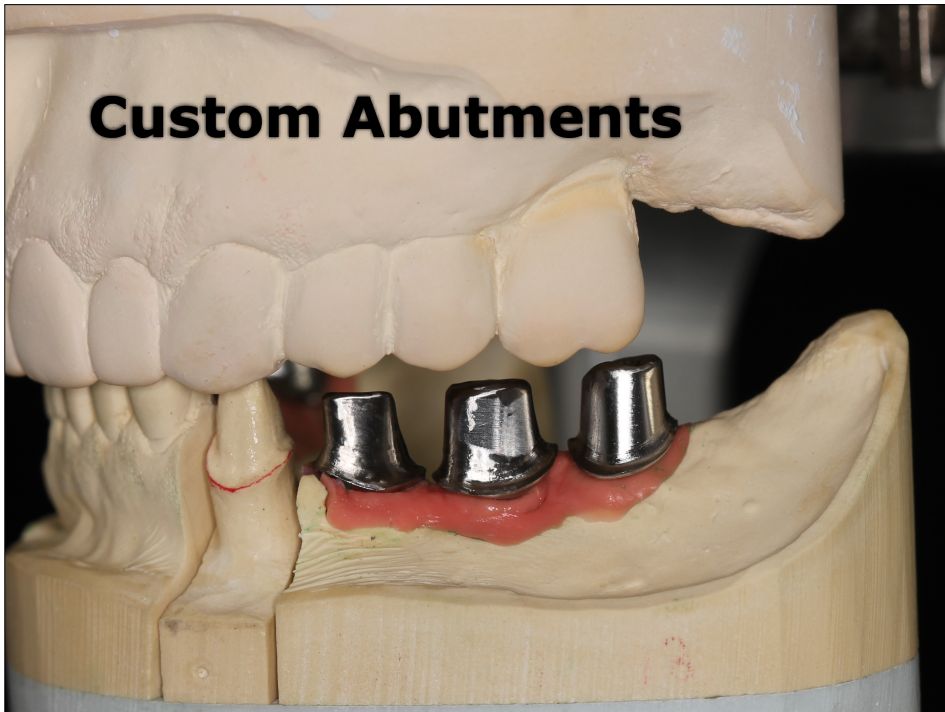
Is there a predictable way to control the cement???

QUESTION?



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Custom Abutments



Chairside Cementation Jig



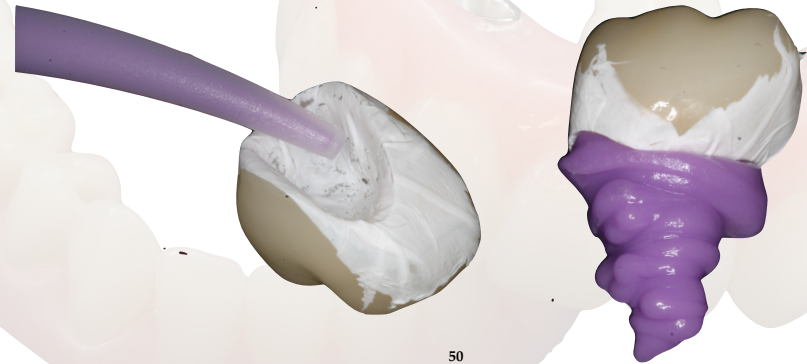
48

Chairside Cementation Jig



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Chairside Cementation Jig



50

Chairside Cementation Jig



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Printed Cementation Jig



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Printed Cementation Jig



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Esthetics & Occlusion???

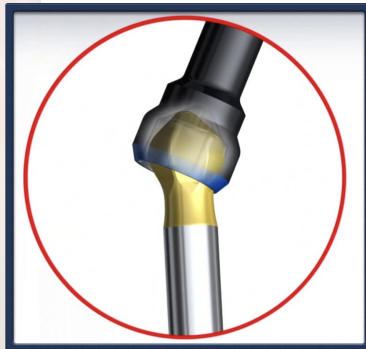
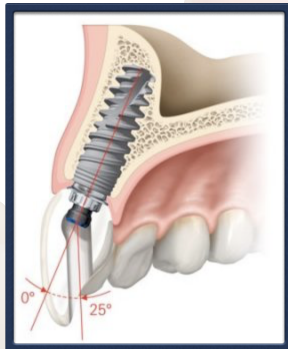
Screw Retained



54

Screw Retained

Ideal Position???



Images Provided by Nobel Biocare

55

Screw Retained

Ideal Position???

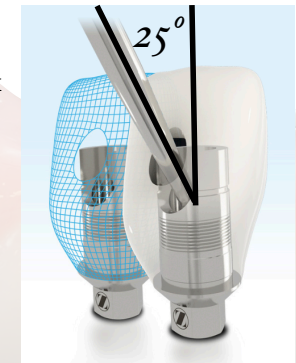
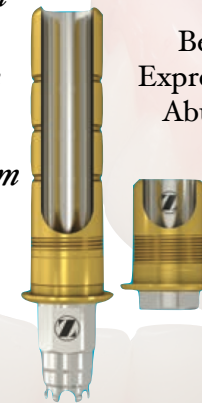
12 mm

9 mm

7 mm

4.75 mm

BellaTek
Express & Flex
Abutments

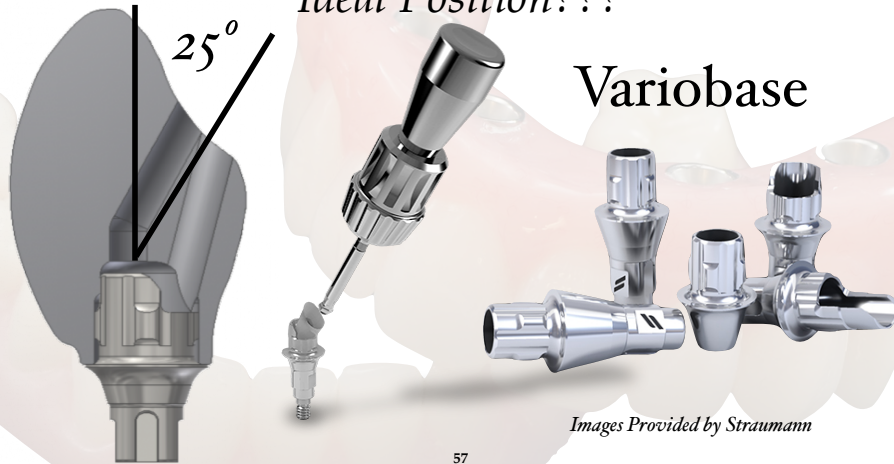


Images Provided by Zimmer

56

Screw Retained

Ideal Position???



57

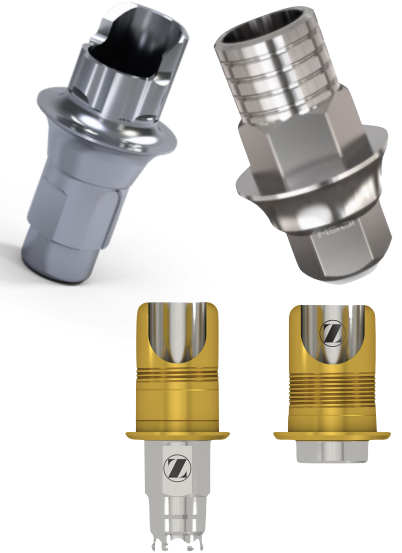
Ti-Base Abutments

Advantages:

- Angled screw channel
- Management of narrowly placed implants
- Cost effective

Disadvantages:

- Less surface area for bonding
- Lack of support for restorative material

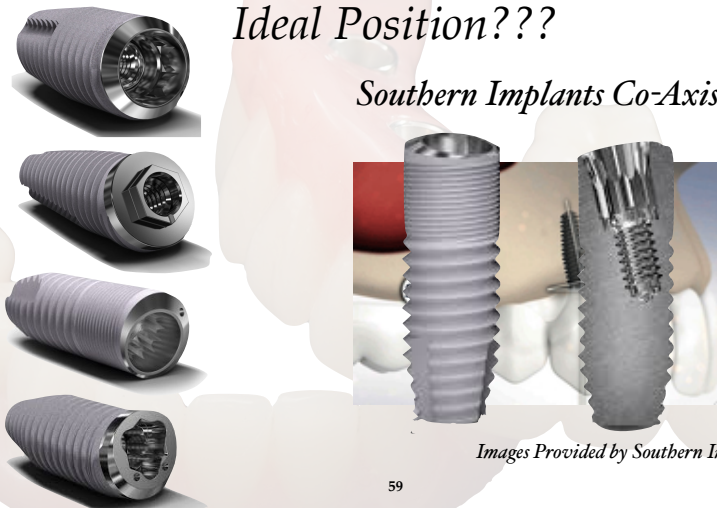


58

Screw Retained

Ideal Position???

Southern Implants Co-Axis



Images Provided by Southern Implants

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What about a screwmentable
QUESTION?

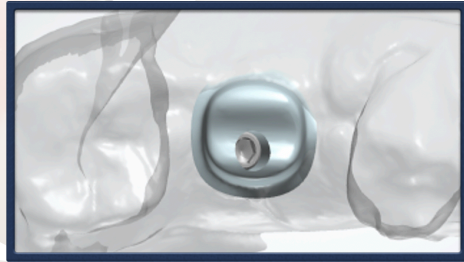


60

Screwmentable??



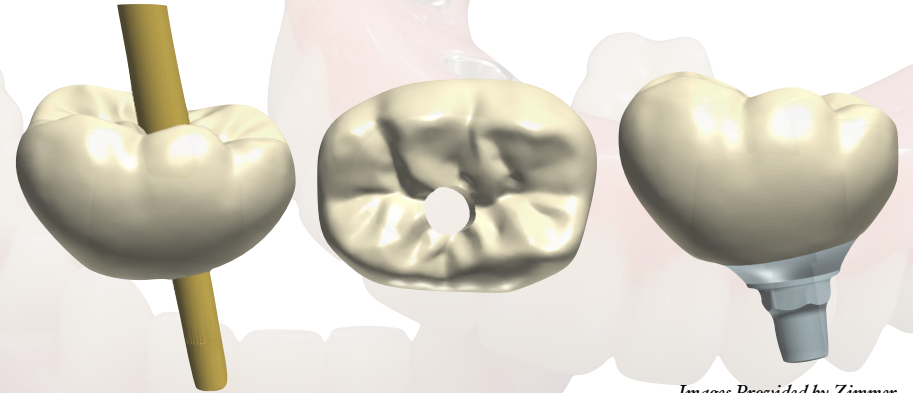
Custom Abutment



Images Provided by Zimmer

61

Screwmentable??



Images Provided by Zimmer

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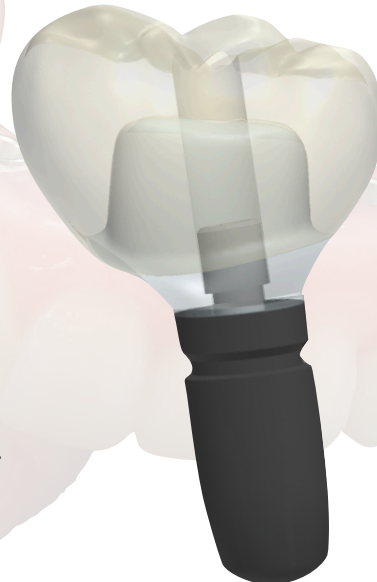
Screwmentable??

Advantages:

- Control of cement!!!!
- Control of contour
- Larger surface area for luting
- Support for the crown material

Disadvantages:

- Lack of angled screw channel
- Cost
- Bound by designing limitations of the manufacturer



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Why do prosthetic screws loosen???

QUESTION?

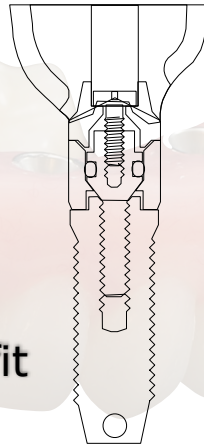


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"Joint Opening Conditions"

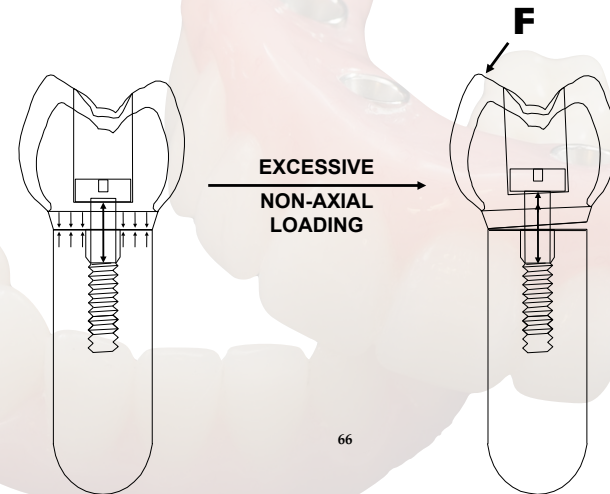


- Off axis loading
- Cantilever loading
- Inadequate pre-load
- Torque wrench?
- Inaccurate prosthesis fit



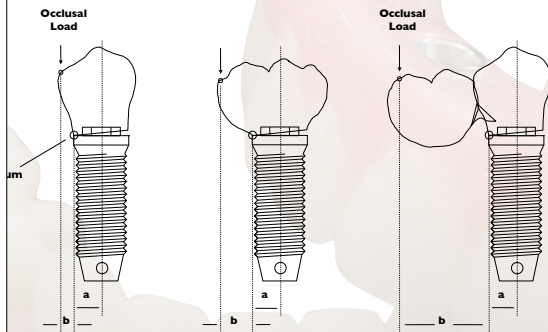
65

Non-axial/cantilever loading



66

Non-axial/cantilever loading



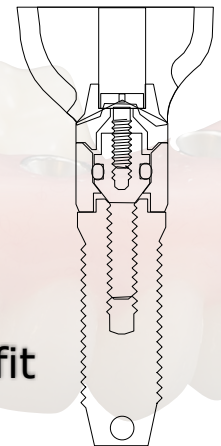
If external loading induces tension in the screw exceeding the preload, the screw may plastically deform, loosen, and the joint may open.

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"Joint Opening Conditions"



- Off axis loading
- Cantilever loading
- Inadequate pre-load
- Torque wrench?
- Inaccurate prosthesis fit

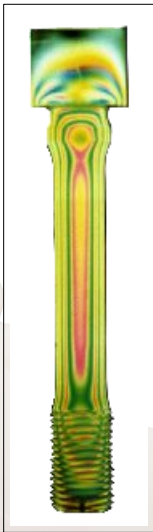


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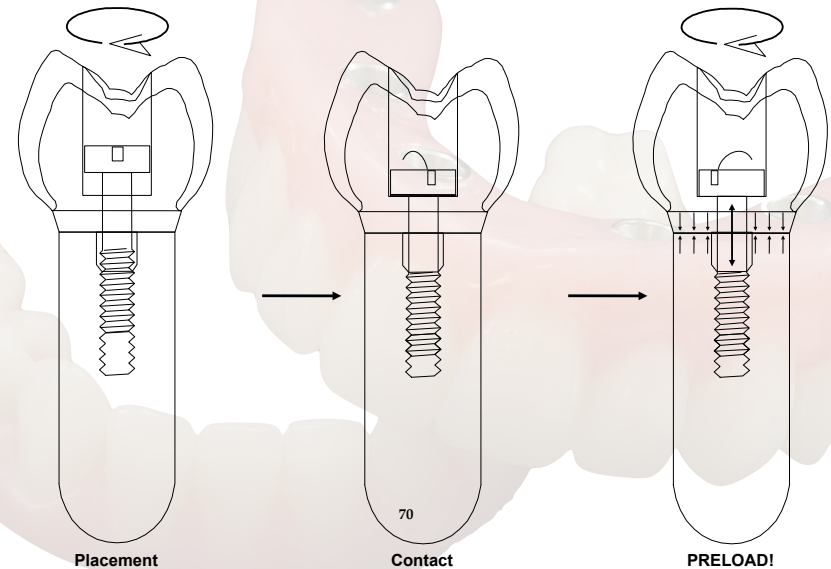
Preload

...the tension developed in the screw as it is tightened...

...75% of the yield strength...



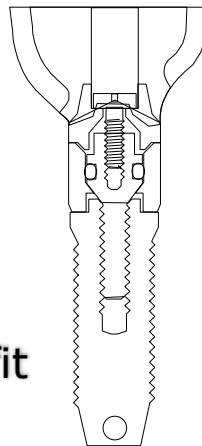
69



"Joint Opening Conditions"



- Off axis loading
- Cantilever loading
- Inadequate pre-load
- Torque wrench?
- Inaccurate prosthesis fit



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Toggle/Friction-Type Wrench



"At higher torque values the spring arm was significantly more accurate"

Beam/Spring-Arm Wrench



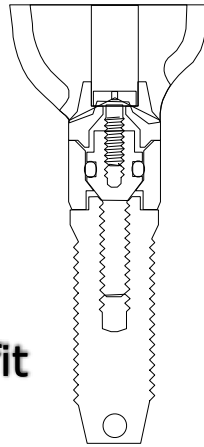
1. Wadhvani C et al. Testing and calibrating the mechanical-type toggle torque wrenches used in implant dentistry: A dental technique. J Pros Dent 2020;123:403-407
2. McCracken MS et al. Variability of mechanical torque-limiting devices in clinical service at a US dental school. J Prosthodont 2010;19:20-4

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"Joint Opening Conditions"



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- Cantilever loading
- Inadequate pre-load
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- Inaccurate prosthesis fit

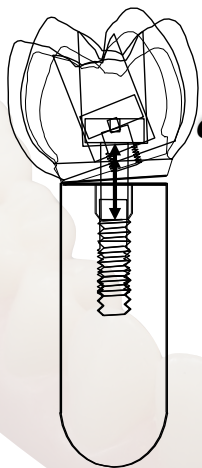


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Upon placement, the prosthesis should not induce stress in:

- Restorative components
- Implant
- Bone-implant interface
- Peri-implant osseous tissues

74



If implant components do not fit accurately and passively then excessive stresses are applied to the screw
...placing the joint components at risk of being damaged.

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"Implant Commandments"

- I. Use only authentic manufacturers parts
- II. Manufacturers torque value
- III. Torque wrench calibration
- IV. Limit tightening and loosening screws

C Wadhvani; Nobel Biocare; 2016

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How do I fabricate a passive framework ???

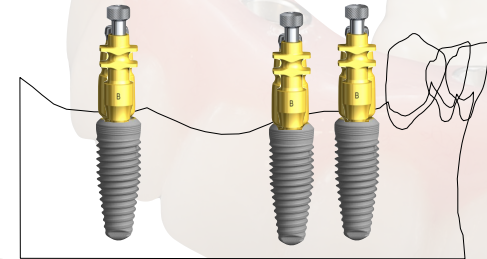
QUESTION?



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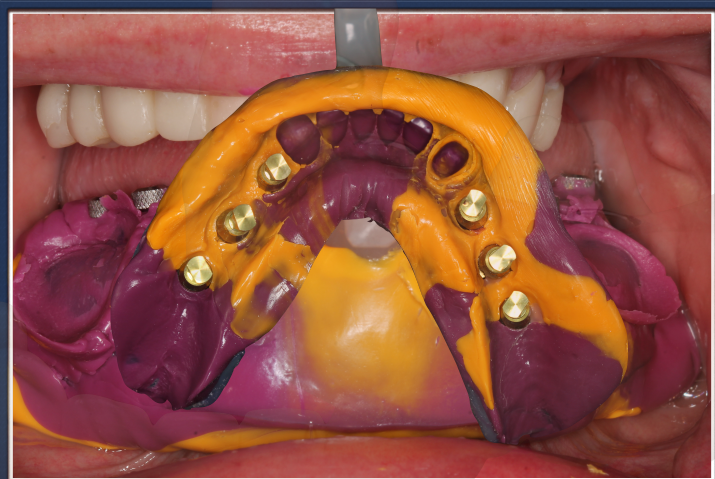


Splinted Implants Impression Imprecision



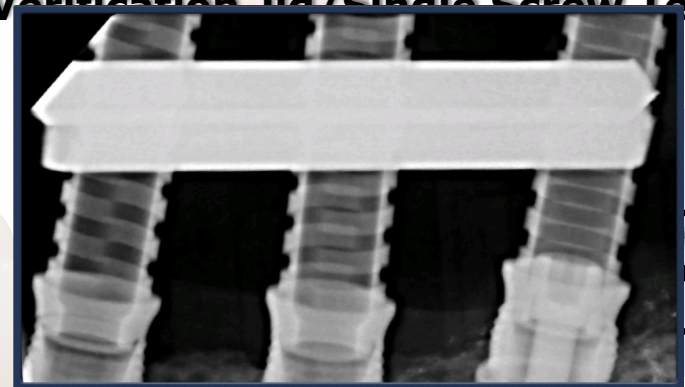
1. Sang-Jik Lee et al. Accuracy of five implant impression technique effect of splinting material and method. J Adv Prosthodontics. 2011; 3:177-85
2. E Dorigatti et al. Effect of splinting in accuracy of two implant impression techniques. J Oral Implant. 2014; 40:633-39

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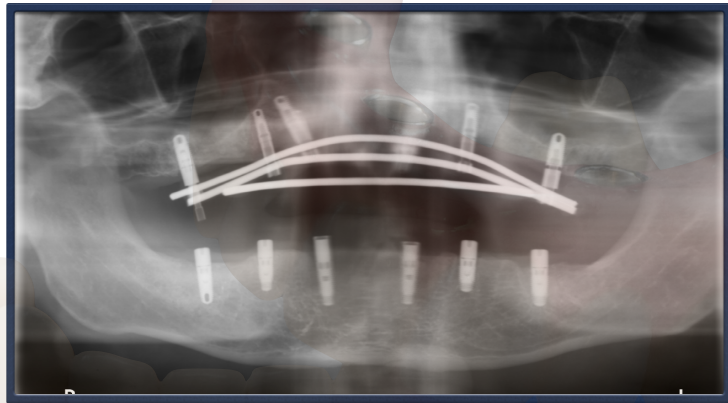


79

Splinted Implants Verification jig / Single Screw Test

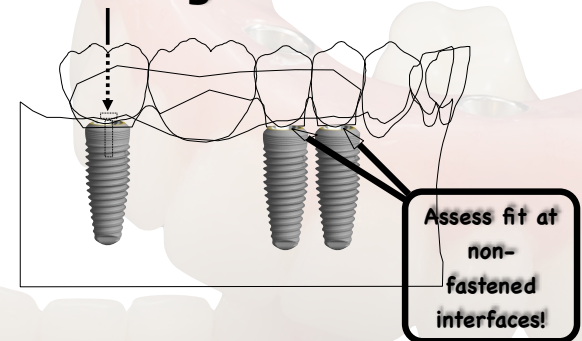


80



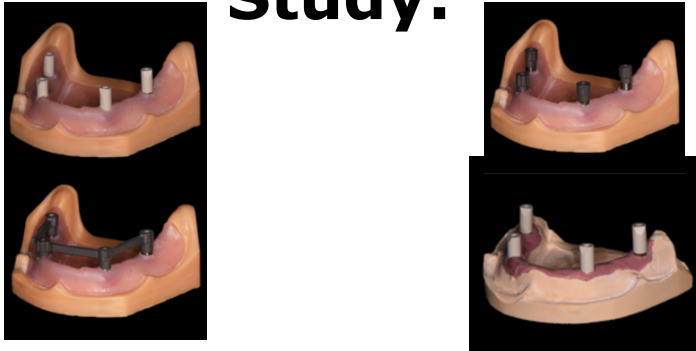
81

Splinted Implants The Single Screw Test



82

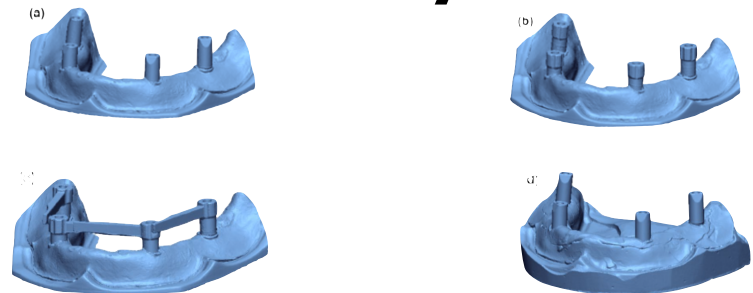
Analogue Impression vs Digital Impression Study:



Huang et al. Improved scanning accuracy with newly designed scan bodies: An in vitro study comparing digital versus conventional impression techniques for complete-arch implant rehabilitation. Clin Oral Impl Res 2020;31:625-33

83

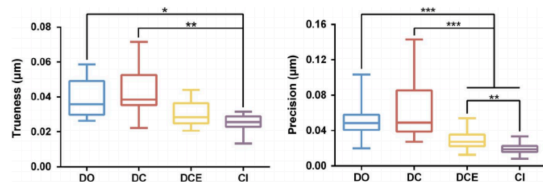
Analogue Impression vs Digital Impression Study:



Huang et al. Improved scanning accuracy with newly designed scan bodies: An in vitro study comparing digital versus conventional impression techniques for complete-arch implant rehabilitation. Clin Oral Impl Res 2020;31:625-33

84

Analogue Impression vs Digital Impression Study:



Huang et al. Improved scanning accuracy with newly designed scan bodies: An in vitro study comparing digital versus conventional impression techniques for complete-arch implant rehabilitation. Clin Oral Implants Res 2020;31:625-33

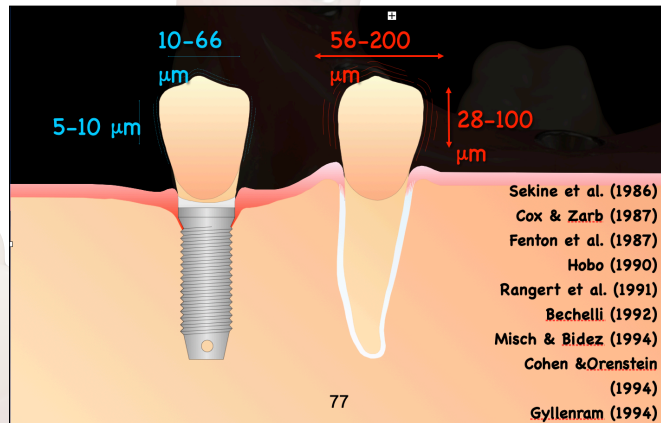
85

Should I apply the same principles of occlusion with my implant patients that I use for patients receiving conventional restorations???

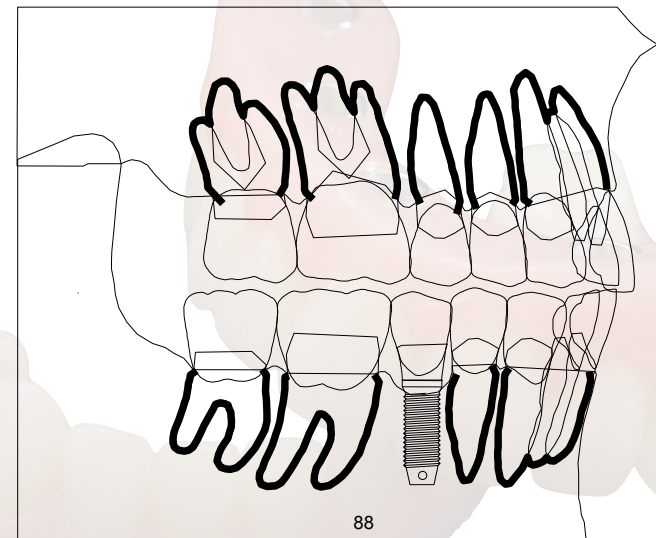


86

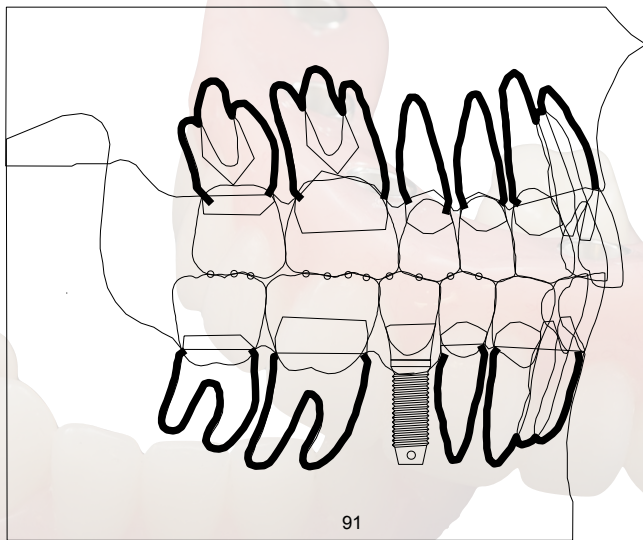
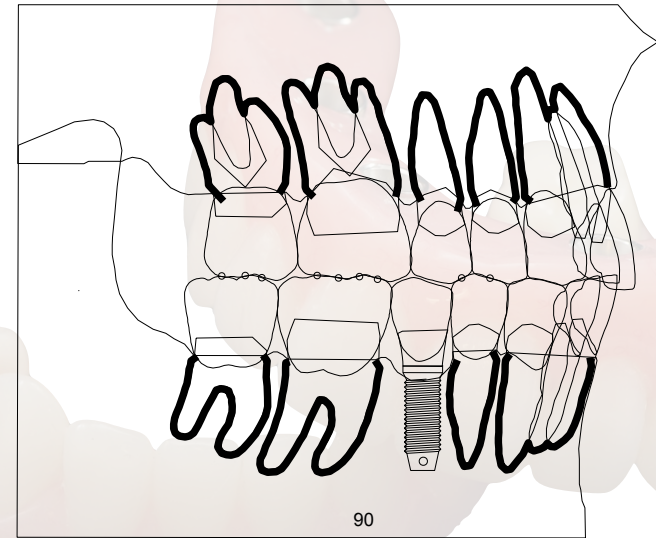
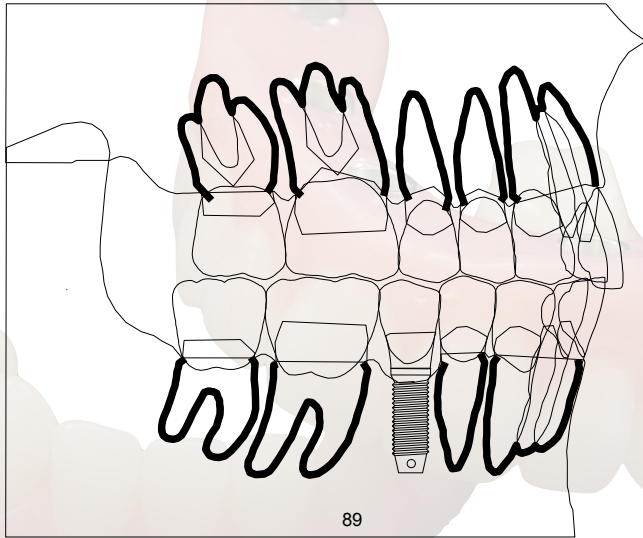
Differential Mobility



77



88

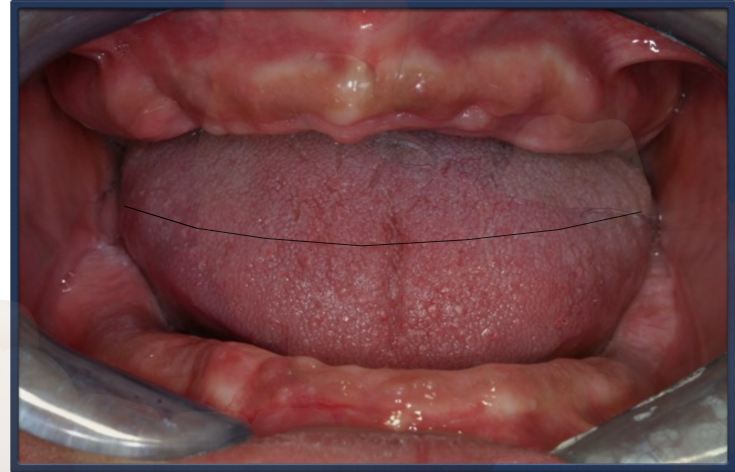


How do you evaluate inter-arch
space for a recent full denture case
requiring implants???

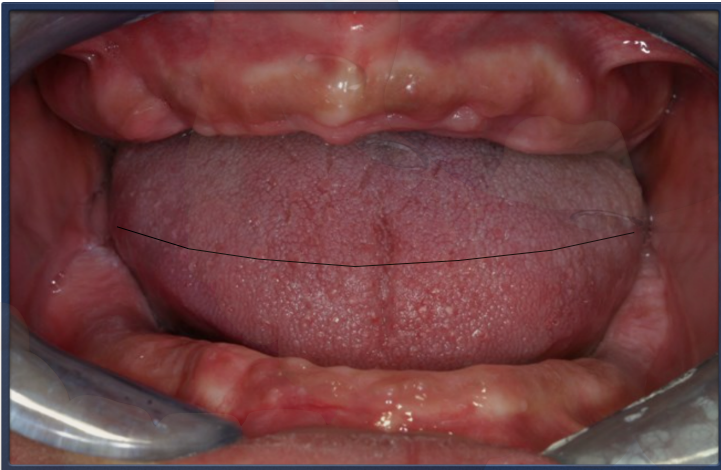




93



94



95

Implant Treatment Planning

**Inter Arch Limitations/
Edentulous**

Prosthetically Driven

- Existing Denture
- Wax Trial Denture

96

Implant Treatment Planning

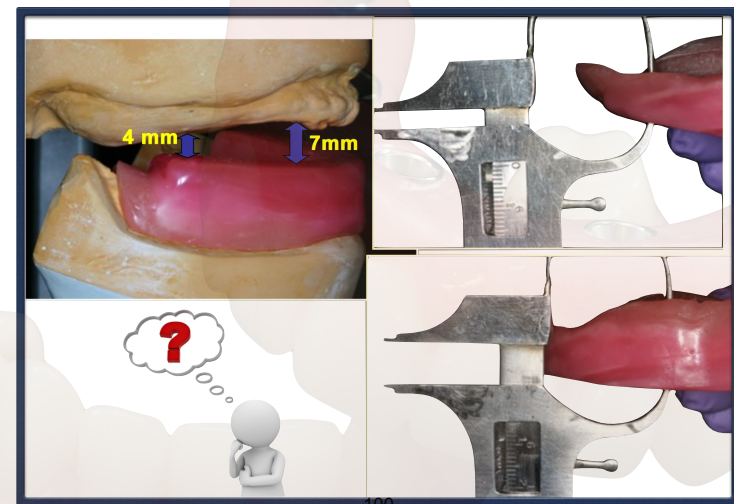
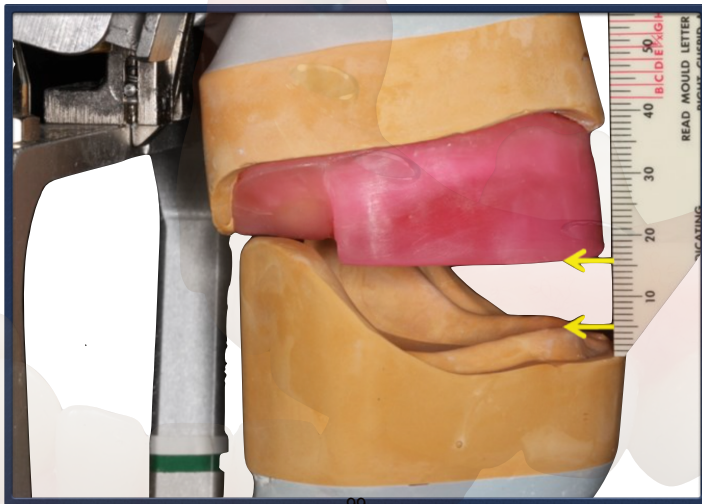
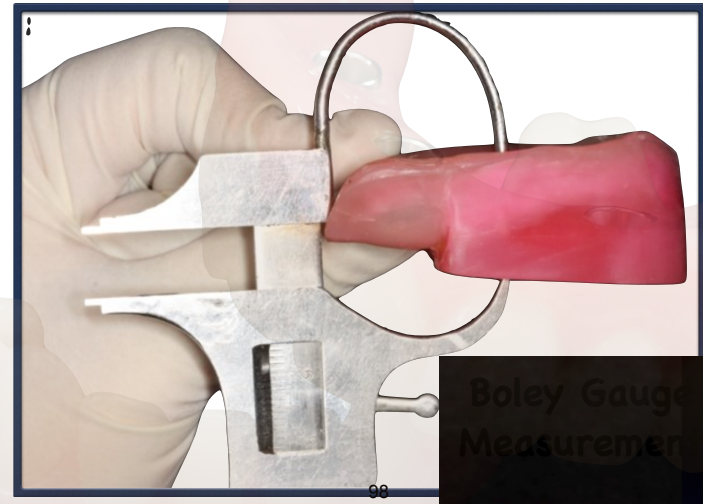
Inter Arch Limitations/ Edentulous Wax Rim

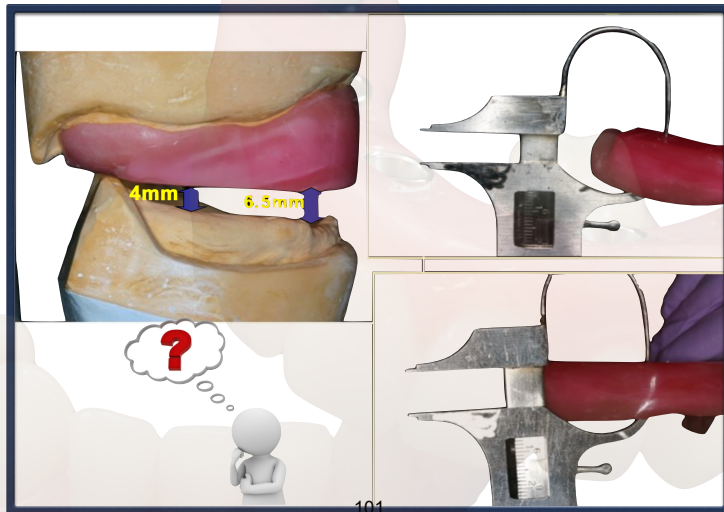
Direct measurement

CBCT measurement

Occlusal/Facial matrix

97





101



Digital Calipers

102

Implant Treatment Planning

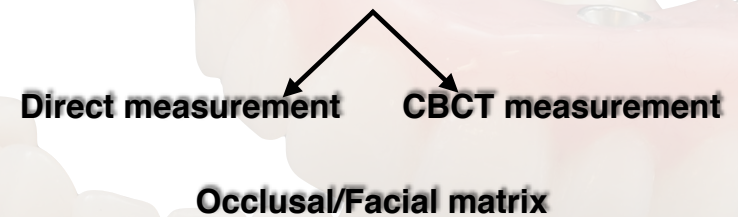
Inter Arch Limitations/ Edentulous

- Wax Rim
- Existing Denture
- Wax Trial Denture

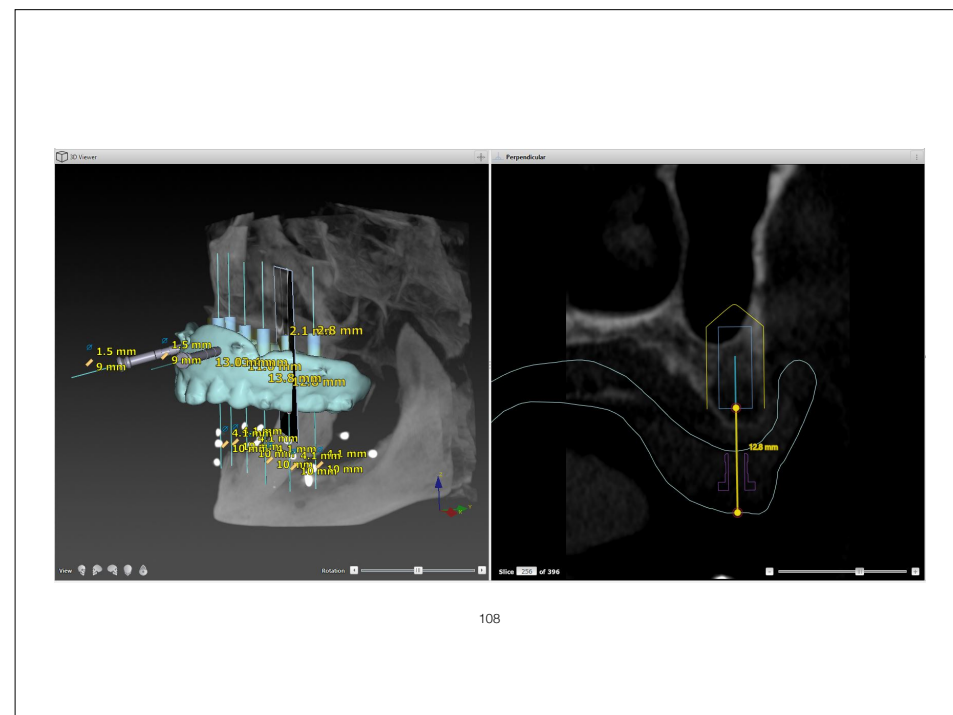
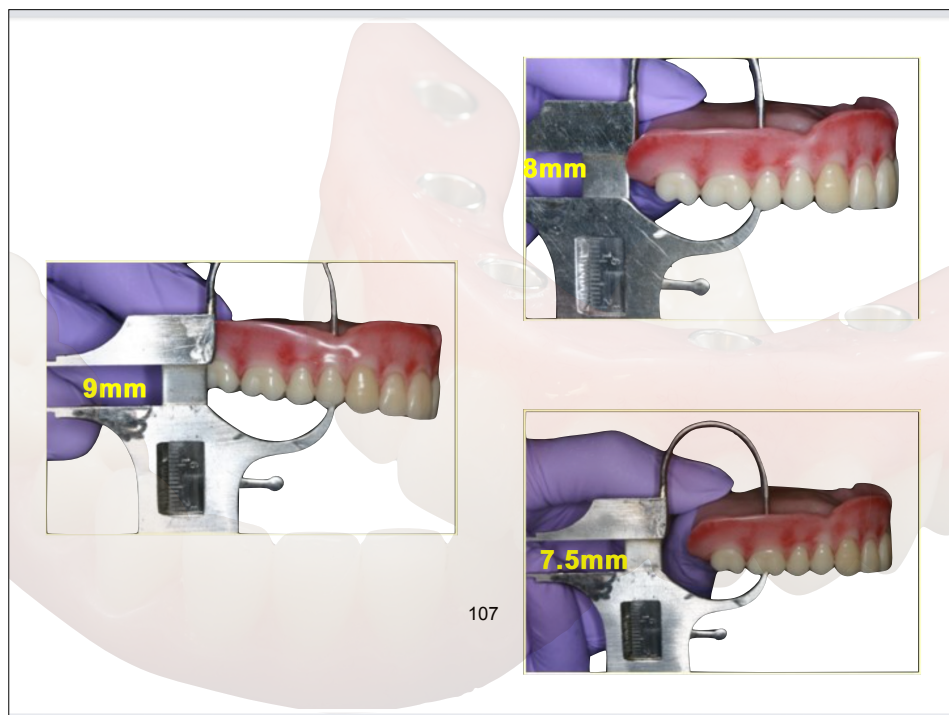
103

Implant Treatment Planning

Inter Arch Limitations/ Edentulous Existing Denture



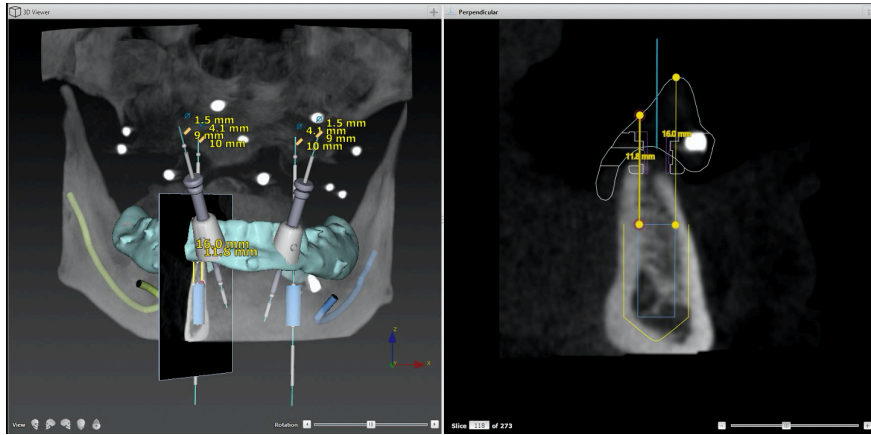
104



Implant Treatment Planning

Inter Arch Limitations/ Edentulous

- Wax Rim
- Existing Denture
- Wax Trial Denture

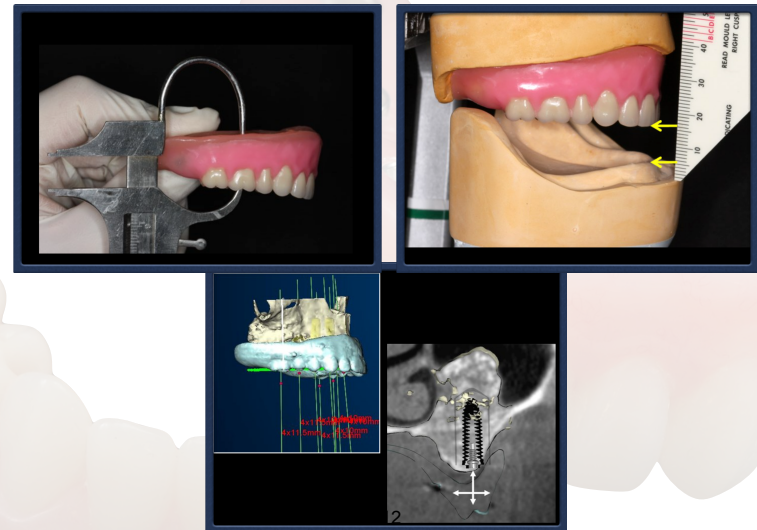


109

110

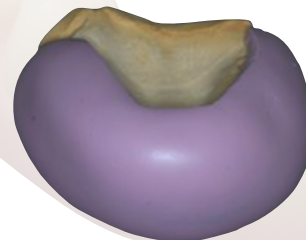


111

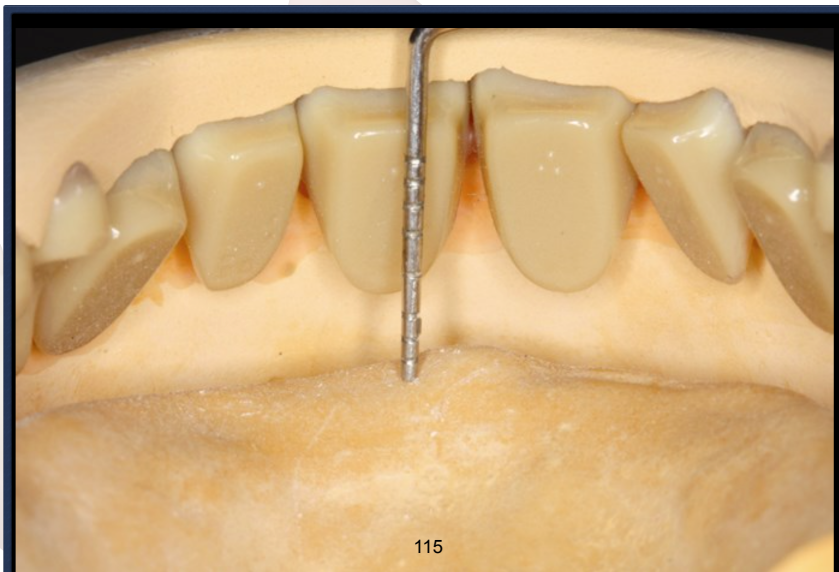




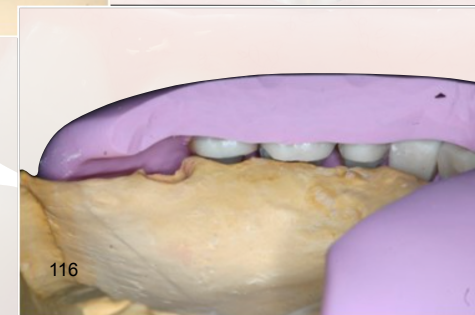
113



114



115



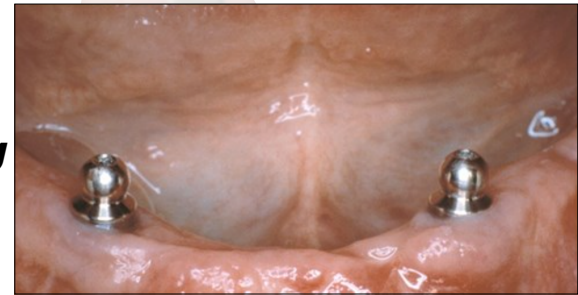
116

What type of implant overdenture
attachment is best?
QUESTION?



117

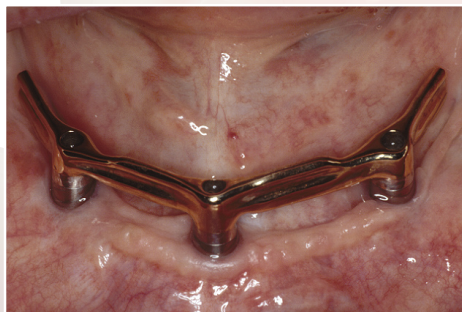
Ball & Ring



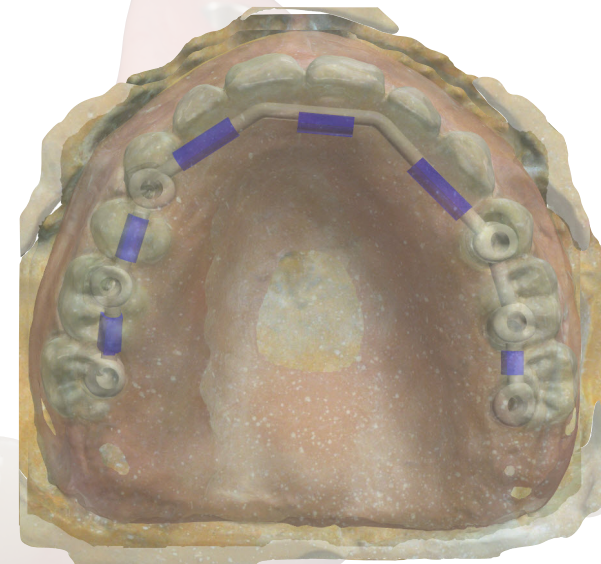
118

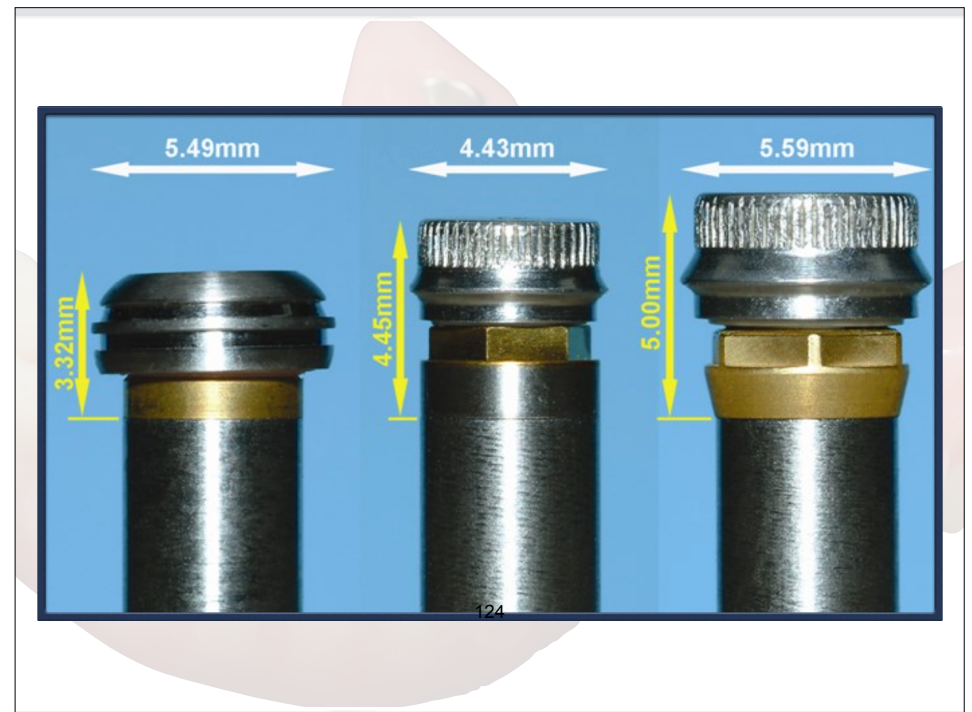
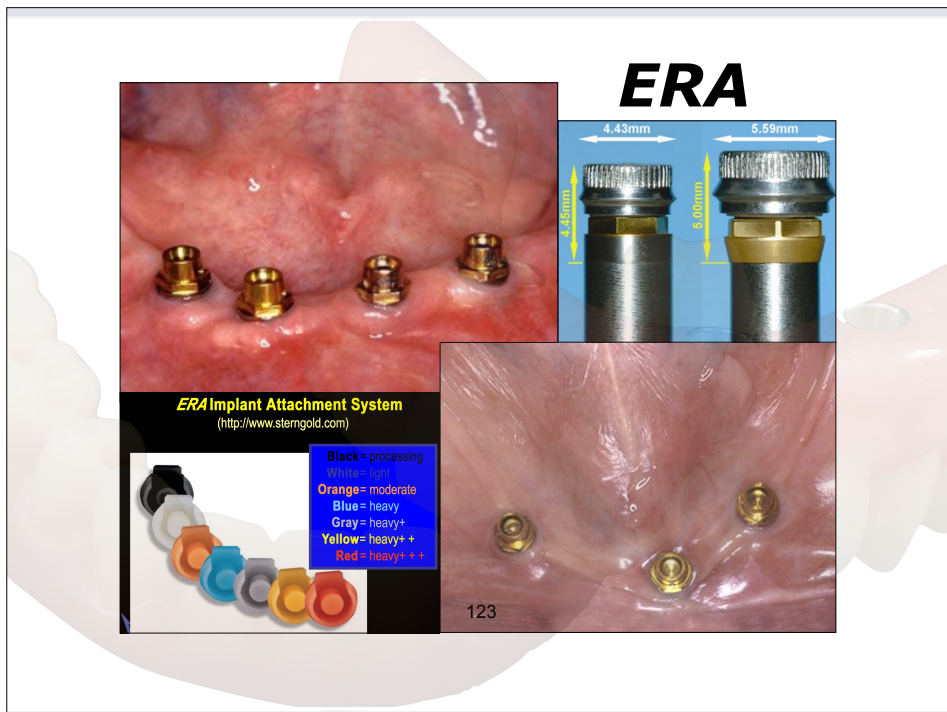
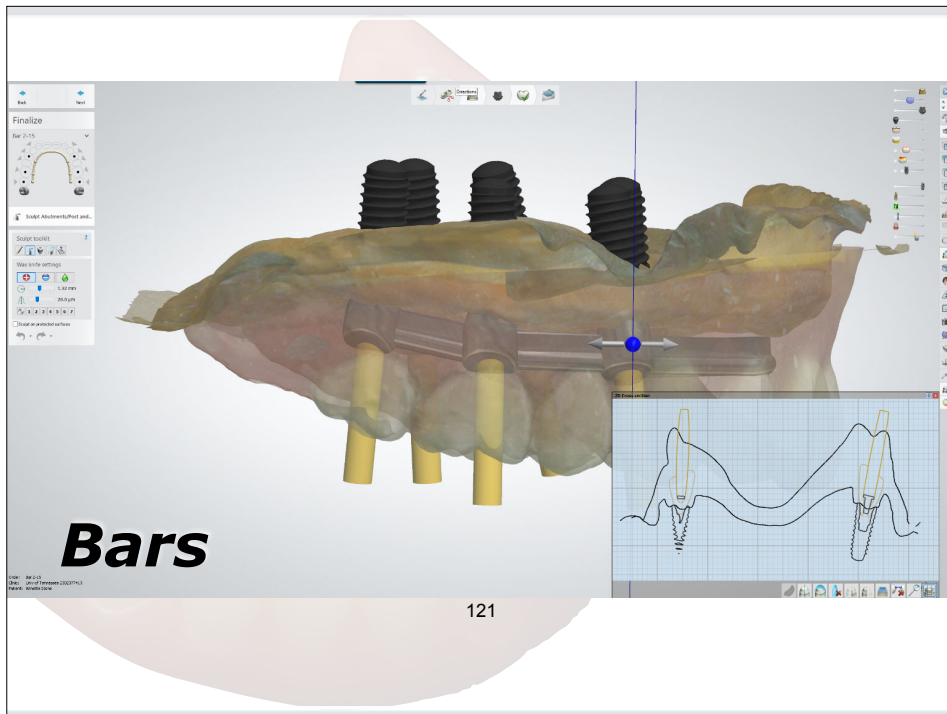


Bars

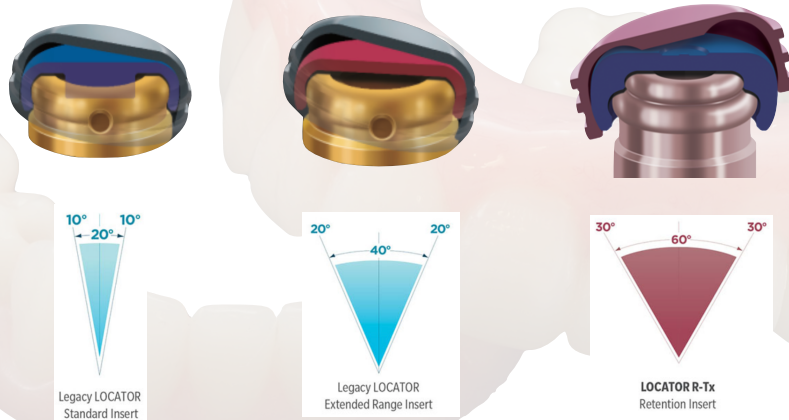


Bars





ZD LOCATOR



126

NOVALOC

MEDENTiKA®
A Straumann Group Brand



Retention insert color	Retention
red, extra light	approx. 300 g
white, light	approx. 750 g
yellow, medium	approx. 1200 g
green, strong	approx. 1650 g
blue, extra-strong	approx. 2100 g
black, ultra-strong	approx. 2550 g

Images Provided by Straumann

127

How much restorative space is required for an implant supported overdenture???

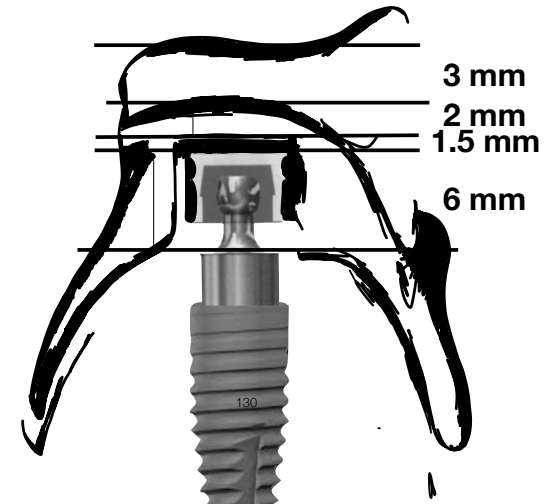


128



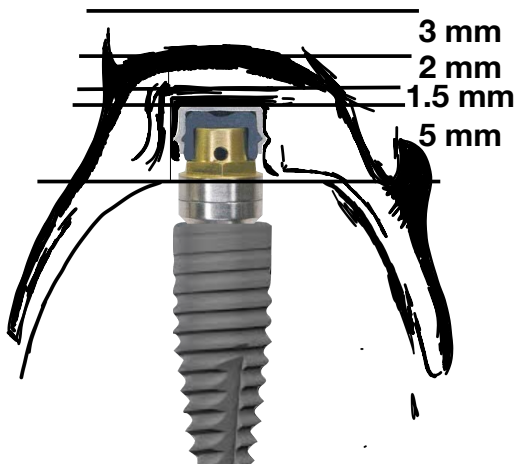
Ball Attachment

12.5 mm



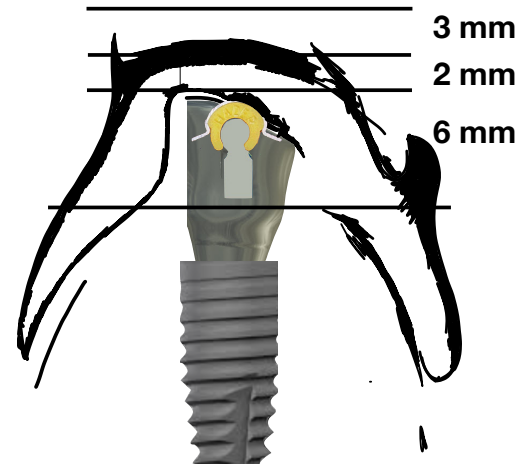
ERA Attachment

11.5 mm



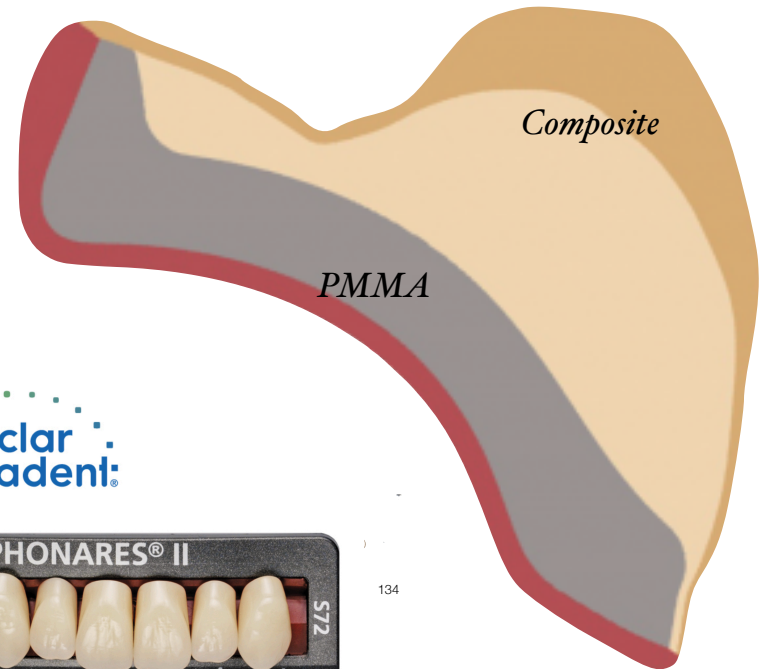
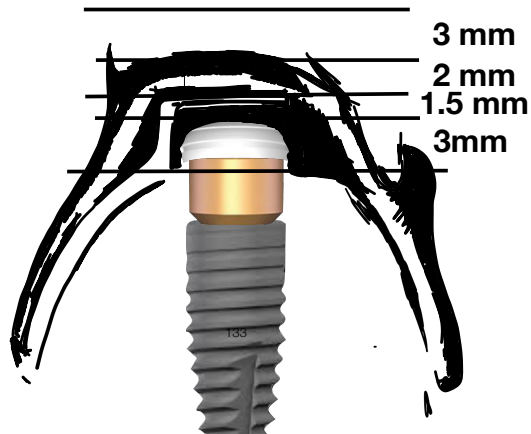
Bar Attachment

11 mm



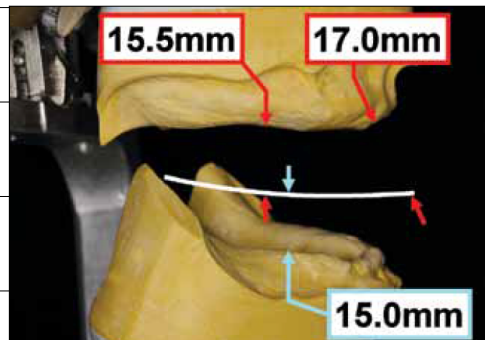
Locator Attachment

9.5 mm



Restorative Space Class I

Ball Attachments	✓	>12.5 mm
ERA	✓	>11.5 mm
Bar	✓	> 11 mm
Locators	✓	> 9.5 mm

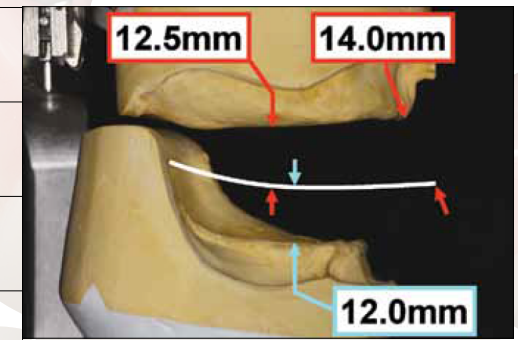


Ahuja, Cagna, J of Prosthetic Dent; 2011

135

Restorative Space Class II

Ball Attachments	✓	>12.5 mm
ERA	✓	> 11.5 mm
Bar	✓	> 11 mm
Locators	✓	> 9.5 mm

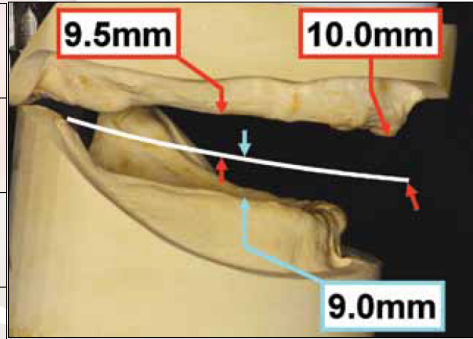


Ahuja, Cagna, J of Prosthetic Dent; 2011

136

Restorative Space Class III

Ball Attachments	! > 12.5 mm
ERA	! > 11.5 mm
Bar	! > 11 mm
Locators	? > 9.5 mm

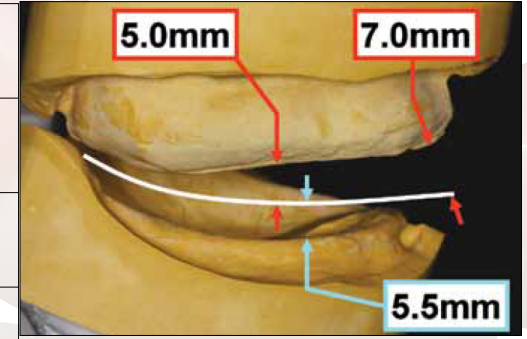


Ahuja, Cagna, J of Prosthetic Dent; 2011

137

Restorative Space Class IV

Ball Attachments	! > 12.5 mm
ERA	! > 11.5 mm
Bar	! > 11 mm
Locators	! > 9.5 mm



Ahuja, Cagna, J of Prosthetic Dent; 2011

138

??????????

How much restorative space is required for a fixed denture???

QUESTION?



139

Metal Resin



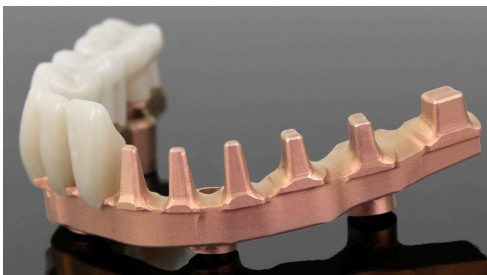
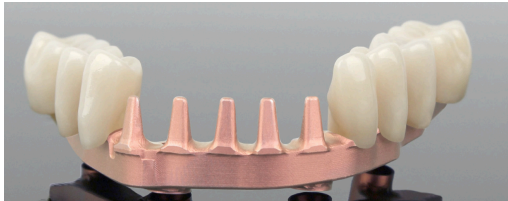
Metal Resin



Zirconia/Ti-Base



Thimble Frame

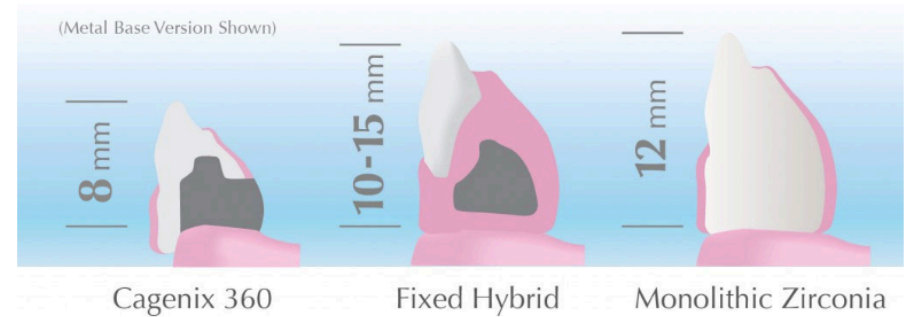


Thimble Frame

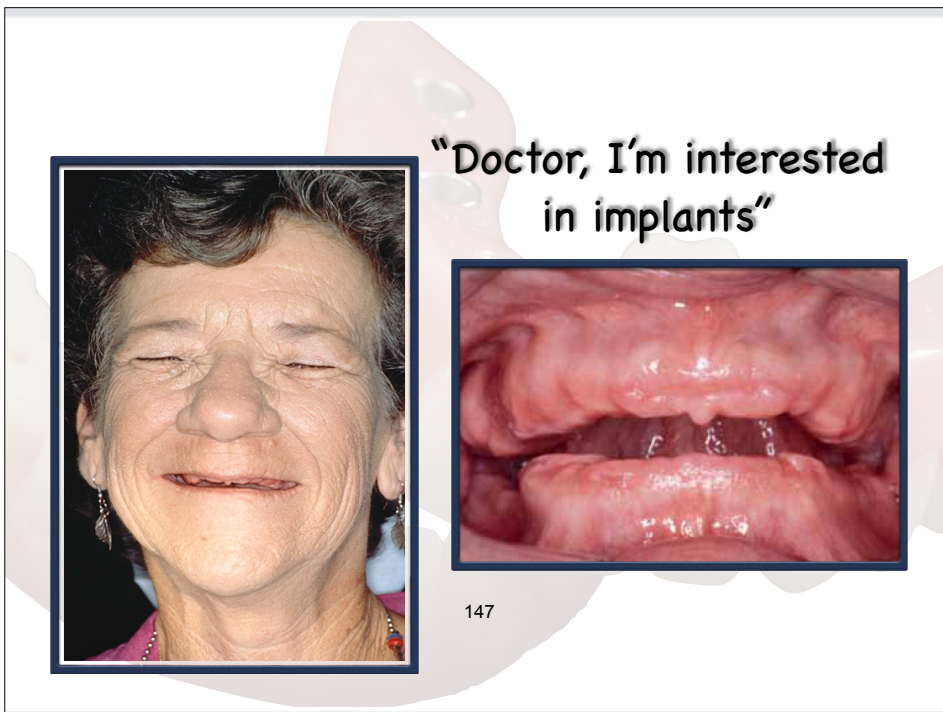




Restorative Space



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Methods to Increase Restorative Space for Edentulous Patients?

- **Increase OVD**
- **Alveoplasty**
- **Attachment Selection**
- **Prosthetic Design**

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Methods to Increase Restorative Space for Edentulous Patients?

OVD?

- **Compromise freeway space**
- **Discomfort in the temporalis muscles**
- **Fabricate a treatment prosthesis**
- **More efficient with a mandibular prosthesis**

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Methods to Increase Restorative Space for Edentulous Patients?

- **Increase OVD**
- **Alveoplasty**
- **Attachment Selection**
- **Prosthetic Design**

Methods to Increase Restorative Space for Edentulous Patients?

Alveoplasty?

- **Most predictable means of creating restorative space**
- **Successfully completed before implant placement**
- **Nerve repositioning surgeries and successful sinus graft surgeries allowed this procedure to be utilized in all areas of the jaw.**
- **Alveoplasty combined with sinus graft surgery enables the restorative doctor to gain as much as 5-7mm of restorative space.**

151

Methods to Increase Restorative Space for Edentulous Patients?

- **Increase OVD**
- **Alveoplasty**
- **Attachment Selection**
- **Prosthetic Design**

Types of Attachments for Overdentures

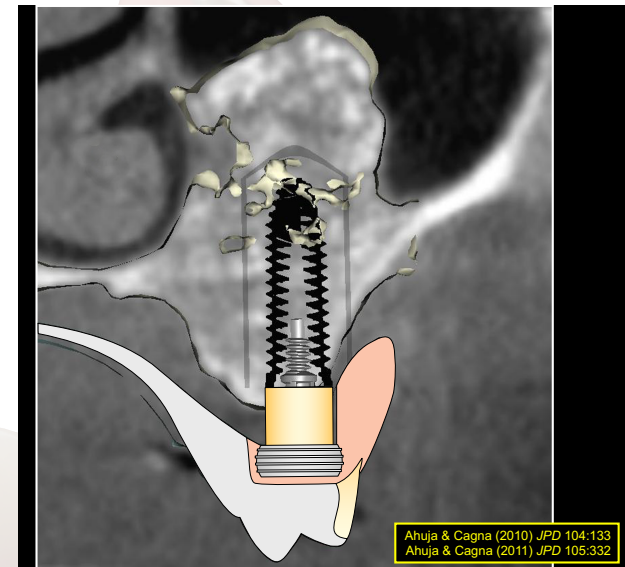
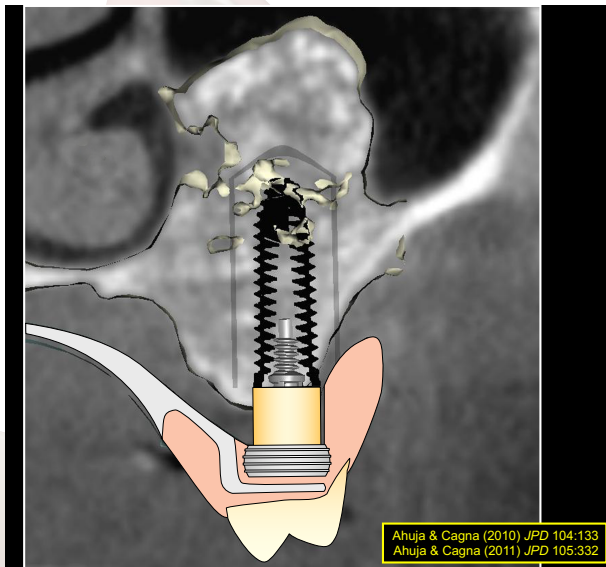
Attachments	Restorative Space
Ball	> 12.5 mm*
ERA	> 11.5 mm*
ERA	> 11.0 mm*
Locators	> 9.5 mm*

* Measured from tissue level

153

Methods to Increase Restorative Space for Edentulous Patients?

- **Increase OVD**
- **Alveoplasty**
- **Attachment Selection**
- **Prosthetic Design**





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Inadequate Vertical Restorative Space

Complications?

- **Overcontoured or weak prosthesis**
- **Esthetic compromise**
- **Encroachment on interocclusal space**
- **Suboptimal stability and retention**

159

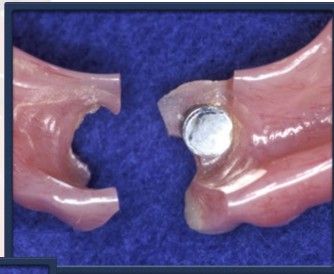


**Lack of
Inter
Arch
Space
Leads to
FAILURE!**



160

Mechanical failure...



...inadequate restorative space

Inadequate Vertical Restorative Space

Complications?

- Overcontoured or weak prosthesis
- Esthetic compromise
- Encroachment on interocclusal space
- Suboptimal stability and retention

162



"I don't like showing pink gums"



"My denture teeth are breaking off"

163

Maxillary Overdenture

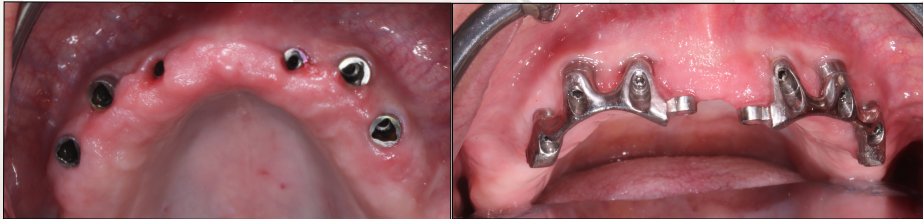
Two Bar/ERA



Restorative Space?

Complications?

Implant Location?



Bar Design?

165

"Factors in Implant Treatment Planning"

- *Implant site assessment*
- *Inter-arch, inter-proximal and inter-implant space limitations*
- *Number, size and location*
- *3D Implant planning and positioning*
- *Maintenance*



166

How many implants does my patient need for an overdenture??

QUESTION?



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Implant Treatment Planning

Number, Size and Location of Implants, Edentulous

- Implant supported overdentures: Maxilla (4), Mandible (2)
- 4-6 implants are routinely treatment planned
- Insufficient width → implant fenestration or dishiscence¹
- Proximity to vital structures (IA canal, mental foramen, sinus, nasal floor...etc)
- CBCT's are becoming the standard of care
- Evaluate the keratinized tissue²

1. Kalpidis CD, Setayesh RM. Hemorrhaging associated with endosseous implant placement in the anterior mandible: a review of the literature. J Periodontol 2004;75:631-45

2. Kan Jy et al. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. J Periodontol 2003;74:557-62

168



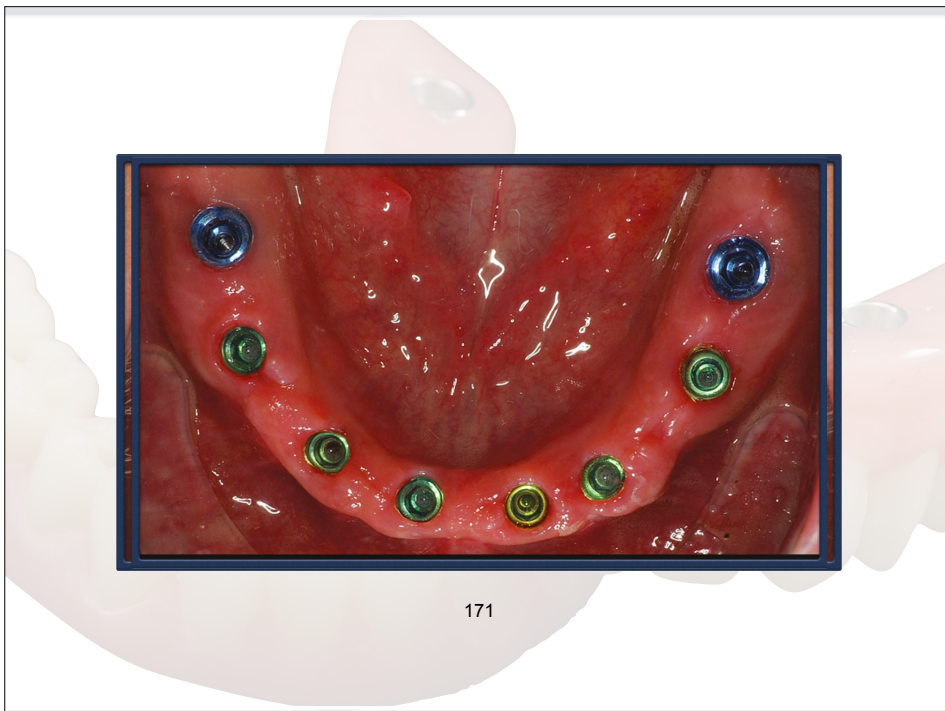
Implant Treatment Planning

Digital Prosthodontics

- Maxillary fixed denture : 6-8 implants
- Mandibular fixed denture: 4-6 implants
- Insufficient width → implant fenestration or dishiscence¹
- Proximity to vital structures (IA canal, mental foramen, sinus, nasal floor...etc)
- CBCT's are becoming the standard of care
- Evaluate the keratinized tissue²

1. Kalpidis CD, Setayesh RM. Hemorrhaging associated with endosseous implant placement in the anterior mandible: a review of the literature. J Periodontol 2004;75:631-45
 2. Kan Jy et al. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. J Periodontol 2003;74:557-62

170



171

What if the prosthesis requires a
QUESTION?



172

Implant Treatment Planning

Number, Size and Location of Implants/Edentulous

Length of cantilever is dictated by:

- Anterior/Posterior location of implants
- Bone quality (maxilla vs. mandible)
- Opposing natural teeth or prosthesis
- Patient's arch form

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Historical Criteria for Cantilever Length

- Two teeth in mandible; one in maxilla.
- 15-20mm in mandible; 10mm in maxilla.
- 2X A-P spread; 1X with short implants.
- 1.5X A-P spread in mandible; 6-8mm in maxilla.
- 20mm on 5-6 implants; 15mm on 4 implants.
- Calculate with complex math equations.

Branemark et al. (1977)
Adell et al. (1981)
Skalak (1983)
Zarb & Jansson (1985)
Skalak (1985)
Brook-Smith (1988)

Zarb & Schmitt (1989)
Chapman (1989)
Takayama (1989)
Rangert, Jemt et al. (1989)
Rangert, Eng et al. (1989)
Zarb et al. (1989)

Taylor & Bergman (1990)
Taylor (1991)
English (1992)
Brunski & Skalak (1992)
Morgan & James (1995)
van Zyl et al. (1995)

Implant Treatment Planning

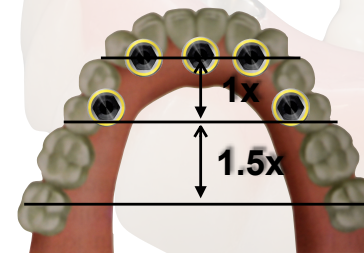
Number, Size and Location of Implants/Edentulous

Length of cantilever is dictated by:

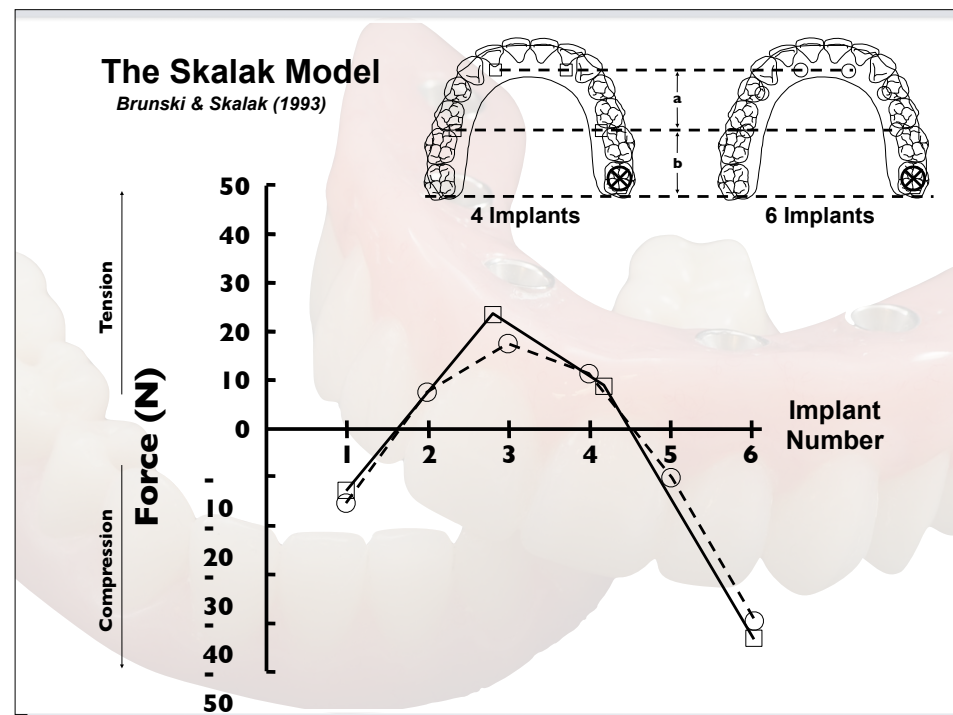
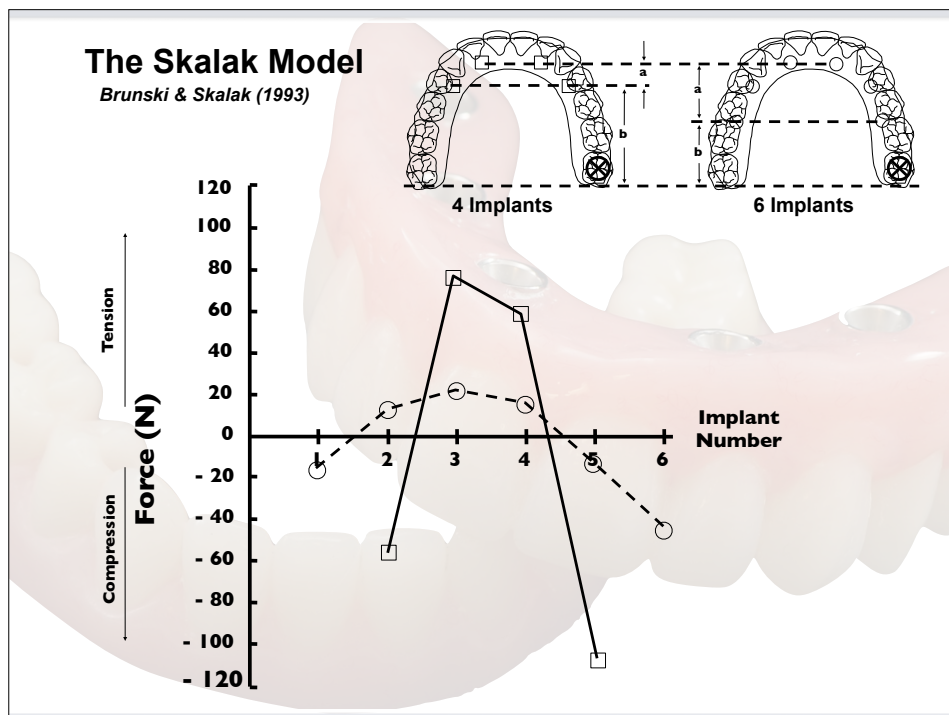
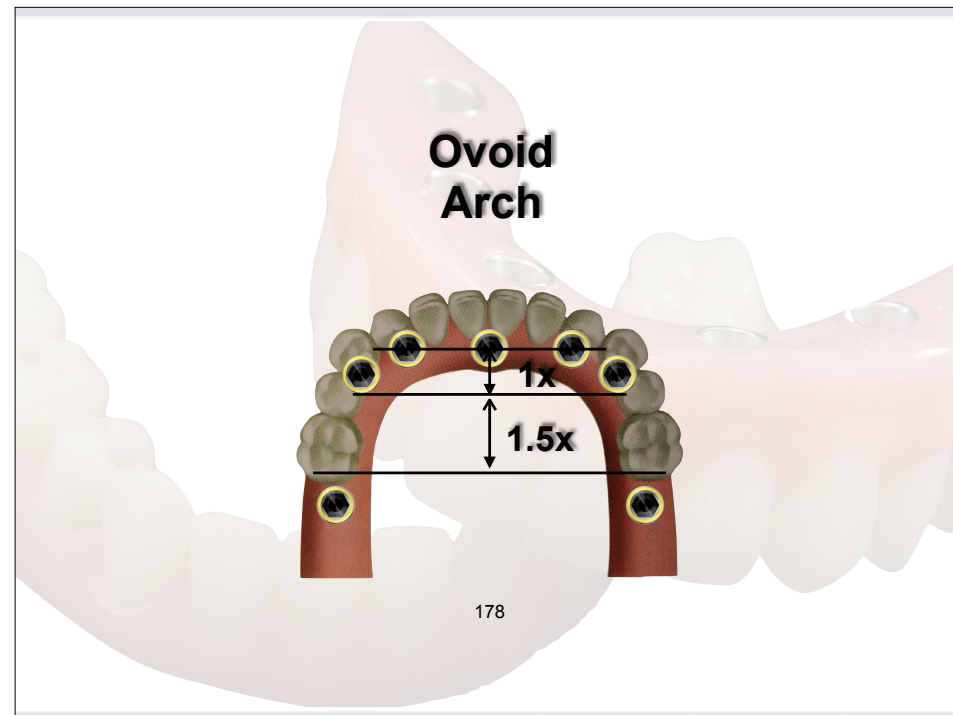
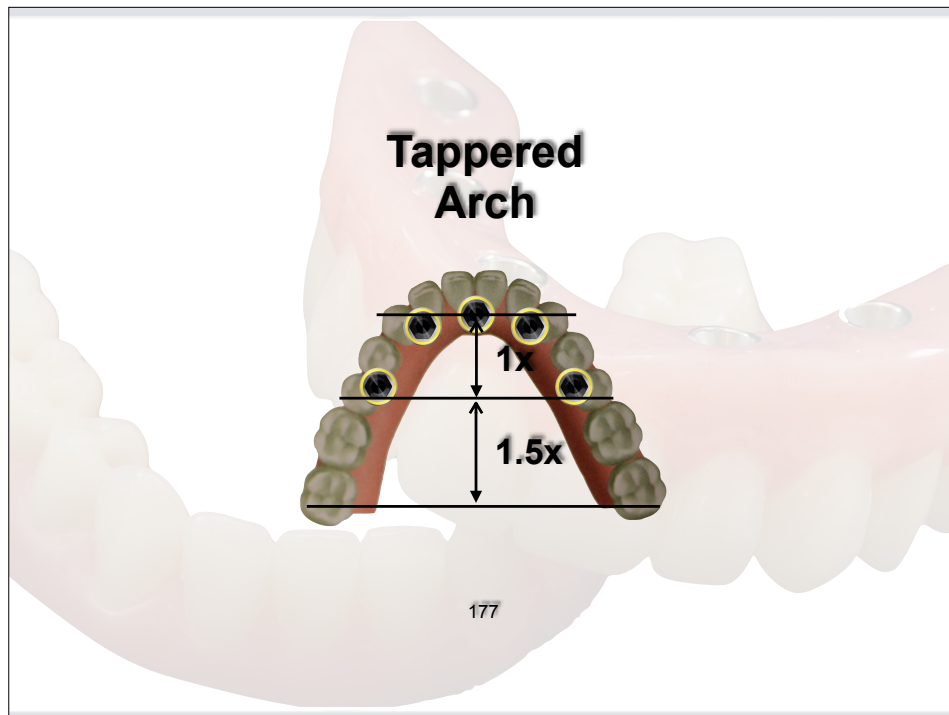
- Anterior/Posterior location of implants
- Bone quality (maxilla vs. mandible)
- Opposing natural teeth or prosthesis
- Patient's arch form

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Normal Arch



176



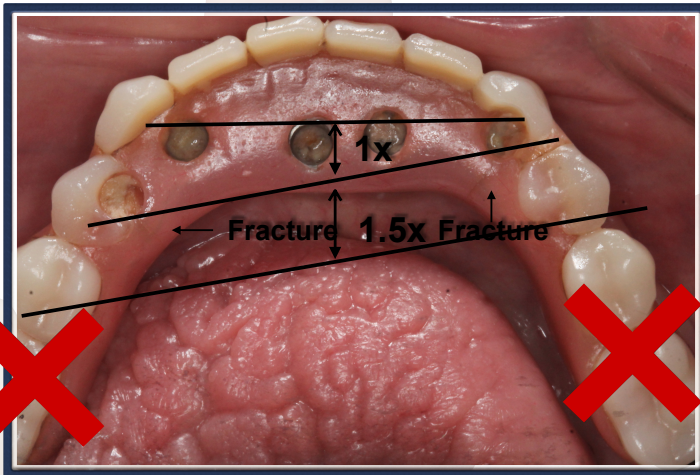
Implant Treatment Planning

Number, size and position of implants

Complications Associated with Poorly Planned Cantilevers

- Screw loosening/fracture
- Prosthesis fracture (teeth/acrylic/zirconia)
- Framework fracture (titanium/zirconia)
- Implant failure (fracture/bone loss)

181



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"Factors in Implant Treatment Planning"

- *Implant site assessment*
- *Inter-arch, inter-proximal and inter-implant space limitations*
- *Number, size and location*
- *3D Implant planning and positioning*
- *Maintenance*



184

Can we routinely predict accurate implant positions from clinical data alone???

QUESTION?



185

QUESTION?

Can we routinely predict accurate implant positions from clinical data alone???

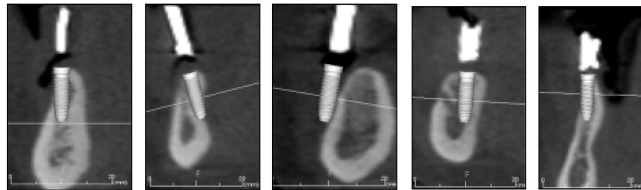


- *CD tooth positions*
- *Diagnostic Casts*
- *Clinical examination*
- *Panoramic radiograph*

1. Scarfe et al. Comparison of restoratively projected and surgically acceptable virtual implant position for mandibular overdentures. Int J Oral Maxillofac Impl (2012); 27:111-8

186

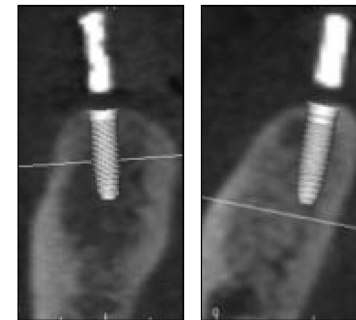
Implant Treatment Planning Study:



Evaluate CBCT's to assess if radiographic markers placed in CDs accurately predicted surgically acceptable implant positions.

1. Scarfe et al. Comparison of restoratively projected and surgically acceptable virtual implant position for mandibular overdentures. Int J Oral Maxillofac Impl (2012); 27:111-8

187



Finding: Accurate or near accurate prediction of surgically acceptable implant positions 27% of the time.

1. Scarfe et al. Comparison of restoratively projected and surgically acceptable virtual implant position for mandibular overdentures. Int J Oral Maxillofac Impl (2012); 27:111-8

188



Finding: Implant displacement beyond the bony housing 10% of the time

1. Scarfe et al. Comparison of restoratively projected and surgically acceptable virtual implant position for mandibular overdentures. Int J Oral Maxillofac Impl (2012); 27:111-8

189



Finding: Bony dehiscence or fenestration 63% of the time.

1. Scarfe et al. Comparison of restoratively projected and surgically acceptable virtual implant position for mandibular overdentures. Int J Oral Maxillofac Impl (2012); 27:111-8

190

QUESTION?

Can we routinely predict accurate implant positions from clinical data alone???

- CD tooth positions
- Maxilla
- Mandible
- Panoramic radiograph

1. Scarfe et al. Comparison of restoratively projected and surgically acceptable virtual implant position for mandibular overdentures. Int J Oral Maxillofac Impl (2012); 27:111-8

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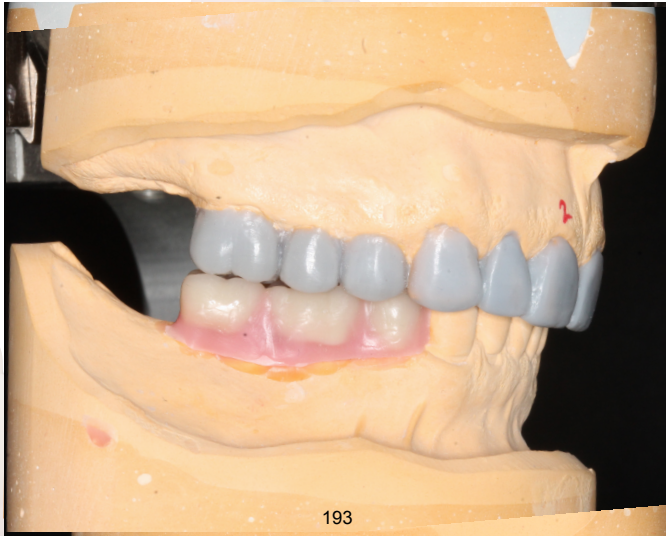
Implant Treatment Planning

3D Implant Positioning

- CBCT scan data along with virtual reconstruction software can aid the clinician in evaluating patient specific anatomy (bony structures, nerves, vessels and placement of virtual implants)
- Properly assessing CBCT data through diagnostic and treatment planning software has the potential to greatly diminish implant complications

1. Rosenfeld AL, Metcalf RA. Use of interactive computed tomography to predict the esthetic and functional demands of implant supported protheses. Comp Contin Educ Dent 1996;17:1125-46
2. Rosenfeld AL, Metcalf RA. Use of prosthesis generated computed tomographic information for diagnostic and surgical treatment planning. J Esthet Dent 1998;10:132-48

192



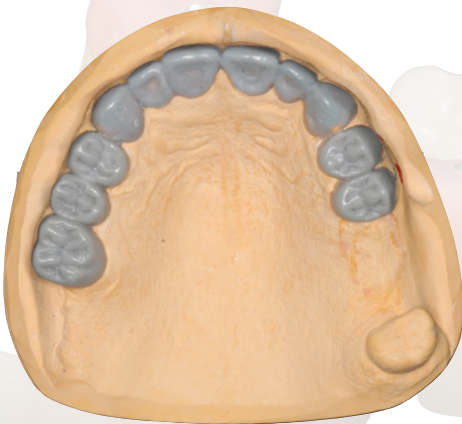
193

Implant Treatment Planning

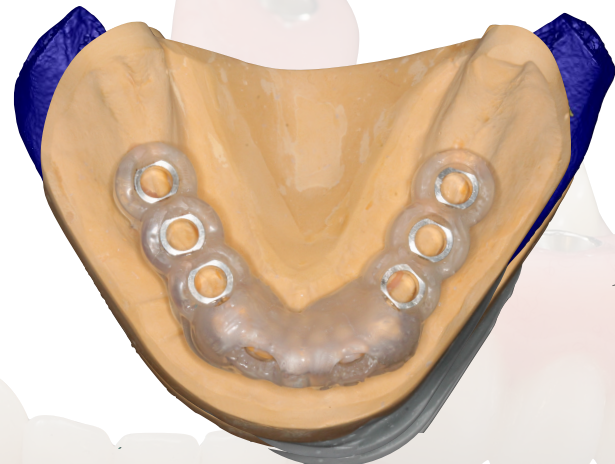
5 Steps in Comprehensive Implant Planning

1. Tooth wax-up or set-up, mock try-in, existing prosthesis
2. Conversion into radiographic guide or scan cast
3. CBCT with radiographic guide (dual scan)
4. Import DICOM file into virtual implant software and plan
5. Guided surgery with stereolithographic or 3D printed guide

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“Factors in Implant Treatment Planning”

- *Implant site assessment*
- *Inter-arch, inter-proximal and inter-implant space limitations*
- *Number, size and location*
- *3D Implant planning and positioning*
- *Maintenance*



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Unacceptable!!!!



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Cleansable!!!!



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Lifetime Commitment to Maintenance

“To prevent complications with dental implant treatment, the dentist must establish a healthy (and maintainable) oral environment and the patient must aid in long-term implant maintenance”.

Razzoog & Hollender (2003) In: *Osseointegration in Dentistry*, 2nd Edition, p. 143.

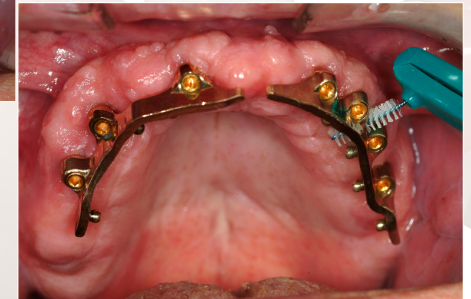


**Minimize
Debris
Accumulation**

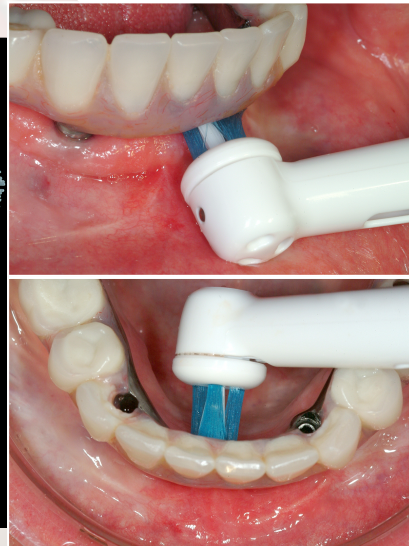
**Optimize
“SCRUBBING”
action!**



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Mechanical Maintenance

“The fabrication of a mechanical device expected to perform comfortably and efficiently 24 hours a day, year in and year out, in a hostile, biomechanical environment is difficult enough”.

Yuodelis & Faucher (1990) In: *Periodontal Diseases*, 2nd Edition, pp. 666-706

“Expecting the device to last forever, without any upkeep, is a bit much; yet we create that expectation when we fail to establish the need for regular mechanical maintenance treatment and fail to create an understanding on the part of the patient that mechanical devices deteriorate and break, just as natural teeth do, if not faster”.

Yuodelis & Faucher (1990) In: *Periodontal Diseases*, 2nd Edition, pp. 666-706

Take-home message:

Failure to consider principles of sound implant prosthesis design PRIOR to implant placement frequently leads to suboptimal results!

Thank You!!!
Questions???