

ELATUS dental bio-architecture



VANCOUVER

April 24, 2020

ZOOMing from Florida

## Preventing & Managing **Prosthetic Complications** in the Implant Patient





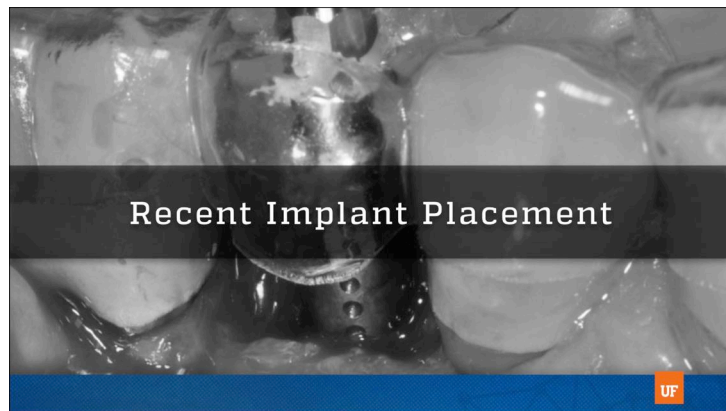


Will **Martin**, DMD, MS  
Gainesville, FL

Implant Periodontic & Prosthodontic Study Club

Thank you!

Dr. Sonia Leziy  
&  
Dr. Brahm Miller

### Single Implant #30 - Post-op Complication

- Pt came in for a **single implant for tooth #30**. #31 is missing. #30 is non-restorable **but no decay, infection or symptoms**.
- Pt had been taking **Amox 500 mg TID for 48 hours prior**. **10 mg Valium** was given at the time of the procedure.
- 1 carp lido w/ 1:100,000 epi, 1.5 carps septo w/ 1:100,000 epi**.
- I gave a block and infiltrated on the buccal and lingual of #30. I did **not lay a flap**. I made my **osteotomy through the tooth with copious irrigation**. I **used some particulate graft around the implant and vicryl sutures for closure**.
- The procedure took from **8:30am - 9:45am**. I put her on **800 mg motrin q6h prn**. (this is the pt who is allergic to codeine).

Dr. Don Cohen

### Single Implant #30 - Post-op Complication

- I **called her around 7:00 pm** for a follow up check, she was doing ok, **minor swelling** but had a red mark in the **area of #30 externally on her cheek**.
- She called me back around **9:00 pm** and a **blister** had formed.
- 9:30 pm** it had **continued to grow**.
- I saw her at the office, intra-orally she looked good. **I went with her to the ER**. They didn't know what it was. **Did a CT** - looked ok.
- They **admitted her and she is still there**. They changed her ab and put her on **IV steroids**.
- I'm stumped. I talked to her this morning no change. They suggested a **dermatologist and biopsy**.

### Single Implant #30 - Post-op Complication



### Single Implant #30 - Post-op Complication





## Disclosures



**Director** - Center for Implant Dentistry  
**Clinical Professor,**  
Department of Oral and Maxillofacial Surgery

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## Disclosures



**Director** - Center for Implant Dentistry  
**Clinical Professor,**  
Department of Oral and Maxillofacial Surgery



**USA Section Chairman**

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## CID TEAM



Luiz Gonzaga - John Hardeman - Tom Bowers - Dean Morton - James Ruskin - Emma Lewis - BJ Schlott - Carlo Guevara - OMFS Chief Residents - Danielle Freburg - Clay Hamrick - Heather Stowell - Paula Pickel - Haley Sampson - Esther Oh - Dawn Martin - Frank Lozano - Cal Dolce - Advantage Dental Design - Michael Heffernan - Michael Patras - Joel Martinez - James Clarke - Neel Patel - Cecilia Donofrio - Coredent Advancements - Chatchai Kunavisarut - Banu Karayazgan - Juan Pablo Villarreal - Roy Rosado - Arne Boeckler - Hidekazu Hayashi - Arne Boeckler - Cagenix - Yuksel Erpardo - Corina Cristache - Robert Santosa - Zahra Rashid - Nick DeTure - John Chou - Kajorn Kungsadalpipob - Alachua Dental Lab - Adam Hamilton - Capital Dental Lab - Lydia Legg - Daniel Baumer - Husain Harianawala - Ahmet Örgen - Himanshu Arora - Ahmed Alhilou - Mohanad Atwa - Zahntechnik Inc

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## Patient Population

### Initiation of Care



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### Initiation of Care

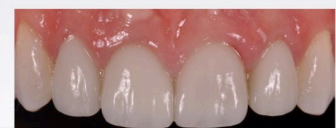


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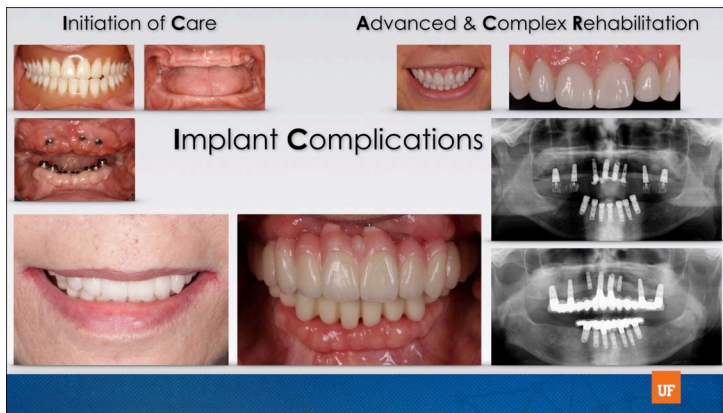
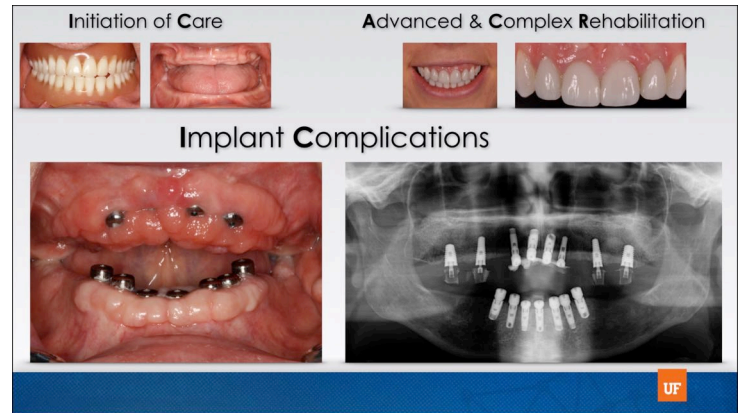
### Initiation of Care



### Advanced & Complex Rehabilitation



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## Review of the Literature - Types of Complications

**Biological Complications** characterized by biological process affecting the supporting tissues. Soft tissue complications, peri-implantitis, and substantial (>2 mm) marginal bone loss.



Jung et al; 2012

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**Technical/Mechanical Complications** characterized by mechanical damage of implants, abutments, and/or the supra-structures.



Jung et al; 2012

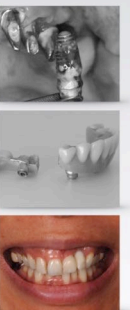
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## Review of the Literature - Types of Complications

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**Technical/Mechanical Complications** characterized by mechanical damage of implants, abutments, and/or the supra-structures.

**Esthetic complications** (e.g., dehiscences of the soft tissue with exposure of the crown margin, suboptimal color of the prosthetic reconstruction) and on general esthetic outcomes



Jung et al; 2012

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## Review of the Literature - Types of Complications

The **5-year** implant **survival** rate was **95.7 - 97.7%** and the **10-year** implant **survival** rate was **92.8 - 94.9%**.

Complications were frequently observed reaching rates of :

**Biological 7.1%**

**Technical 8.8%**

**Esthetic 7.1%**



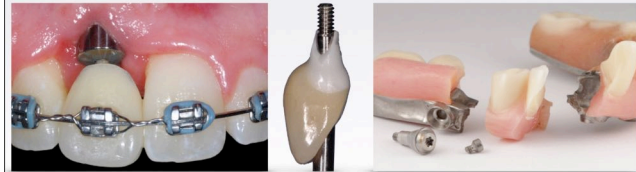
**Only 66.4%** of patients were completely **free** from any type of reported **complications**

Albrektsson et al, 2012

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## PROSTHETIC COMPLICATIONS

are not unusual...



## Introduction - Prosthetic Complications



1

### Planning & Execution

- Clinician experience - SAC
- Restoration-driven planning
- Prosthetic volume requirements
- Retention



2

### Mechanical

- Splinted vs. un-splinted
- Parafunction
- Abutment fracture & wear
- Screw stripping & fracture



3

### Technical

- Frameworks
- Materials

1



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- Clinician experience - SAC
- Restoration-driven planning
- Prosthetic volume requirements
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## Planning & Execution

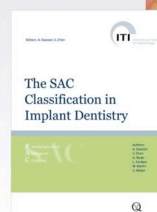
## Key to Success

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**Prevention** through **planning** and **practicing evidence-based techniques**

## Planning & Execution

## TREATMENT



## Diagnosis and Planning Tools for the Treatment Team

- International Team for Implantology (ITI) Conference - March 2007
- Multi-disciplinary group of 28 clinicians
- Publication of the proceedings
- **Aim** - provide **objective input** with regard to likely **treatment difficulty** and **likelihood of outcome compromise**.



### • Surgical and Restorative Classification:

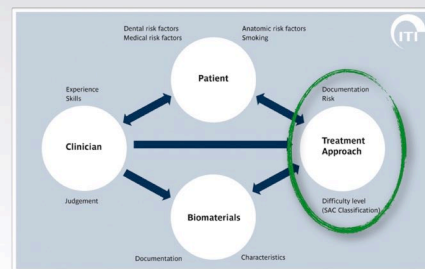
- **Straightforward (S)**
- **Advanced (A)**
- **Complex (C)**

*\*Second Edition in preparation*

## Diagnosis and Planning Tools for the Treatment Team

### • Influencing factors:

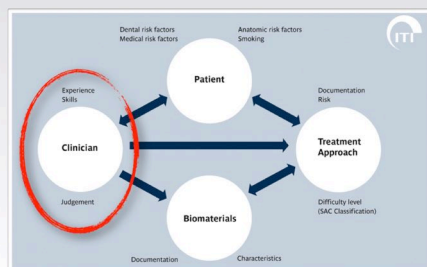
- Patient
- Clinician
- Treatment Approach
- Biomaterials



## Diagnosis and Planning Tools for the Treatment Team

### • Influencing factors:

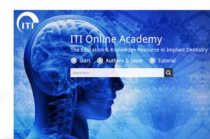
- Patient
- **Clinician**
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## Diagnosis and Planning Tools for the Treatment Team

### • Resources for the clinician:

- ITI Consensus Conference
- ITI SAC Classification
- ITI Treatment Guides
- ITI Study Clubs
- ITI Online Academy
- ITI Curriculum
- and more...



[www.iti.org](http://www.iti.org)

## Restoration-driven Planning



## Restoration-driven Planning

*You wouldn't build a home  
without a blue-print  
would you?*







Planning & Execution - Complication

- **Treatment Errors:**
  - Diagnosis
  - Treatment Planning
  - Site enhancement
  - 3-D Implant Placement
- **Results:**
  - Limitations in restoration
  - Esthetic complication
  - Early failure\*
  - Added treatment costs

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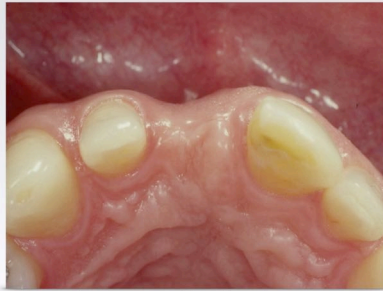
**It starts with a foundation.**

**The “SEED” Approach**

Ramifications of tooth loss...

## Ramifications of tooth loss...

- Loss of **support**
- Loss of **function**
- Loss of **esthetics**
- Loss of **phonetics**
- Loss of **facial support**
- Loss of **self esteem**



Site enhancement is a key to success...

## Bone Regeneration - Objective

- To **reconstruct** the **alveolus** with **predictability** and **minimal risk** to the **patient** in such a manner that the **tissue support** and **restoration resemble a natural tooth**.



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## Clinical Technique: Highlighting Pink Deficiencies



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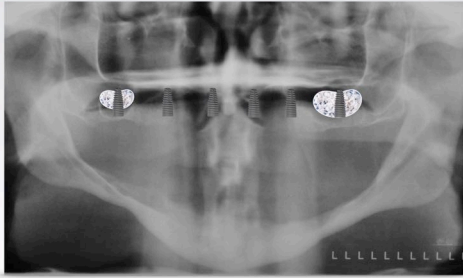
## Clinical Technique: Highlighting Pink Deficiencies





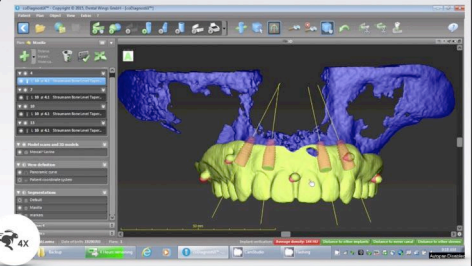
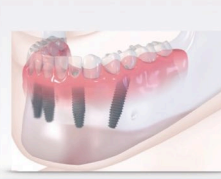
## Edentulous - Parallel Approach - Augmentation

- Ideal available bone
- Favorable anatomy
- (+) augmentation



## Edentulous - Tilted - Minimizing need for augmentation

- "all on four" (concept - 4,5,6)
- Avoid anatomical structures
- (-) augmentation



## The "SEED" Approach

## Understanding and communicating treatment needs...

### • Reinforces interdisciplinary approach to care

### • Improves:

- case acceptance
- implant positioning
- esthetic outcomes
- long-term survival\*

### • Reduces:

- restorative chair-time
- complexity
- laboratory costs

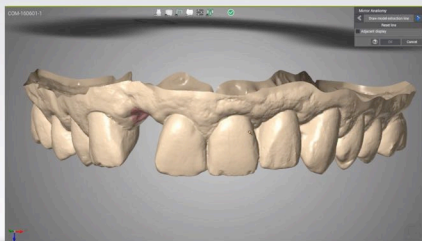


## Restoration-driven Planning - Step 1

- Start with a **wax-up** (analog or digital)



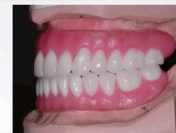
Analog



Digital

## Restoration-driven Planning - Step 1

- Start with a **wax-up** (analog or digital)



Confirmed Try-in

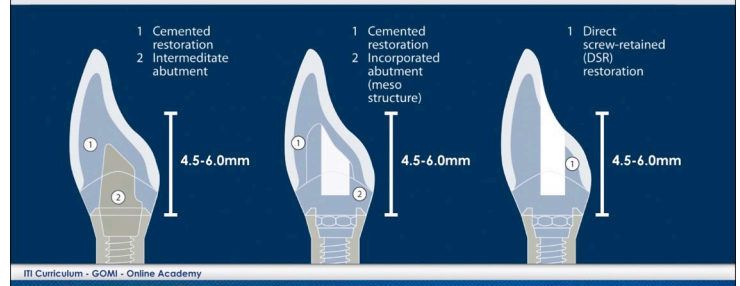
## Restoration-driven Planning - Step 2

- Understand **Prosthetic Volume** and plan for *adequate restorative space*.

The **prosthetic space requirements** for the **materials** (abutment, coping, veneering material) to *allow for a functional, durable and esthetic restoration*.

## Restoration-driven Planning - Step 2

- Understand **Prosthetic Volume** and plan for *adequate restorative space*.



ITI Curriculum - GOMI - Online Academy

## Restoration-driven Planning - Step 2

- Understand **Prosthetic Volume** and plan for *adequate restorative space*.



Full-gold screw-retained crowns - <5.5mm space.

ITI Curriculum - GOMI - Online Academy

## Restoration-driven Planning - Step 2

- Understand **Prosthetic Volume** and plan for *adequate restorative space*.



Ceramic screw-retained crowns - >7mm space.

ITI Curriculum - GOMI - Online Academy

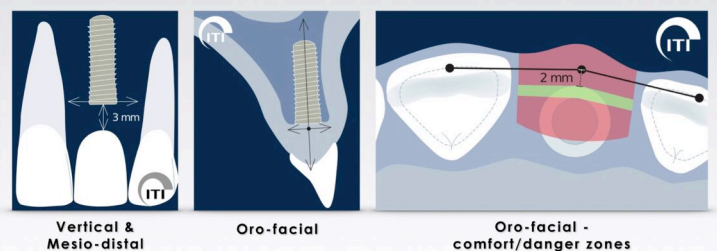
## Restoration-driven Planning - Step 2

- Understand **Prosthetic Volume** and plan for *adequate restorative space*.
- Periodontally Accelerated Osteogenic Orthodontics**
- Corticotomy-Accelerated Orthodontics**



## Restoration-driven Planning - Step 2 - Partially Edentulous

- Understand **Prosthetic Volume** and plan for *adequate restorative space*.

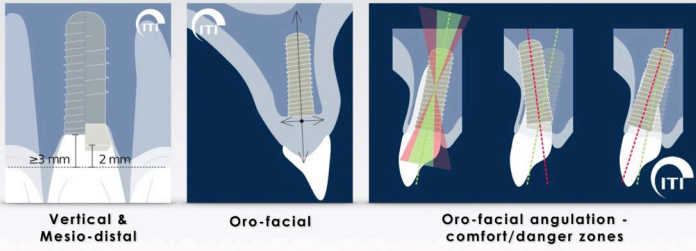


Buser D, Marlin W, Belser U. IJOMI 2004, Vol. 19, Supplement. Marlin W, Chappuis V. IJOMI Treatment Guide, Vol. 10, 2017



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Buser D, Marlin W, Belser U. UOMI 2004, Vol. 19, Supplement. Marlin W, Chappuis V. ITI Treatment Guide, Vol. 10, 2017

## Restoration-driven Planning - Complication



These complications are **often associated** with implants placed in **sites excess or deficient** in bone and soft tissue.

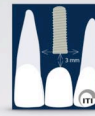
## Restoration-driven Planning - Complication



Ø 3.3mm



## Restoration-driven Planning - Complication



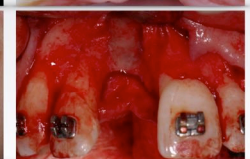
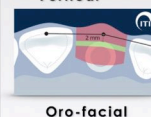
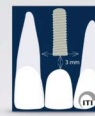
## Restoration-driven Planning - Complication



Ø 6.5mm



## Restoration-driven Planning - Complication



## Restoration-driven Planning - Complication



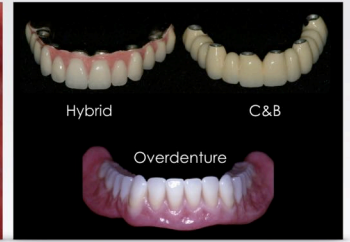
Vertical



Oro-facial

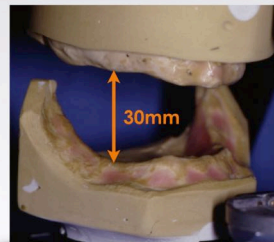


## Restoration-driven Planning - Step 2 - Completely Edentulous

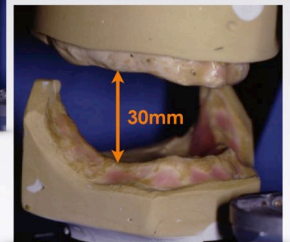
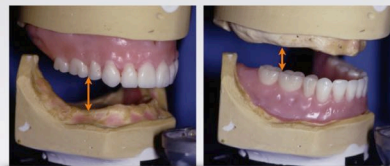


## Restoration-driven Planning - Step 2 - Completely Edentulous

What type of restoration & how much space is needed?



## Restoration-driven Planning - Step 2 - Completely Edentulous



### Minimum space requirements:

LOCATOR® attachments: 8mm\*

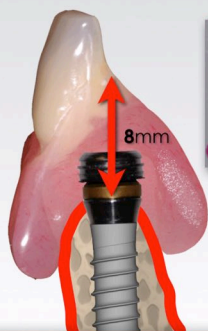
Bar & attachment: 13mm\*

FDP: 7mm

Hybrid: 12mm\*

\*measure from mucosa to opposing occlusion

## Inter-arch Space Requirements - Locator Overdenture



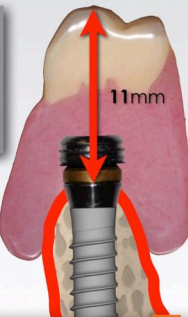
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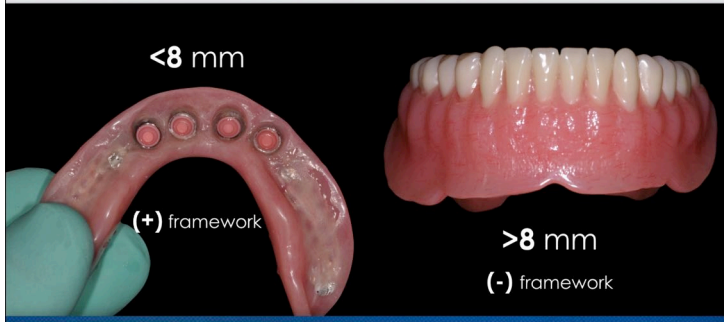


## Prosthetic Volume Requirements - LOCATOR®

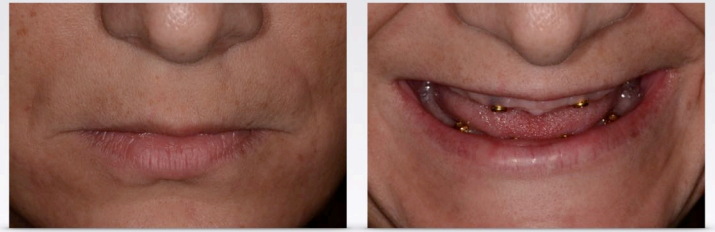




## Prosthetic Volume Requirements - LOCATOR®



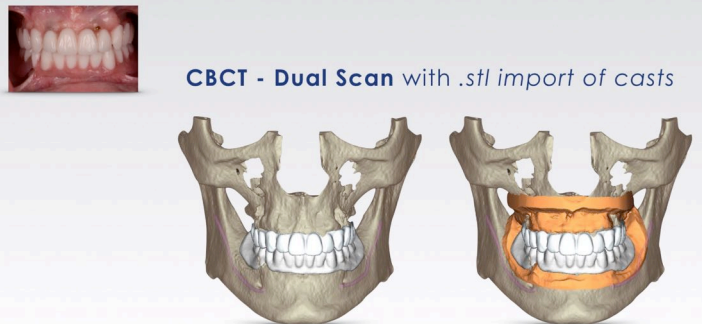
## Prosthetic Volume Requirements - LOCATOR® - Complication



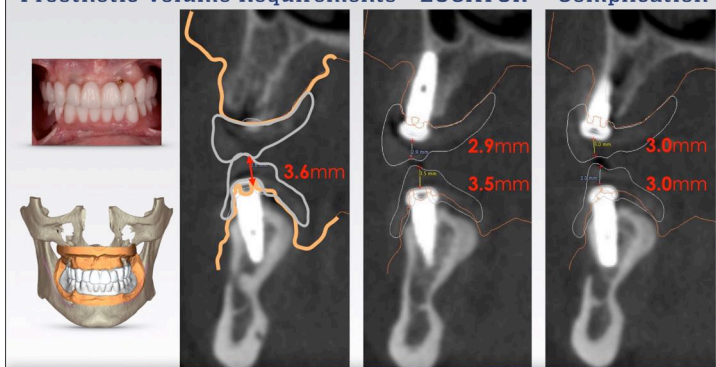
## Prosthetic Volume Requirements - LOCATOR® - Complication



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## Prosthetic Volume Requirements - LOCATOR® - Complication



## Phase 1 - Milestone



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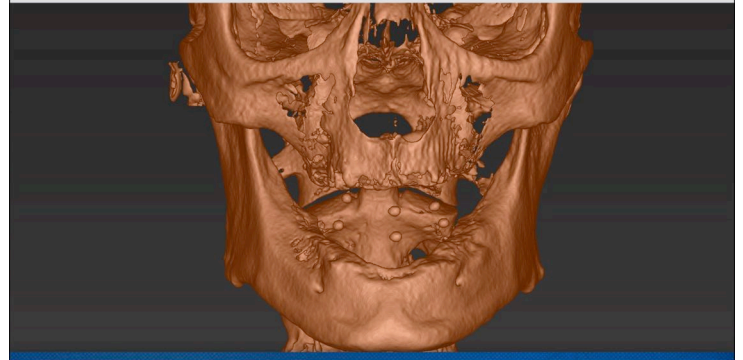


**Pre-treatment:**  
Consult

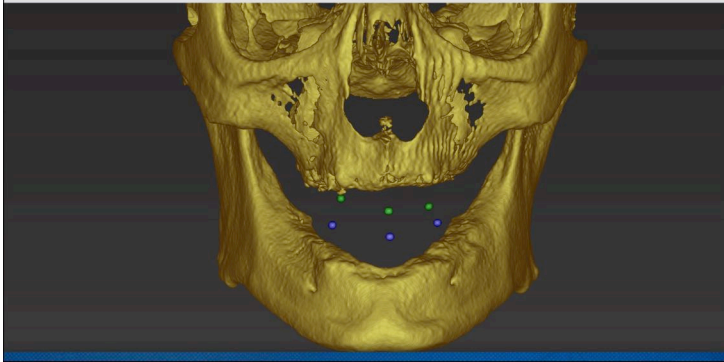


**Post-treatment:**  
implant removal & alveoloplasty  
digital planning & implant placement

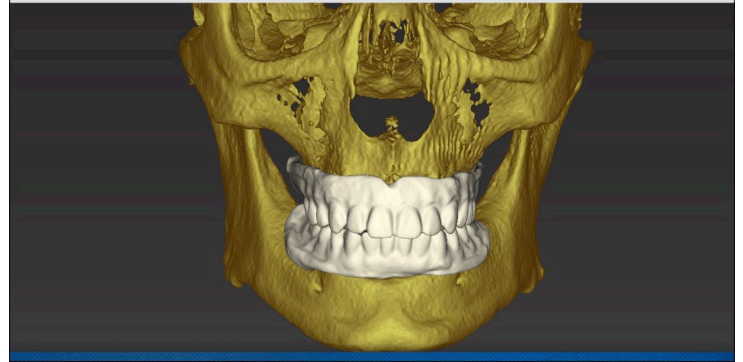
## Phase 2 - Planning & Placement



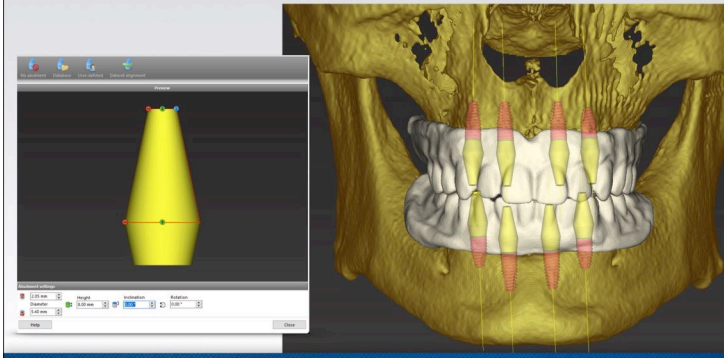
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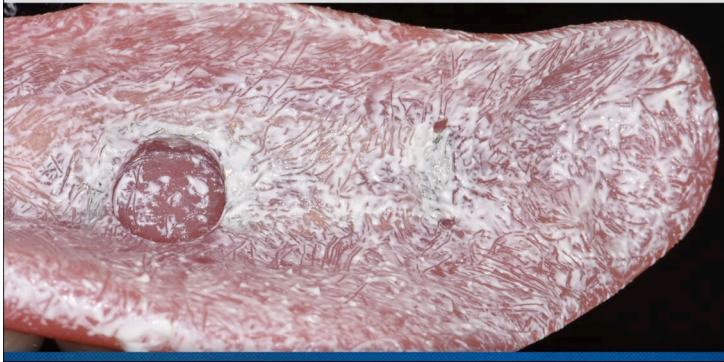


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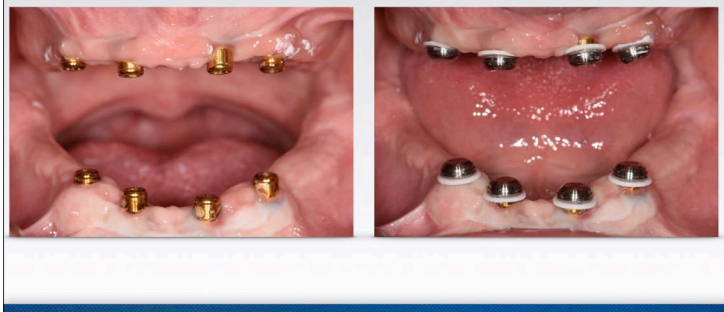
Phase 3 - Restoration



Phase 3 - Restoration



Phase 3 - Restoration



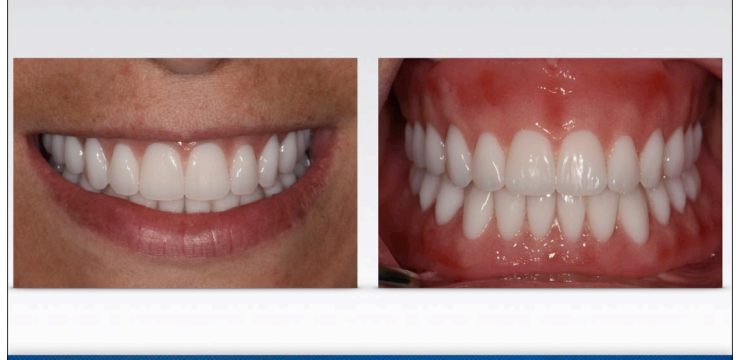
Phase 3 - Restoration



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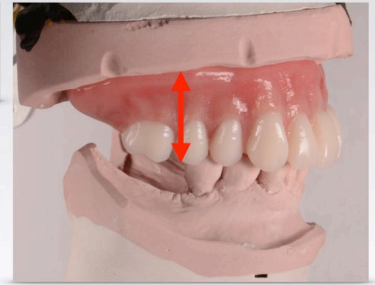
Phase 3 - Restoration



## Phase 3 - Restoration



## Inter-arch Space Requirements - Bar and Clip



**Total space with denture base and teeth = 13+mm**

### Minimum space requirements:

LOCATOR® attachments: 8mm\*

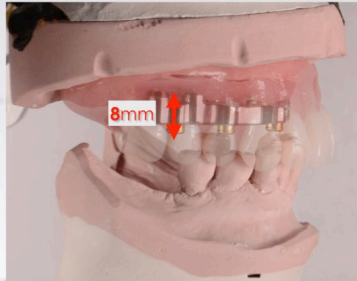
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FDP: 7mm

Hybrid: 12mm\*

UF

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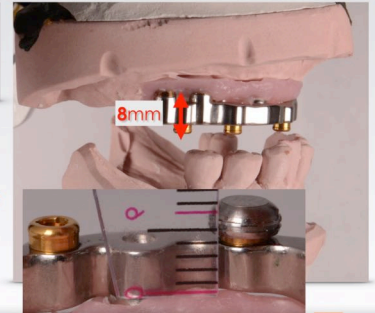
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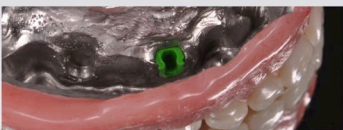
Bar & attachment: 13mm\*

FDP: 7mm

Hybrid: 12mm\*

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## Inter-arch Space Requirements - Bar and Clip



**Total space with denture base and teeth = 9+mm**

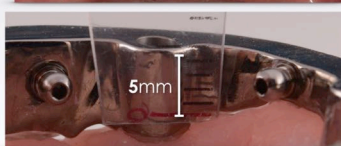
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Bar & attachment: 13mm\*

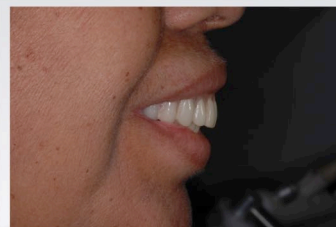
FDP: 7mm

Hybrid: 12mm\*



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## Prosthetic Volume Requirements - Bar & Clip - Complication



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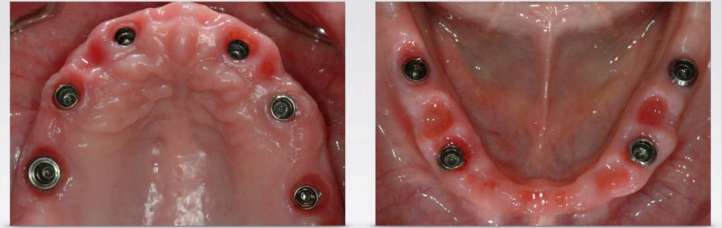


### Prosthetic Volume Requirements - Bar & Clip - Complication



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### Prosthetic Volume Requirements - FDP's



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### Inter-arch Space Requirements - FDP-

**7-12 mm**

Abutment &  
Coping Height

**4-7mm**

+

Framework

**2-3 mm**

+

Veneering Material

**1-2 mm**



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### Inter-arch Space Requirements - Alternative Material Hybrids

Range **12 - 15+mm** inter-occlusal space



e.max Hybrid Restorations



Monolithic Zirconia Restorations

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### Inter-arch Space Requirements - Alternative Material Hybrids



Abutments

&



Framework  
**10+ mm**



Restorations  
**2 mm**

#### Minimum space requirements:

LOCATOR® attachments: **8mm\***

Bar & attachment: **13mm\***

FDP: **7mm**

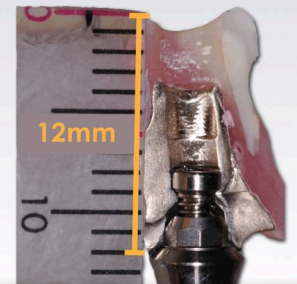
Hybrid: **12mm\***

**12+ mm**

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### Inter-arch Space Requirements - Resin-based Hybrid

**12 mm** minimum inter-occlusal space



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## Prosthetic Volume Requirements - Hybrid - Complication



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## Prosthetic Volume Requirements - Hybrid - Complication



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## Prosthetic Volume Requirements - Hybrid - Complication



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## Prosthetic Volume Requirements - Hybrid - Complication



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## Planning Considerations - KEY Extra-oral Factors

- Facial support
- Lip support
- Ridge position at smile



Pollini A, Goldberg J, Mitrani R and Morton D.

The LTR Classification. A Guideline for Edentulous Maxillary Arches: Diagnosis, Risk Assessment and Treatment Indications. (2017 Nov/Dec;37(6):835-841)

LTR = Lip, Tooth, Ridge



Fixed Prosthesis

Fixed Prosthesis - Pink Transition

Fixed/Removable Prosthesis

Removable Prosthesis

## Planning Considerations - KEY Extra-oral Factors

- Facial support
- Lip support
- Ridge position at smile

- Tooth position and lip position and mobility are provided by the patient
- The clinical treatment team can alter the relationship of the ridge to the tooth and lip to optimize prosthesis foundation
  - Ridge reduction (alveoloplasty) to increase prosthesis space
  - Augmentation to reduce deficit dimension and prosthesis space

LTR = Lip, Tooth, Ridge



Fixed Prosthesis

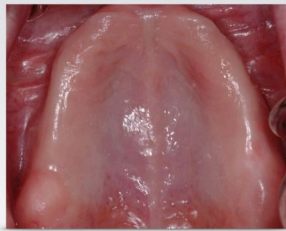
Fixed Prosthesis - Pink Transition

Fixed/Removable Prosthesis

Removable Prosthesis



## Planning and Execution - Impact of the CBCT



- Desires implant supported restoration
- Not removable
- Fixed-detachable vs. FDP's



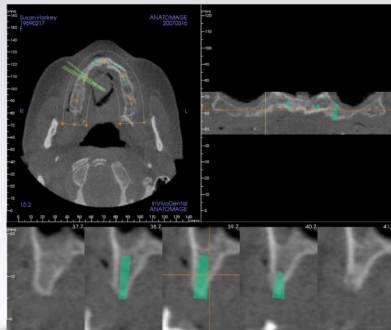
UF

## Planning and Execution - Impact of the CBCT



UF

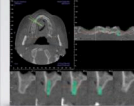
## Planning and Execution - Impact of the CBCT



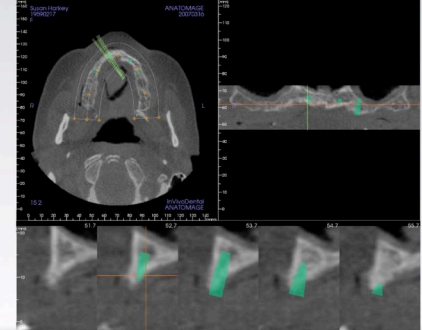
Site 4

UF

## Planning and Execution - Impact of the CBCT



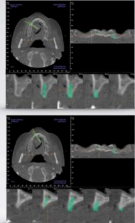
Site 4



Site 6

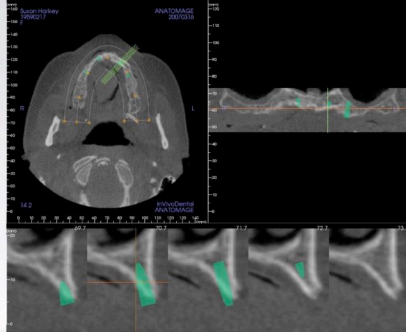
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## Planning and Execution - Impact of the CBCT



Site 4

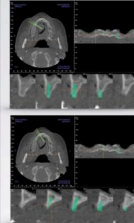
Site 6



Site 11

UF

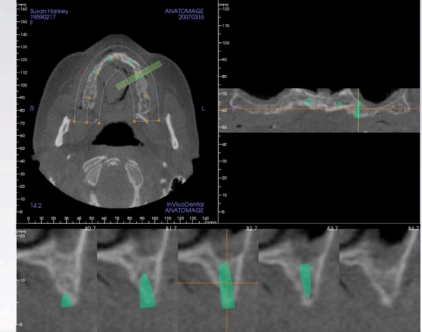
## Planning and Execution - Impact of the CBCT



Site 4

Site 6

Site 11



Site 13

UF

Planning and Execution - Impact of the CBCT



Planning and Execution - Impact of the CBCT



Planning and Execution - Impact of the CBCT



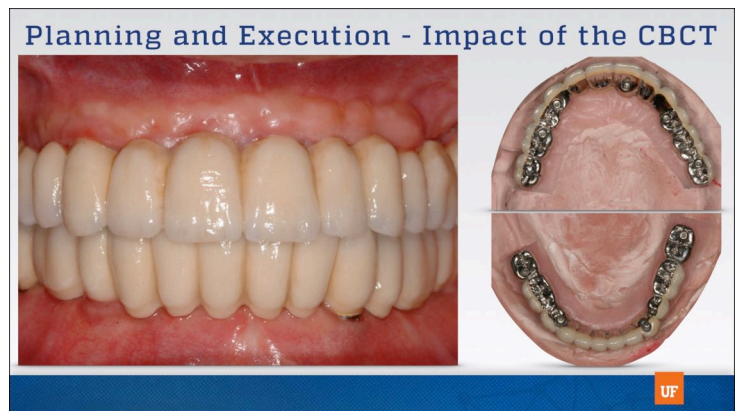
Planning and Execution - Impact of the CBCT



Planning and Execution - Impact of the CBCT



Planning and Execution - Impact of the CBCT

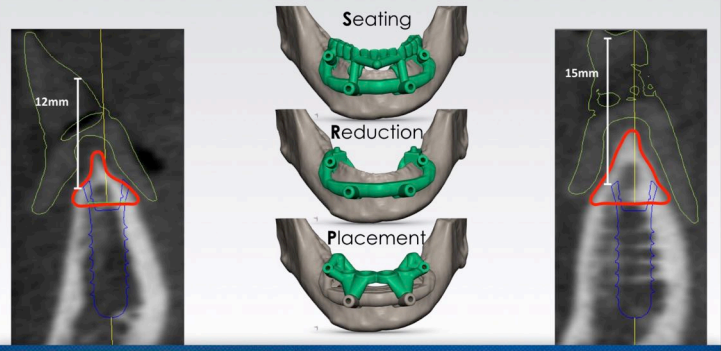




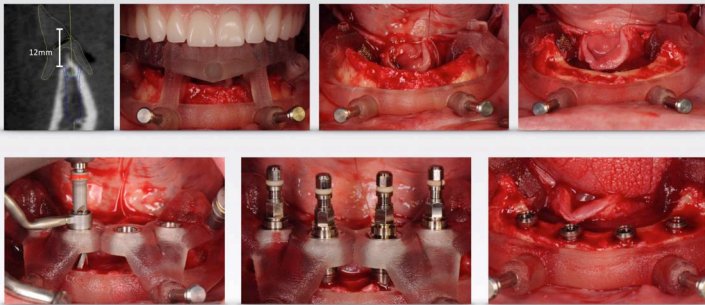
### Restoration-driven Planning - Co-Diagnostics™ Planning



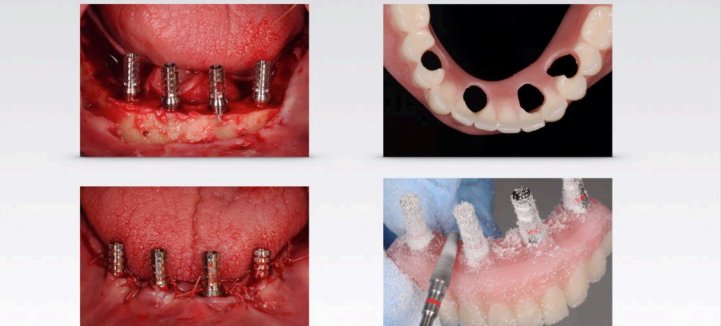
### Restoration-driven Planning - Co-Diagnostics™ Planning



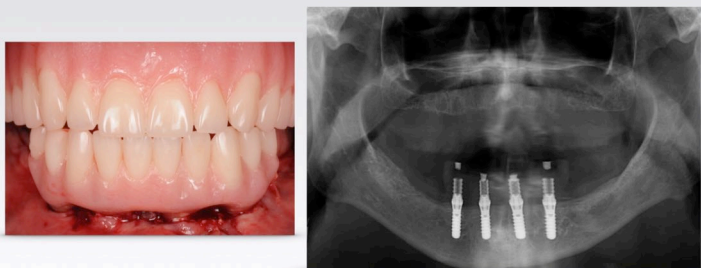
### Restoration-driven Surgery - SGS



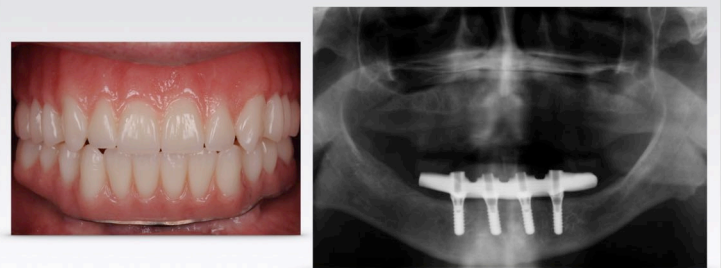
### Restoration-driven Surgery - SGS



### Restoration-driven Surgery - SGS



### Restoration-driven Surgery - SGS



## Virtual Implant Planning - Full-service Providers



UF

## Smile in a box workflow

USE THE COMPLETE WORKFLOW FOR ALL YOUR TREATMENT STEPS	SELECT WORKFLOW STEPS NEEDED FOR YOUR INDIVIDUAL SET-UP
<b>Full Service</b> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Surgical treatment planning by coDiagnostiX®</li> <li><input checked="" type="checkbox"/> Temporary restoration designed by CARES® Visual</li> <li><input checked="" type="checkbox"/> Surgical guides</li> <li><input checked="" type="checkbox"/> Temporary restoration</li> <li><input checked="" type="checkbox"/> Implants, abutments and auxiliaries</li> </ul>	<b>Modular Service</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Surgical treatment planning by coDiagnostiX®</li> <li><input type="checkbox"/> Temporary restoration designed by CARES® Visual</li> <li><input type="checkbox"/> Surgical guides</li> <li><input type="checkbox"/> Temporary restoration</li> <li><input type="checkbox"/> Implants, abutments and auxiliaries</li> </ul>



UF

## Smile in a box workflow

From digital planning to Smile in a Box.



UF

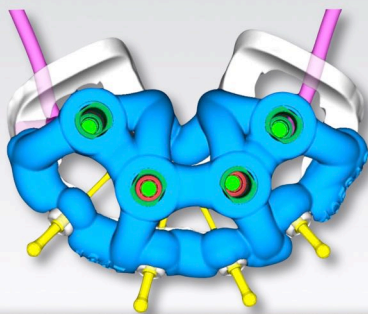
## Smile in a box workflow

From digital planning to Smile in a Box.



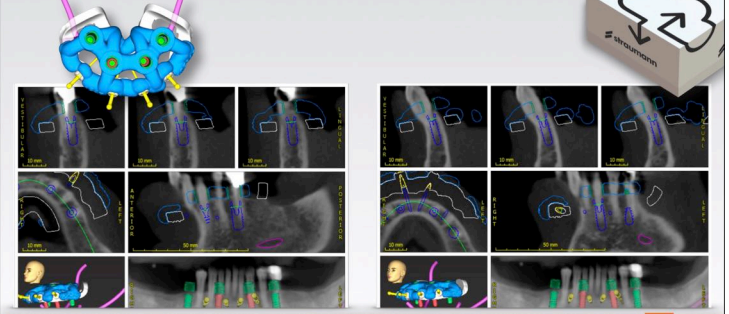
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## Smile in a box workflow - Guide Design



UF

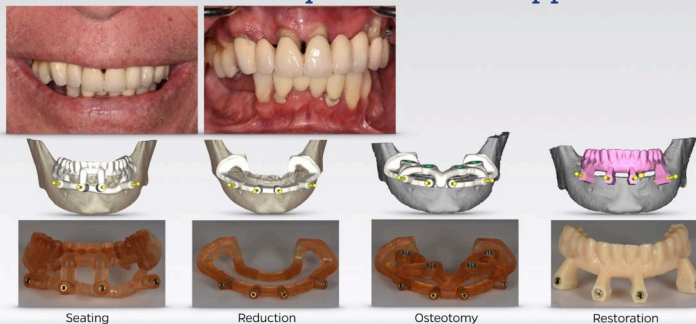
## Smile in a box workflow - Guide Design



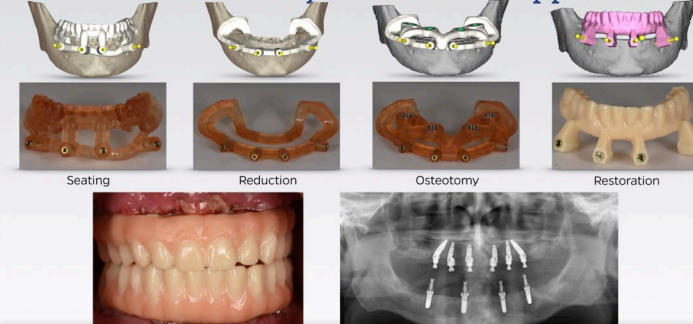
UF



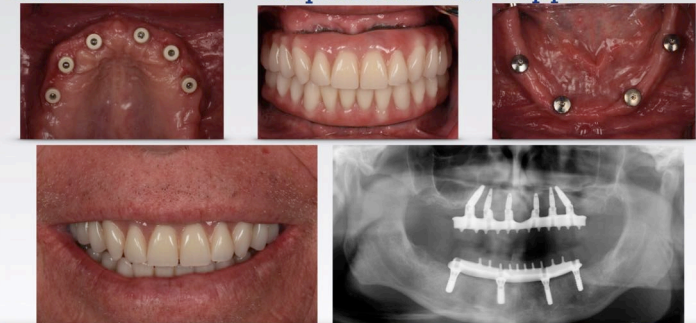
## Smile in a box - Sequential Pin Supported



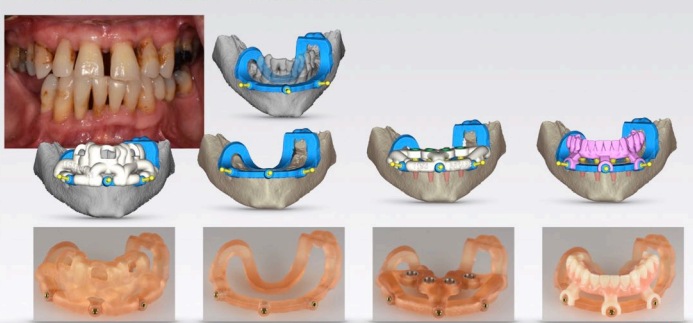
## Smile in a box - Sequential Pin Supported



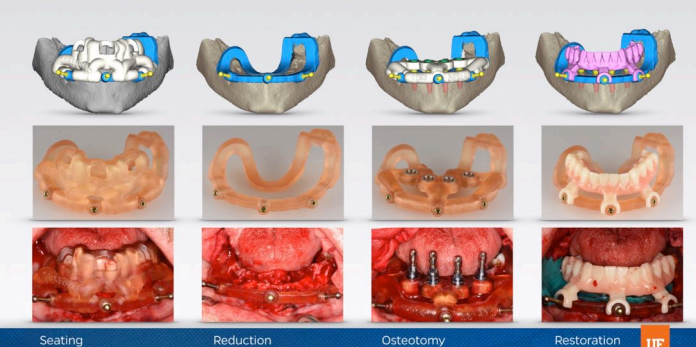
## Smile in a box - Sequential Pin Supported



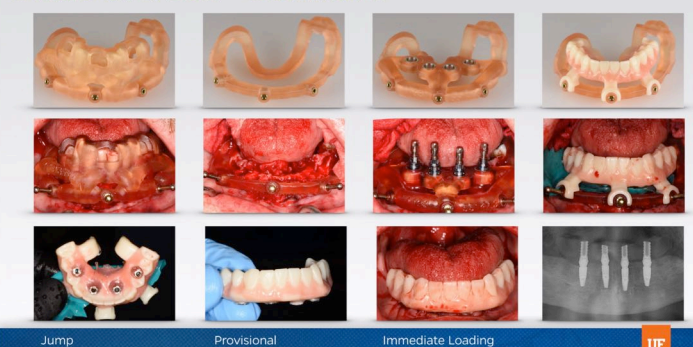
## Smile in a box - Stackable



## Smile in a box - Stackable



## Smile in a box - Stackable



## Smile in a box - Stackable



Healing

Intra-oral Scan

Verification Jig

Wax Try-in

UF

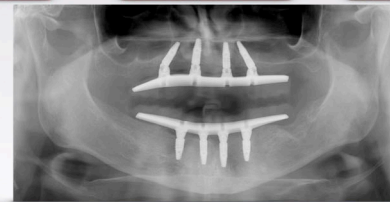
## Smile in a box - Stackable



Pre-tx



F-up



UF

## Guided Surgery Limitations/Complications

UF

## Limitations - CBCT Guided Surgery

- Time - planning & fabrication = cost



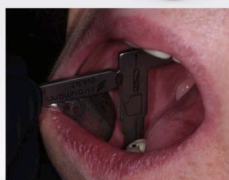
UF

## Limitations - CBCT Guided Surgery

- Time - planning & fabrication = cost

### • Access

Diagnostic T



UF

## Limitations - CBCT Guided Surgery

- Time - planning & fabrication = cost

### • Access

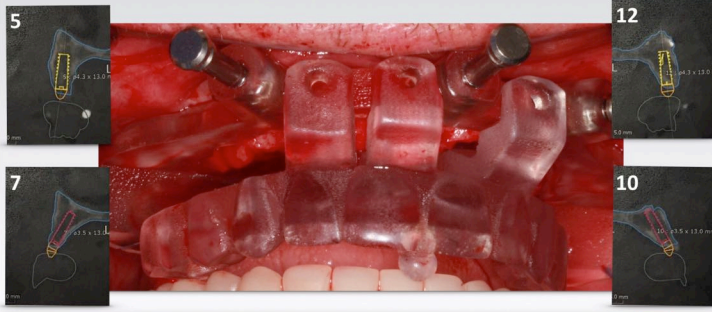
### • Attention to detail



UF



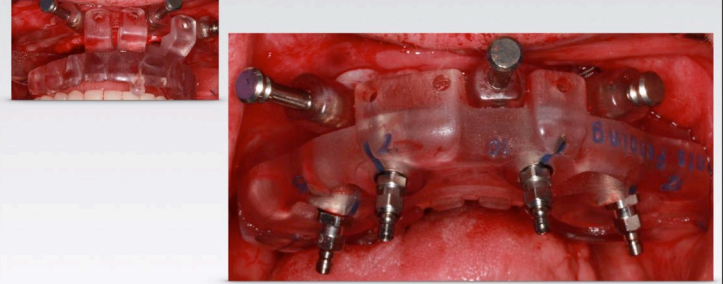
### CBCT Guided Surgery - Attention to detail



Base Template and Seating Jig

UF

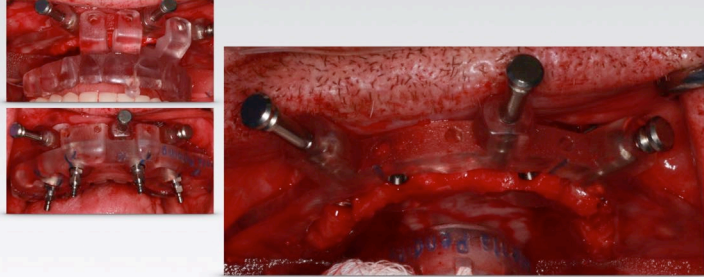
### CBCT Guided Surgery - Attention to detail



Osteotomy Template with Implants Placed

UF

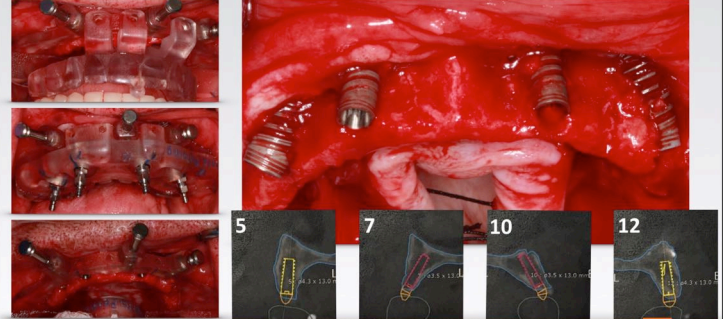
### CBCT Guided Surgery - Attention to detail



Base Template with Implants Placed

UF

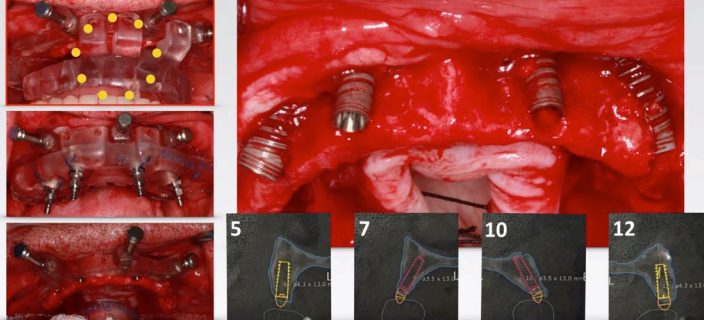
### CBCT Guided Surgery - Attention to detail



MAJOR COMPLICATION

UF

### CBCT Guided Surgery - Attention to detail

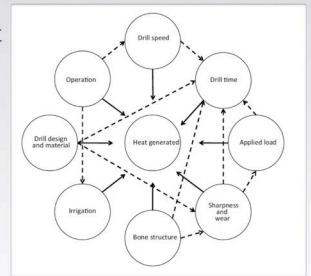
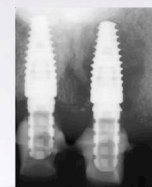


MAJOR COMPLICATION

UF

### Limitations - CBCT Guided Surgery

- Time - planning & fabrication = cost
- Access
- Attention to detail
- Irrigation



Möhlhenrich et.al. 2015

Bone necrosis can occur at 47° C (Eriksson AR & Albrektsson T, 1983)

UF

## Limitations - CBCT Guided Surgery

• Time - planning & fabrication = cost

• Access

• Attention to detail

• **Irrigation**



Seung-Mi et. al 2014



Gehrke et. al 2016



Möhlhenrich et.al 2015

Bone necrosis can occur at 47° C (Eriksson AR & Albrektsson T, 1983)

UF

## Limitations - CBCT Guided Surgery

• Time - planning & fabrication = cost

• Access

• Attention to detail

• **Irrigation**

Custom 3D Printed Dental Surgical Guides  
with Internally Irrigated Cooling Canals for  
Temperature Reduction during Dental  
Implants and Endodontics

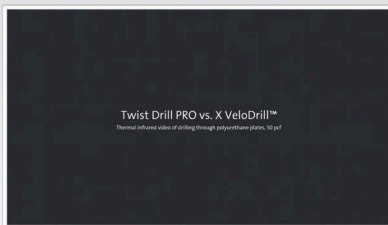


MUSC  
MEDICAL UNIVERSITY  
OF SOUTH CAROLINA

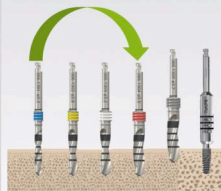
Inventors: Walter Renne & Zachery Evans (2018)

UF

## VeloDrill™



- Low Temperature Drilling
- Lower Surface Friction
- Optimized Geometry



- Pilot to final guided protocol

UF

## Limitations - CBCT Guided Surgery

• Time - planning & fabrication = cost

• Access

• Attention to detail

• Irrigation

• **Contingency Plans**



Benchmark Dental Manufacturing Company  
540-797-8543  
info@benchmarkdenture.com



UF



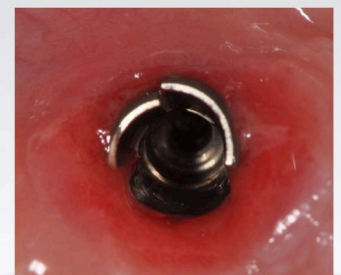
2

Removing Implants

## Removal of Osseointegrated Implants

Indications are limited:

- Fracture of the implant
- Poor restorative position/non-restorable
- Peri-Implantitis or Infection
- Impingement on anatomic structures
- Psychological issues
- Obsolete components



UF



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UF

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UF

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- Obsolete components



UF

## Methods to Remove Implants

- Elevator & Forceps
- Chisel
- Bur
- Piezo Surgical Unit
- Trephine
- Thermo-explantation
- Reverse/Explantation Driver
- Counter-Torque Ratchet Technique

Compend Contin Educ Dent. 2011 Sep;32(7):22-6. 28-30

UF

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- ~~Elevator & Forceps~~
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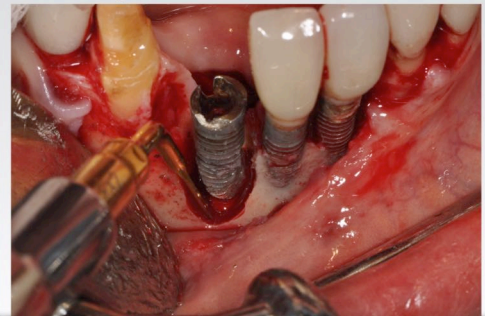
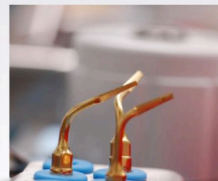


Compend Contin Educ Dent. 2011 Sep;32(7):22-6. 28-30

UF

## Methods to Remove Implants

- Piezo Surgical Unit

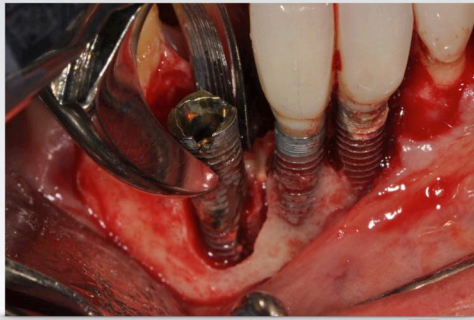


Compend Contin Educ Dent. 2011 Sep;32(7):22-6. 28-30

UF

## Methods to Remove Implants

### • Piezo Surgical Unit

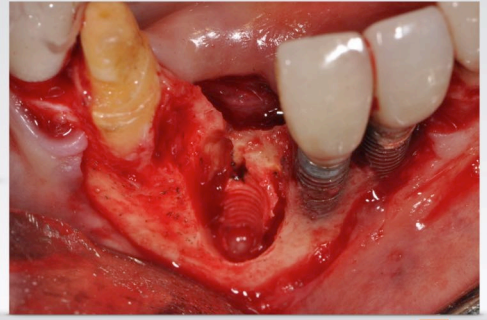
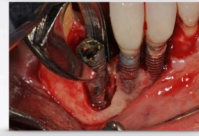
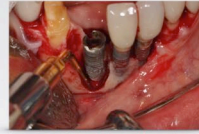


Compend Contin Educ Dent. 2011 Sep;32(7):22-6, 28-30

UF

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### • Piezo Surgical Unit

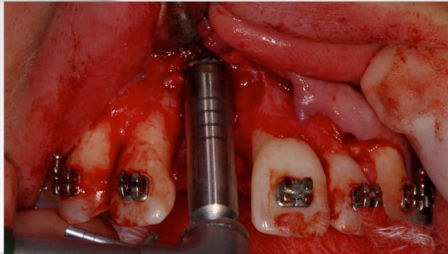


Compend Contin Educ Dent. 2011 Sep;32(7):22-6, 28-30

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## Methods to Remove Implants

### • Trepine

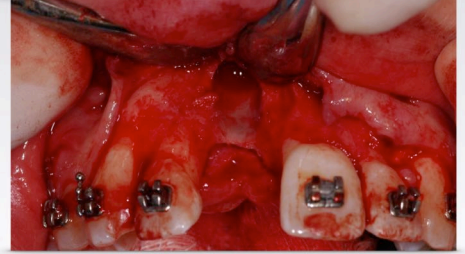


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UF

## Methods to Remove Implants

### • Trepine

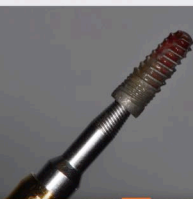
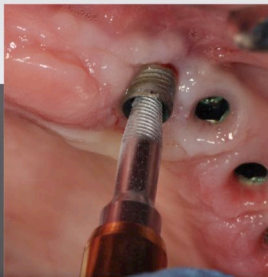


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## Methods to Remove Implants

### • Reverse/Explantation Driver



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## Methods to Remove Implants

### • Counter-Torque Ratchet Technique

- Essentially "unscrewing" the implant
- Relies on counter-torque to de-integrate the implant
- Success depends on your ability to engage the implant



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## Complication - Implant Positioning



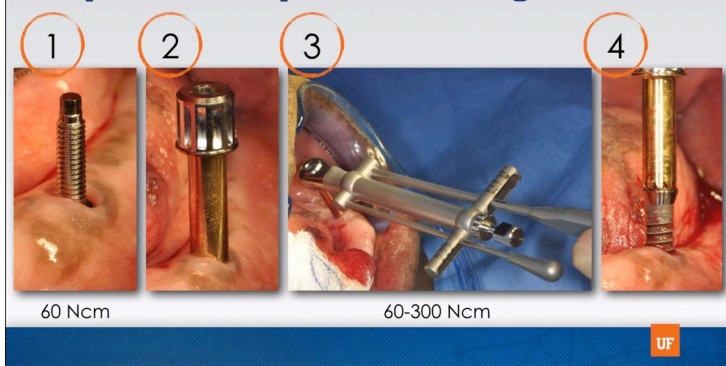
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## Complication - Implant Positioning



UF

## Complication - Implant Positioning



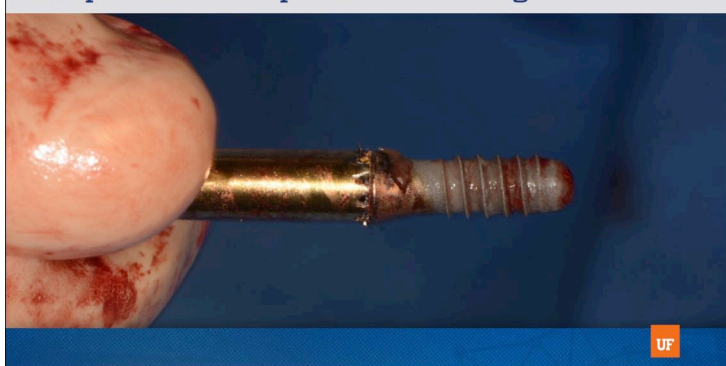
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UF

## Complication - Implant Positioning



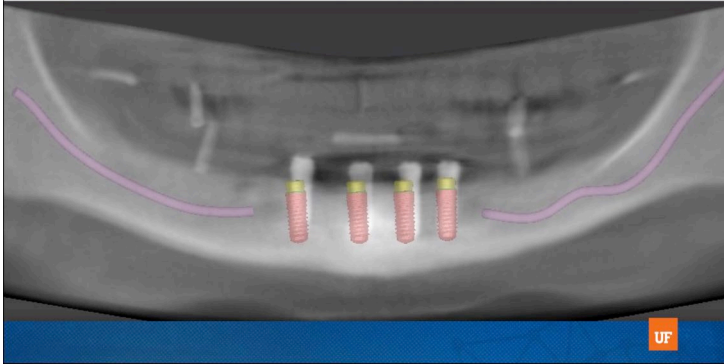
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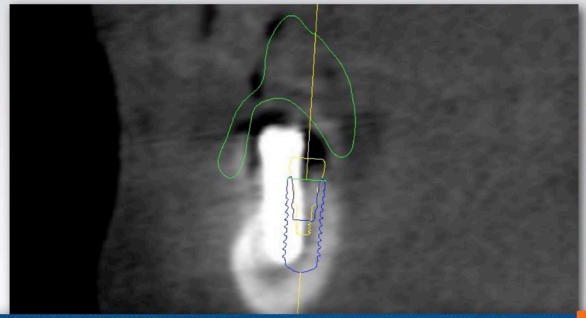


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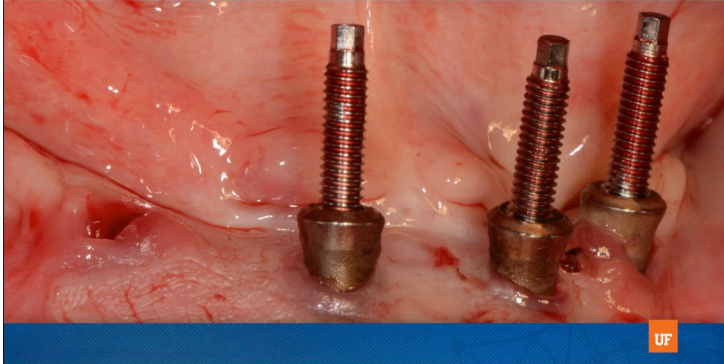
Implant Removal with Placement



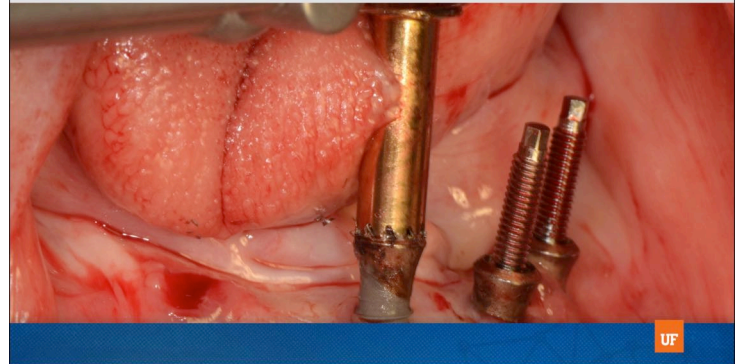
Implant Removal with Placement



Implant Removal with Placement



Implant Removal with Placement



Implant Removal with Placement



Implant Removal with Placement



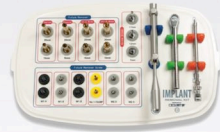
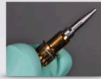


## Conclusions

### Implant Removal Situations:

- Fracture of the implant
- Poor restorative position/non-restorable
- Peri-Implantitis or Infection
- Impingement on anatomic structures
- Psychological issues
- Obsolete components

### Reverse/Explantation Driver



### Counter-Torque Ratchet Technique

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## Completely Edentulous - Implant Numbers

### Prostheses:

- Fixed dental prosthesis
- Individual attachments



**Question:** How many implants are recommended for fixed restorations in the edentulous patient?

III Curriculum Development Project 2014

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## Completely Edentulous - Implant Numbers

### Prostheses:

- Fixed dental prosthesis
- Individual attachments



A number of factors influence this decision: The **number of teeth** planned for the final prosthesis, the **loading protocol** to be used, the patients **bruxing status**, and the **materials** to be used in fabricating the prosthesis, are but a few of these considerations.

III Curriculum Development Project 2014

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## Completely Edentulous - Implant Numbers

### Prostheses:

- Fixed dental prosthesis
- Individual attachments



There are **few studies** that directly investigate this question, however, some clinical studies provide limited guidance in this area. It would appear that **four implants in the mandible**, and **six implants in the maxilla**, are sufficient to support "full-arch" prostheses that meet the functional and aesthetic needs of most patients.

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## Completely Edentulous - Implant Numbers

### Prostheses:

- Fixed dental prosthesis
- Individual attachments



**Question:** How many implants are recommended for removable restorations in the edentulous patient?

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## Completely Edentulous - Implant Numbers

### Prostheses:

- Fixed dental prosthesis
- Individual attachments



There is **strong** evidence demonstrating that **mandibular full** prostheses **retained/supported by 2 or more implants** are highly satisfactory and survive in the long term.

There is **moderate** evidence demonstrating that **maxillary full** prostheses **supported by 4 or more implants** are highly satisfactory and survive in the long term.

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## Maxillary Locator® Overdentures

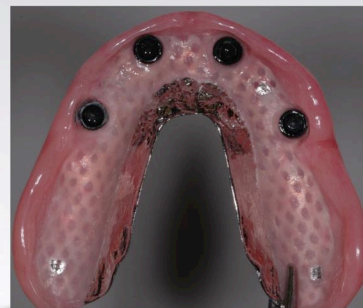


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## Maxillary Locator® Overdentures

### Plan to the "weakest link"

- Patient factors
- Arch form
- Palatal vault
- Bone quality
- Implant stability
- Opposing occlusion:
  - natural
  - denture
  - overdenture
  - hybrid
  - fixed - porcelain



UF

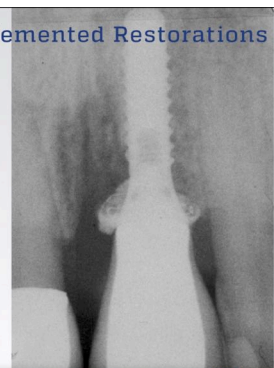
## Management of the Prosthesis - Cemented Restorations



D.Buser

UF

## Management of the Prosthesis - Cemented Restorations



D.Buser

UF

## Management of the Prosthesis - Cemented Restorations



UF

## Management of the Prosthesis - Cemented Restorations



UF



## Cementation - A Risk Factor

Tomas Linkavicius  
Algirdas Puisys  
Egle Vindasute  
Laura Linkaviciene  
Petris Apse

Does residual cement around implant-supported restorations cause peri-implant disease? A retrospective case analysis



The sample size of **129 implants** comprised of **32 implant restorations** with **mechanical failures (24.8%)** and **97 implants** affected by **biological complications (75.2%)**.

UF

## Cementation - A Risk Factor

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Algirdas Puisys  
Egle Vindasute  
Laura Linkaviciene  
Petris Apse

Does residual cement around implant-supported restorations cause peri-implant disease? A retrospective case analysis

Cement remnants were found in 11 of 32 implants affected by mechanical complications and in **62 of 97 implants with biological complications**, making it 73 implants of 129 in total (56%).

The control group of screw-retained restorations all 53 restored implants in periodontally healthy patients **did not have biological complications**. There were two occurrences of peri-implant disease (1.08%) in the group of 185 implants in patients with history of periodontitis.

UF

## Literature Review

Tomas Linkavicius  
Egle Vindasute  
Algirdas Puisys  
Vytaute Peciliene

The influence of margin location on the amount of undetected cement excess after delivery of cement-retained implant restorations

**Implant positioned approximately 5mm below the gingival level**

- **group1 (control)** - 1mm above the mucosa
- **group 2** - at the mucosal margin
- **group 3** - 1mm below the mucosal margin
- **group 4** - 2mm below the mucosal margin
- **group 5** - 3mm below the mucosal margin



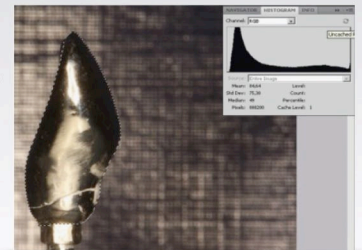
UF

## Literature Review

Tomas Linkavicius  
Egle Vindasute  
Algirdas Puisys  
Vytaute Peciliene

The influence of margin location on the amount of undetected cement excess after delivery of cement-retained implant restorations

**All cement remnants were removed only when the margin was visible. The greatest amount of cement remnants was left when the crown margin was 2 or 3mm below the mucosal level.**



UF

CR

Clinical Recommendation



**Location of the Implant Shoulder.** In most esthetic areas, the implant shoulder is located submucosally, resulting in a deep interproximal margins. This shoulder location makes seating of the restoration and removal of cement difficult. Therefore, a screw-retained abutment/restoration interface is advisable to minimize these difficulties.

Consensus Statements and Recommended Clinical Procedures Regarding Optimizing Esthetic Outcomes in Implant Dentistry - Morton D, et. al.

CR

Clinical Recommendation



Stock

VS

Custom



UF

## Management of the Prosthesis - Cement vs. Screw-retained

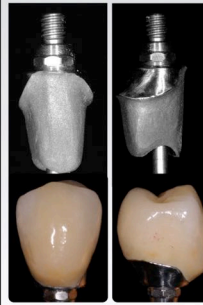
Screw-Retained Restoration	Cement-Retained Restoration
Passive fit	
Esthetics	
Microgap colonization risk	Natural occlusal form
Retrievability	Cost
Retention	Angulation correction
Limited abutment height	Misaligned implants
Cement inclusion risk	Ease of fabrication
Deep insertion of implant	Access to posterior mouth
Multiple abutments restoration	

© 2010 ITI International Team for Implantology



UF

## CAD/CAM Abutments



UF

## Management of the Prosthesis - Venting Excess Cement



TECHNIQUE FOR CONTROLLING THE CEMENT FOR AN IMPLANT CROWN

Chandur Wadhvani, BDS, MSD,\* and Alfonso Piñeyro, DDS\*  
School of Dentistry, University of Washington, Seattle, Wash



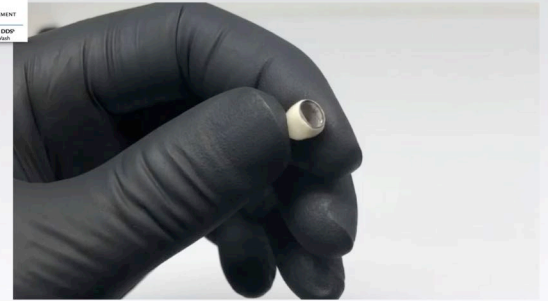
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## Management of the Prosthesis - Venting Excess Cement



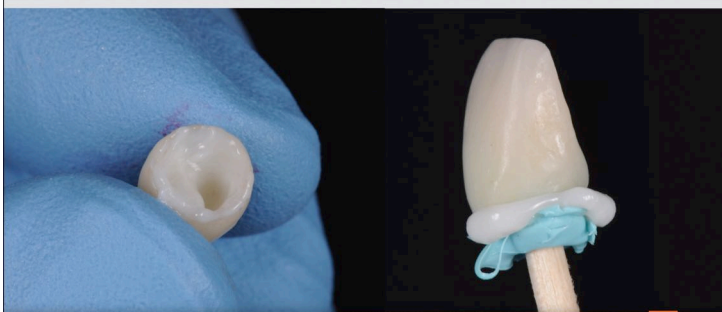
TECHNIQUE FOR CONTROLLING THE CEMENT FOR AN IMPLANT CROWN

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School of Dentistry, University of Washington, Seattle, Wash



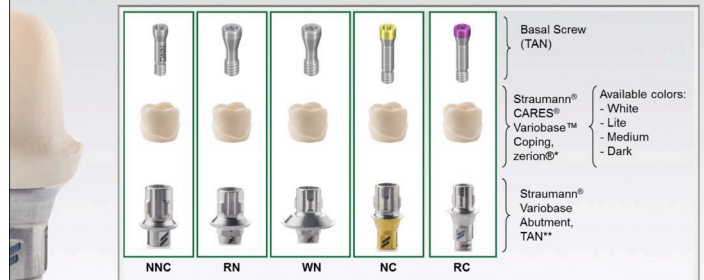
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## Management of the Prosthesis - Venting Excess Cement



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## Ti-base Abutments

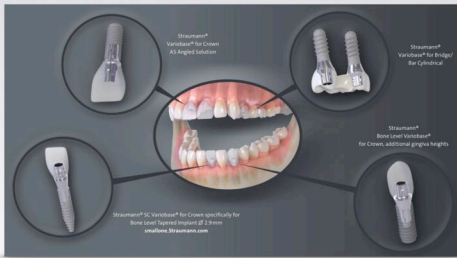


CARES®: Variobase™ Abutment

UF



## Ti-base Abutments



UF

## Ti-base Abutments - Example



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## Ti-base Abutments - Example



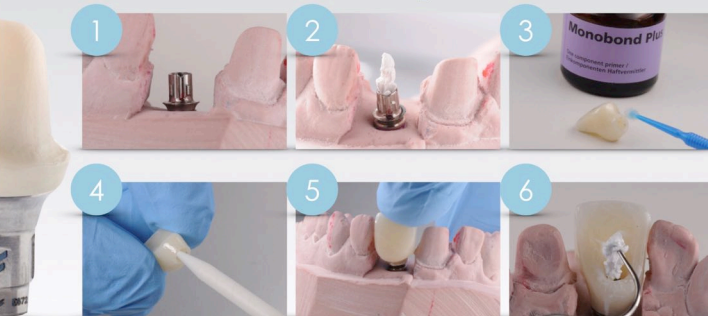
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## Ti-base Abutments - Example



UF

## Ti-base Abutments - Example



UF

## Ti-base Abutments - Example



2-years

UF

## Management of the Prosthesis - Abutment Design



UF

## Management of the Prosthesis - Abutment Design



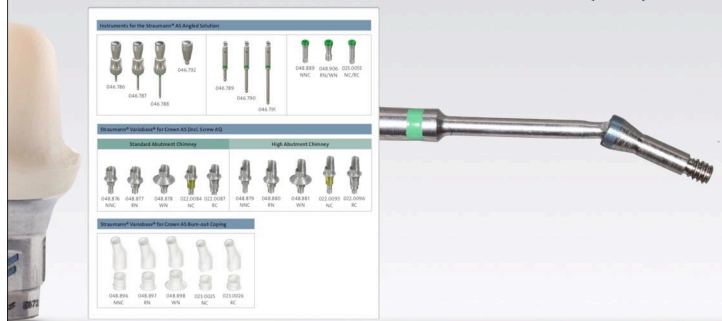
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## Management of the Prosthesis - Abutment Design



UF

## Ti-base Abutments - Screw-retained (AS)



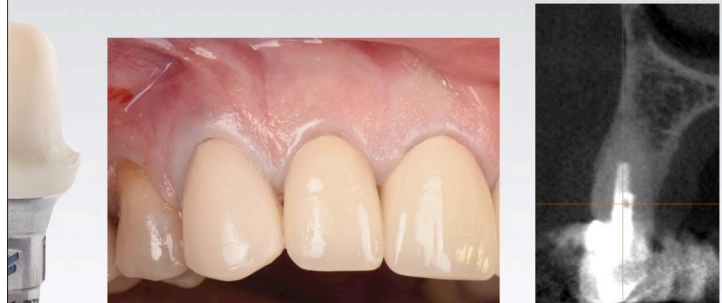
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## Ti-base Abutments - Screw-retained (AS)



UF

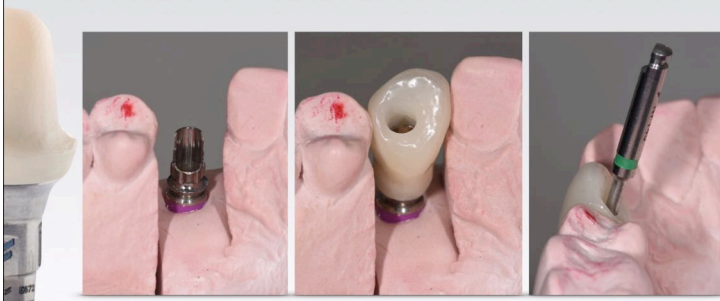
## Ti-base Abutments - Screw-retained (AS)



UF



Ti-base Abutments - Screw-retained (AS)



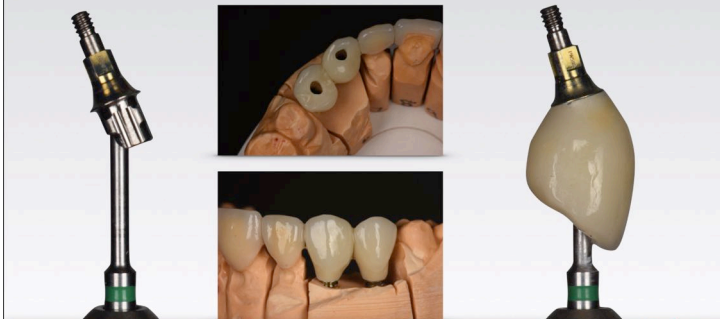
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Ti-base Abutments - Screw-retained (AS)



UF

Ti-base Abutments - Screw-retained (AS)



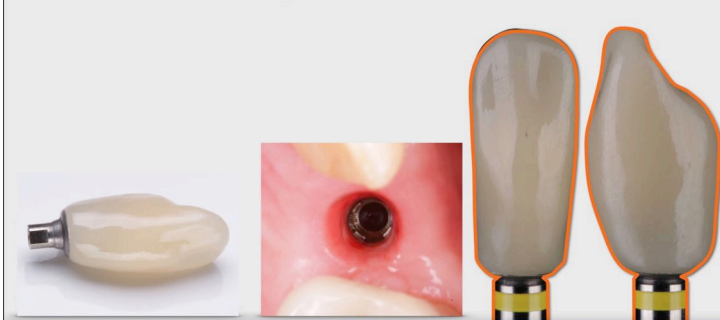
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Ti-base Abutments - Screw-retained (AS)



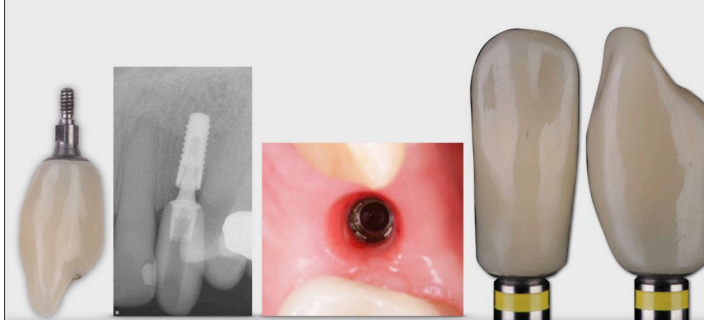
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Ti-Base - Challenges



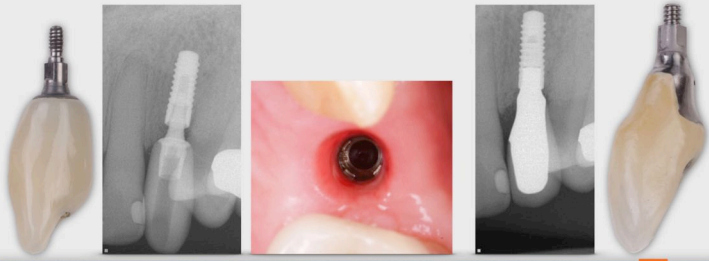
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Ti-Base - Challenges



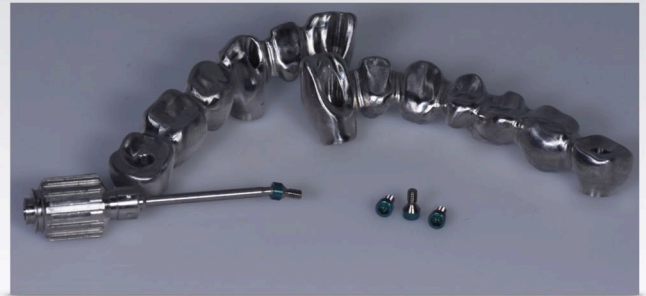
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## Ti-Base - Challenges



UF

## CARES FDP - Screw-retained (AS)



UF

## CARES FDP - Screw-retained (AS)



UF

## CARES FDP - Screw-retained (AS)



UF

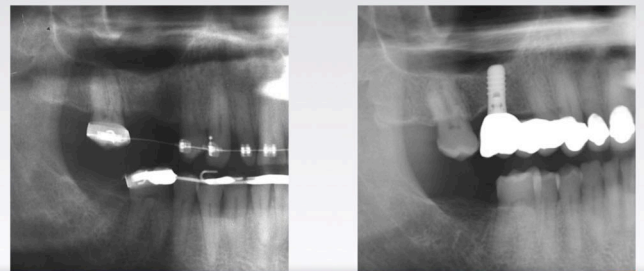


UF

- Splinting *implants* to **natural teeth**?
- Splinting *implants* to **each other**?
- Cantilevering pontics...**unilateral** vs. **full-arch**?

## Partially Edentulous - Restoration Design for Durability

### Splinting implants to teeth

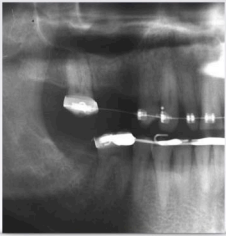


UF



## Partially Edentulous - Restoration Design for Durability

### Splinting implants to teeth



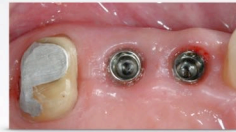
- **Systematic Review**
- 5-year survival - **94.73%**
- 10-year survival - **77.77%**
- **Tooth loss - > 10 yrs.**
- **Rigid connection**
- **Cement = screw-retained**

Mamalis A., et.al. 2012



## Partially Edentulous - Restoration Design for Durability

### Splinting vs. individual implant restorations



No scientific article has been found comparing the specific clinical outcome of IS FPD when implants are **splinted vs nonsplinted** or a pontic is incorporated in the design, so there is **no proven functional or biological superiority of either treatment concept**. Advantages and limitations should be **evaluated individually for each patient**, but less invasive and most cost effective option should be considered.

## Partially Edentulous - Restoration Design for Durability

### Splinting vs. individual implant restorations



"splinting **may not be significant** for internally connected implants when the **crown-to-implant ratio is less than 1"**

Blanes R., et.al. Clin Oral Impl Res. 2007

## Partially Edentulous - Restoration Design for Durability

### Cantilevered Restorations - Partially Edentulous

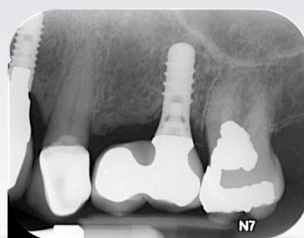


- Fixed **implant-supported prosthesis** with **cantilever** show a **higher rate of mechanical complications** when compared with **non-cantilevered designs**.

ITI Curriculum Development Project

## Partially Edentulous - Restoration Design for Durability

### Cantilevered Restorations - Partially Edentulous



## Partially Edentulous - Restoration Design for Durability

### Cantilevered Restorations - Partially Edentulous



- **No increased rate of vertical or horizontal bone loss** was found in **implants supporting cantilever prosthesis**.

ITI Curriculum Development Project

## Cantilevered Restorations - Partially Edentulous



**Clinical Service Complications**

## Mechanical and Technical Risks in Implant Therapy

**Purpose:** To systematically appraise the impact of mechanical/technical risk factors on implant-supported reconstructions. **Material and Methods:** A MEDLINE (PubMed) database search from 1966 to April 2008 was conducted. The search strategy was a combination of MeSH terms and the key words: design, dental implants), risk, prosthodontics, fixed prosthodontics, fixed partial denture(s), fixed denture prosthesis (FDP), fixed reconstruction(s), oral rehabilitation, bridge(s), removable partial denture(s), complete denture(s). **Results:** Of the 111 articles identified, 33 were included in the final cohort studies with a mean follow-up of at least 4 years were included. The material evaluated in each study had to include cases with/without exposure to the risk factor. **Results:** From 3,568 articles, 111 were selected for full text analysis. Of the 111 articles, 33 were included for data extraction after grouping the outcomes into 10 risk factors: type of retentive elements supporting overdentures, presence of cantilever extension(s), cemented versus screw-retained FDPs, angled/angulated abutments, bruxism, crown/implant ratio, length of the suprastructure, prosthetic materials, number of implants per arch, and occlusal contact. The results showed that the most common risk factor was the use of a metal framework in overdentures, the presence of cantilever extension(s) > 15 mm and of bruxism, the length of the reconstruction, and a history of repeated complications were associated with increased mechanical/technical complications. The type of retention, the presence of angled abut-



Salvi and Bragger, (2009)

- Systematic review identified 35 publications

- **Mechanical Risk** - Failure of prefabricated components most often as a result of mechanical forces
- **Technical Risk** - Failure or complications associated with fabrication (and service) of the prosthesis



Salvi G, Bragger U, IJOMI, Supplement, 2009

- 10 Factors associated with risk of complication

- Retentive elements for over-dentures (framework)
- Presence of cantilevers (>15mm & Bruxism)
- Cement vs. screw-retention
- Angled/angulated abutments
- Bruxism (parafunction)
- Crown/implant ratio
- Length of suprastructure
- Prosthetic materials
- Implant number supporting FDP
- History of mechanical/technical complications



- 3,568 articles
- 111 full analysis
- 35 data extraction



Salvi G, Bragger U, IJOMI, Supplement. 2009

- 10 Factors associated with risk of complication

- **Retentive elements for over-dentures (framework)**
- **Presence of cantilevers (>15mm & Bruxism)**
- Cement vs. screw-retention
- Angled/angulated abutments
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- **Length of suprastructure**
- Prosthetic materials
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- **History of mechanical/technical complications**



- 3,568 articles
- 111 full analysis
- 35 data extraction



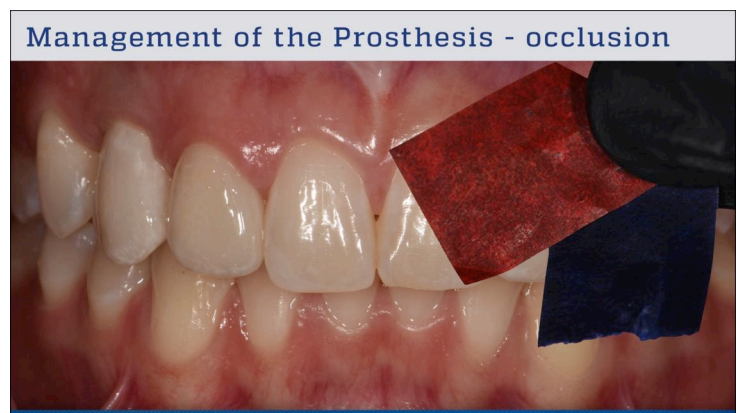
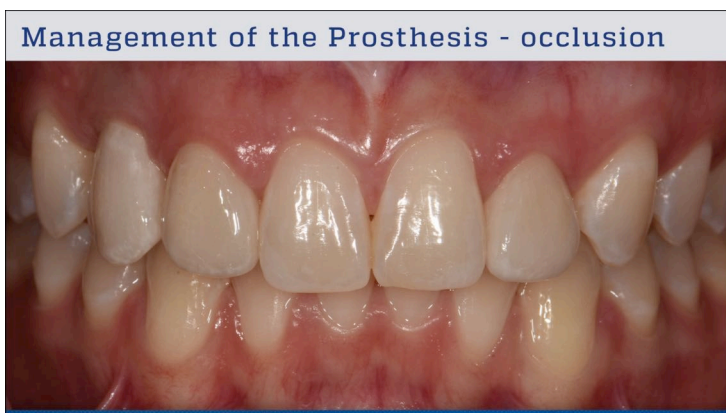
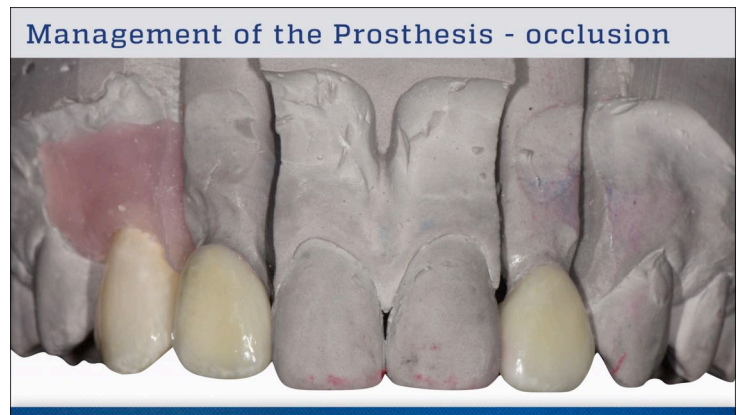
Salvi G, Bragger U, IJOMI, Supplement, 2009





### Mechanical Complications

- **Failure:**
  - Abutments
  - Attachments
  - Abutment/retaining screws
- **Possible Causes:**
  - Material selection
  - Misfit
  - Overload



## Management of the Prosthesis - occlusion

1



2



## Management of the Prosthesis - occlusion

3



4



## Management of the Prosthesis - occlusion

### ● Occlusal contacts:

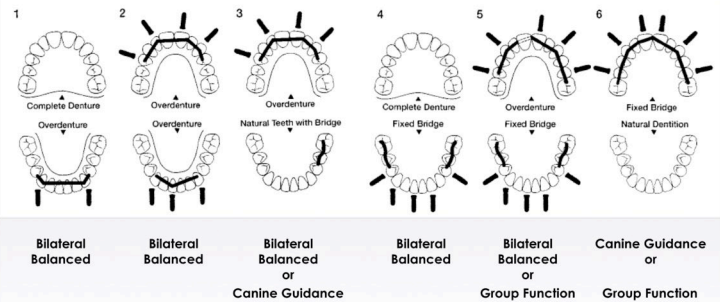
- functional cusps
- fossae

### ● NO occlusal contacts:

- marginal ridges
- transverse planes



## Prosthesis Considerations - Implant Supported Restorations



Sheridan R, et.al. 2016, Koyano K and Esaki D, 2015

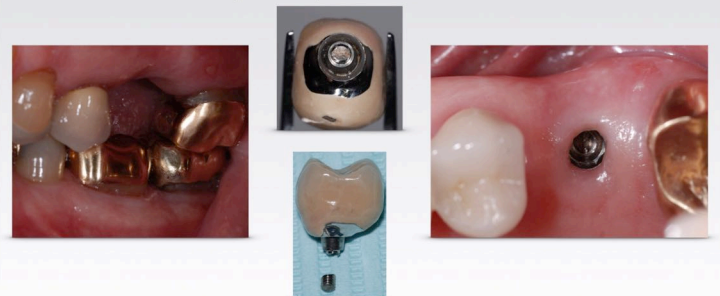
## Management of the Prosthesis - occlusion

**Polishing the occlusal surface is just as important as the occlusal adjustment itself...proper polishing takes about the same time as the adjustment. ~WM**



## Mechanical Complications - Parafunctional Habits

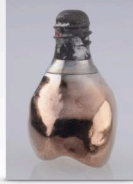
### Parafunctional Habits (Bruxism)





## Mechanical Complications - Parafunctional Habits

### Parafunctional Habits (Bruxism)



## Mechanical Complications - Parafunctional Habits

### • Patients with parafunctional habits:

- Attempt to **address cause**
- Implant selection key - **prosthetic connection strength**
- **Over-engineer** restoration design/materials
- **Avoid** deflecting contacts
- Design **smaller occlusal tables**, low cusp angle
- Intervene with **tighter maintenance intervals**



## Mechanical Complications

### • Failure:

- Abutments
- Attachments
- Abutment/retaining screws

Loose restoration **6-months** post-delivery



### • Possible Causes:

- Material selection
- Misfit
- Overload

## Mechanical Complications - Abutment Failure

Loose restoration **6-months** post-delivery



## Mechanical Complications - Abutment Failure - Misfit

### Implants with Original and Non-Original Abutment Connections

Michel Gigandet, mod. dent\*, Gianni Bigolin\*, Francisco Ferrero\*, Walter Bittgen, Heimed, eng\*  
Ute Brüggen, Prof. Dr. med. dent\*



Original



Non-Original

### AIM:

- To **test** in vitro the **mechanical resistance**, **rotational misfit** and **failure mode** of **three original implant-abutment connections** and to compare them to **two connections between non-original abutments** connected to one of the **original implants**.

### CONCLUSIONS:

- **Non-Original abutments** differ in design of the connecting surfaces and material and demonstrate **higher rotational misfit**. These differences may result in unexpected failure modes.

## Mechanical Complications - Abutment Material Selection



### Wear at the Titanium-Zirconia Implant-Abutment Interface: A Pilot Study.

IJOMI Volume 26, Number 5, 2011



- **Off-axis sinusoidal loading 20-200 N for 1,000,000 cycles.**
- Mean wear at **titanium-titanium** -  $15.8 \pm 3.3 \times 10^3 \mu\text{m}^2$
- Mean wear at **titanium-zirconia** -  $131.8 \pm 14.5 \times 10^3 \mu\text{m}^2$
- statistically significant ( $p = .0081$ )

**Conclusions:** ~the amount of titanium transfer seen on the zirconia abutment increased with the number of loading cycles, but appeared to be self-limiting.

## Mechanical Complications - Abutment Material Selection

**A systematic review of the performance of ceramic and metal implant abutments supporting fixed implant reconstructions.**

Authors: Sailer I, Philipp A, Zembic A, Pjetursson BE, Hämmerle CH, Zwahlen M.

The **estimated survival rate** of **ceramic abutments** was **99.1%** (95% CI: 39.8-99.9%) **at 5 years of function**. **No difference** to the **survival rate of metal abutments** (97.4% (95% CI: 96-98.3%)) was found.



Clin Oral Implants Res. 2009 Sep;20 Suppl 4:4-31.

## Mechanical Complications - Abutment Material Selection

USE OF PREFABRICATED TITANIUM ABUTMENTS AND CUSTOMIZED ANATOMIC LITHIUM DISILICATE STRUCTURES FOR CEMENT-RETAINED IMPLANT RESTORATIONS IN THE ESTHETIC ZONE

Wei-Shao Lin, DDS,\* Bryan T. Harris, DMD,\* Amirali Zandinejad, DDS, MSc, William C. Martin, DMD, MS,\* and Dean Morton, BDS, MS School of Dentistry, University of Louisville, Louisville, Ky; College of Dentistry, University of Florida, Gainesville, Fla



## Mechanical Complications - Attachment Wear

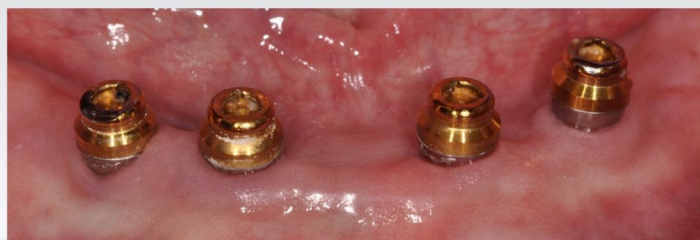
**1 to 2 years out...**



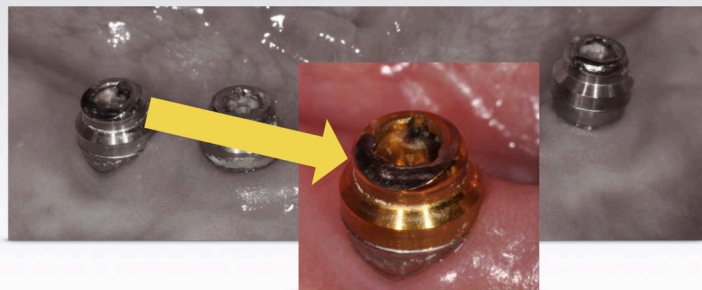
- 1) "My denture doesn't snap in like it used to."
- 2) "I have several sore spots."
- 3) "My denture moves too much when I chew."



## Mechanical Complications - Attachment Wear



## Mechanical Complications - Attachment Wear



## Mechanical Complications - Attachment Wear



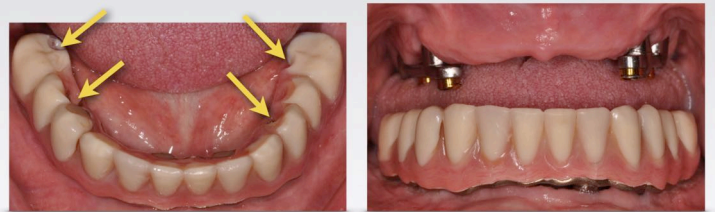


Mechanical Complications - Attachment Wear



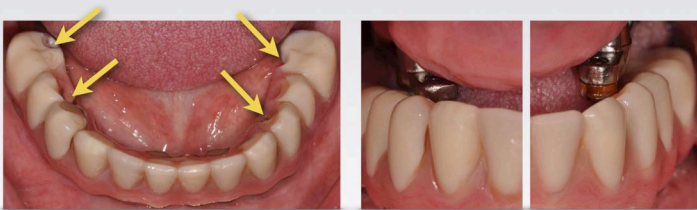
3-month follow-up

Mechanical Complications - Attachment Wear



3-month follow-up

Mechanical Complications - Attachment Wear



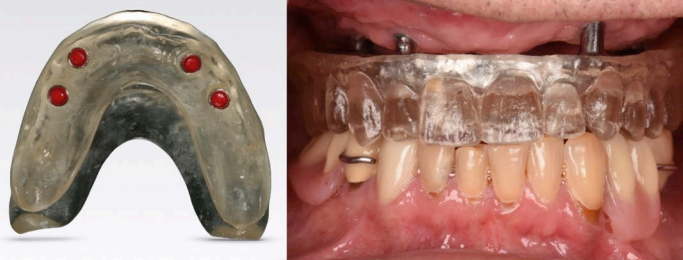
3-month follow-up

Mechanical Complications - Attachment Wear



*duplicated denture* = **night guard**

Mechanical Complications - Attachment Wear

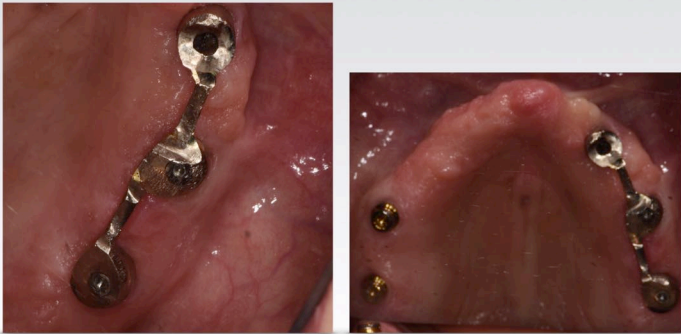


*duplicated denture* = **night guard**

Mechanical Complications - Attachment Wear



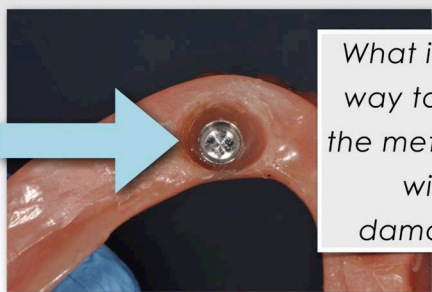
## Mechanical Complications - Attachment Wear



## Clinical Service - LOCATOR® abutments

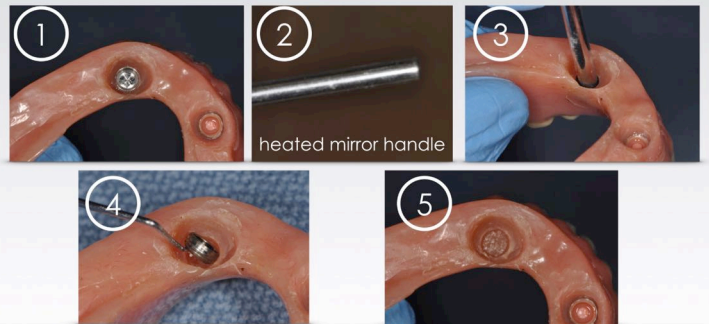


## Clinical Tip: LOCATOR® housing removal

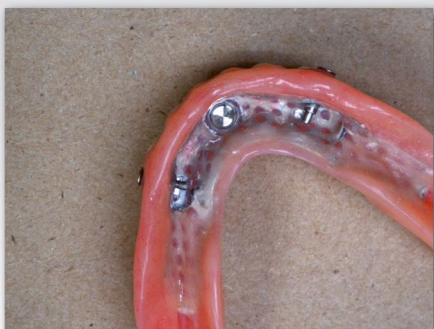


What is the best way to removal the metal housing without damaging it?

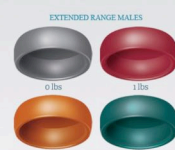
## Clinical Tip: LOCATOR® housing removal



## Clinical Tip: LOCATOR® housing removal



## Clinical Tip: LOCATOR® male attachments





## Clinical Tip: LOCATOR® male attachments



## How should we manage screws?

Tightening protocol..  
Replacement protocol..



## How should we manage screws?

### Evaluation of Screw Loosening on New Abutment Screws and After Successive Tightening

Gustavo Sadeh BARBOSA<sup>1</sup>  
Jade Paula de SILVA NETO<sup>2</sup>  
Paulo Cesar SIMAMOTO JUNIOR<sup>3</sup>  
Flávia Domingues das NEVES<sup>4</sup>  
Marta da Glória Chianello de MATTOS<sup>5</sup>  
Ricardo Faria RIBEIRO<sup>6</sup>

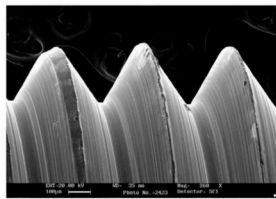


Figure 1. Screw before tightening.

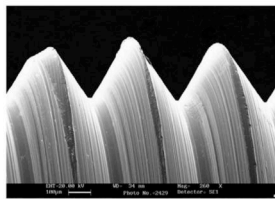


Figure 2. Screw after tightening.

## How should we manage screws?

### Evaluation of Screw Loosening on New Abutment Screws and After Successive Tightening

Gustavo Sadeh BARBOSA<sup>1</sup>  
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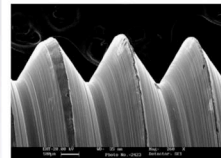


Figure 1. Screw before tightening.

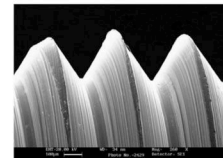


Figure 2. Screw after tightening.

.....loosening percentage of the initial torque is smaller when using screws that already suffered application of an initial torque, staying stable after successive tightening procedures.

## How should we manage screws?

Clin. Oral. Implants Res. 2012 Apr;23(4):475-80. doi: 10.1111/j.1600-0501.2011.02165.x. Epub 2011 Apr 4.

### Torque removal evaluation of prosthetic screws after tightening and loosening cycles: an in vitro study.

Cardoso M<sup>1</sup>, Torres MC, Lourenco EA, de Moraes Telles D, Rodrigues RC, Ribeiro RE.

#### Abstract

**OBJECTIVES:** The aim of this study was to evaluate the variation in removal torque of implant prosthetic abutment screws after successive tightening and loosening cycles, in addition to evaluating the influence of the hexagon at the abutment base on screw removal torque.

**MATERIAL AND METHODS:** Twenty hexagonal abutments were tightened to 20 regular external hex implants with a titanium alloy screw, with an insertion torque of 32 N cm, measured with a digital torque gauge. The implant/abutment/screw assemblies were divided into two groups: (1) abutments without hexagon at the base and (2) abutments with a hexagon at the base. Each assembly received a provisional restoration and was submitted to mechanical loading cycles. After this, the screws were removed and the removal torque was measured. This sequence was repeated 10 times, then the screw was replaced by a new one, and another cycle was performed. Linear regression analysis was performed.

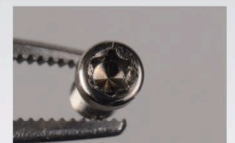
**RESULTS:** Removal torque values tended to decrease as the number of insertion/removal cycles increased, for both groups. Comparisons of the slopes and the intercepts between groups showed no statistical difference. There was no significant difference between the mean values of last five cycles and the 11th cycle. Within the limitations of this in vitro study, it was concluded that (1) repeated insertion/removal cycles promoted gradual reduction in removal torque of screws, (2) replacing the screw with a new one after 10 cycles did not increase resistance to loosening, and (3) removal of the hexagon from the abutment base had no effect on the removal torque of the screws.

## Measurements and treatment at recall visits

### Opinions Regarding Reuse or Replacement of Implant Prosthesis Retaining Screws: A Systematic Review

Xiao, Yang, Liu, Taylor

IJOMI 2017



- Limited available literature
- Appears **retightening** occlusal or abutment screws **is acceptable**
- Routine **replacement cannot be recommended at this time**
- **Routine assessment of screw tightness is strongly recommended**

## Clinical Service - fractured restoration

- Problem: Fractured Restoration

- determine retention (S or C)

Screw-retained  
or  
Cement-retained

Solid Abutments



## Clinical Service - fractured restoration

- Problem: Fractured Restoration

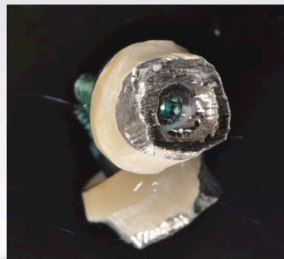
- determine retention (S or C)



## Clinical Service - fractured restoration

- Problem: Fractured Restoration

- determine retention (S or C)



## Clinical Service - COMPLICATION

- Problem: Fractured Restoration

*DO NOT* use a  
conventional approach to  
remove crowns.



## Clinical Service - loose abutments/screws

- Problem: Loose Restoration

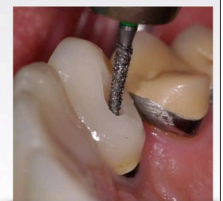
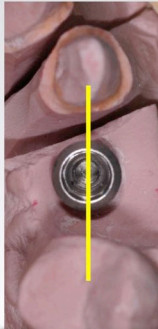
- determine retention (S or C)



## Clinical Service - loose abutments/screws

- Problem: Loose Restoration

- determine retention (S or C)
- (S) retrieve master cast
- (S) access abutment screw head





## Clinical Service - loose abutments/screws

### Problem: Loose Restoration

- determine retention (S or C)
- (S) retrieve master cast
- (S) access abutment screw head
- \*Seal custom abutments with teflon and CAVIT®



## Clinical Service - "Stuck" Screw

### Problem: Stuck Abutment Screw/Healing Abutment

- Tapping of torque wrench
- Thermo cooling (3 seconds)

1



2



Blal K, et. al., 2017

## Clinical Service - stripped abutment screw

### Causes:

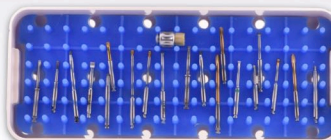
- Debris
- Off-angle loosening
- Worn driver
- Lock-tite



## Clinical Service - Screw Stripping

### Problem: Stripped Screw

- Try different drivers



Straight	Straight Systems
SCS	Straumann
UniGrip	Repace Select
Hex 1.3 mm/.050 inch	Lifecore, Biohorizons, Astra, Zimmer
Hex 1.2 mm/.048 inch	3i System
Hex 0.9 mm/.035 inch	Frident, Ankylos, 3i Cover Screw
Square 1.3 mm/.050 inch	Gold Screw/Nobel Biocare



## Clinical Service - Screw Stripping

### Problem: Stripped Screw

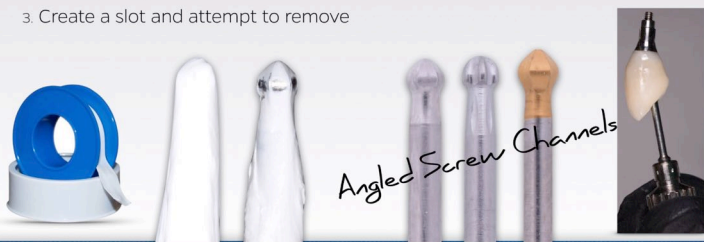
- Try different drivers
- Teflon (PTFE)



## Clinical Service - Screw Stripping

### Problem: Stripped Screw

- Try different drivers
- Teflon (PTFE)
- Create a slot and attempt to remove



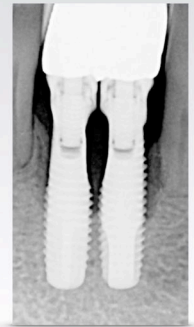
## Clinical Service - Screw Stripping

### Problem: Stripped Screw

1. Try different drivers
2. Teflon (PTFE)
3. Create a slot and attempt to remove
4. Cut off the screw head



## Clinical Service - stripped abutment screw



## Clinical Service - stripped abutment screw



## Clinical Service - stripped abutment screw



## Mechanical Complications - Abutment Screw Fracture POTENTIAL CAUSES



**Mishandling:** clinician follow the manufacturer's instructions for use.

**Misfit:** An inadequately fitting framework may be a predisposing factor to prosthetic screw fracture or loosening.

**Occlusal forces:** usually in the presence of other predisposing factors, misfit, and mishandling, may lead to prosthetic screw fracture or loosening.



Heitz-Mayfield L., et. al., 2013

## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

1. Explorer & patience





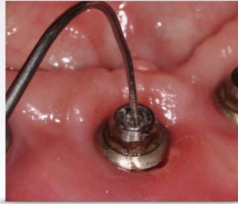
## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

1. Explorer & patience
- + cleaning solution (tatar & stain)



Ref. Dr. Gerard Cuomo



## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

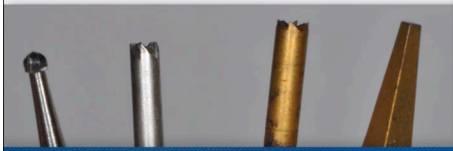
1. Explorer & patience
2. Cavitron



## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

1. Explorer & patience
2. Cavitron
3. Screw retrieval kit (Service)



## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

1. Explorer & patience
2. Cavitron
3. Screw retrieval kit (Service)

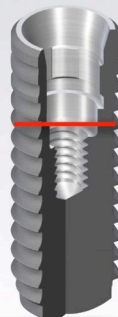
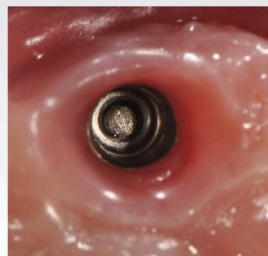


## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

1. Explorer & patience
2. Cavitron
3. Screw retrieval kit (Service)

#### 4.THINK OUTSIDE THE BOX



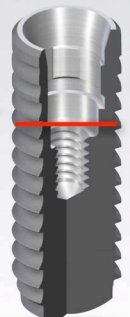
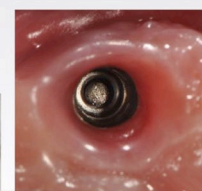
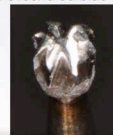
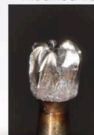
## Clinical Service - Abutment Screw Fracture

### Problem: Broken Screw

1. Explorer & patience
2. Cavitron
3. Screw retrieval kit (Service)

#### 4.THINK OUTSIDE THE BOX

Modified #2 or 3 round carbide



## Clinical Service - Abutment Screw Fracture

**Problem: Broken Screw**

**1. THINK OUTSIDE THE BOX**



## Clinical Service - Abutment Screw Fracture

**Problem: Broken Screw**

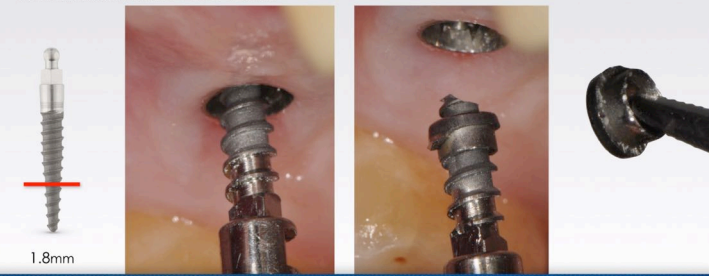
**1. THINK OUTSIDE THE BOX**



## Clinical Service - Abutment Screw Fracture

**Problem: Broken Screw**

**1. THINK OUTSIDE THE BOX**



3





Technical Risks

## Clinical Service - Technical Complications

### • Failure:

- Frameworks
- Materials

### • Possible Causes:

- Material selection
- Design
- Management



## Technical Complications - Framework Design

### • Cantilevered Restorations:

The presence of cantilever extensions  $> 15 \text{ mm}$  was **associated** with an **increased risk** of **full-arch FDP fracture** compared with the presence of **cantilever extensions  $\leq 15 \text{ mm}$**





## Technical Complications - Framework Design

### • Cantilevered Restorations:

#### • Patient:

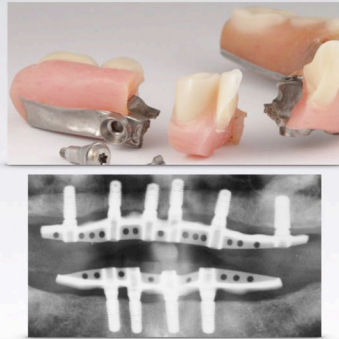
- Opposing occlusion
- Inter-occlusal space

#### • Prosthesis:

- Prosthetic connection
- Framework design & passivity
- A/P Spread

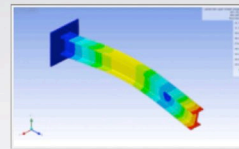
#### • Material:

- Strength

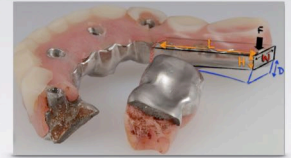


## Technical Complications - Framework Design

### • Cantilevered Restorations:



F = Force  
D = Deflection  
H = Height  
W = Width  
L = Length  
K = Constant  
E = Elastic Modulus



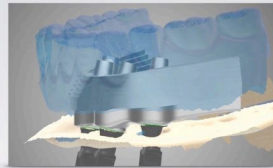
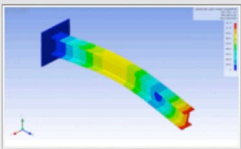
Cantilevered Beams - Height<sup>3</sup> vs. Width

$$D \approx \frac{K L^3 F}{E W H^3}$$

Drago & Howell, 2012

## Technical Complications - Framework Design

### • Cantilevered Restorations:



I and L beam designs with **greater height** were proposed to provide superior resistance to deflection



Drago & Howell, 2012

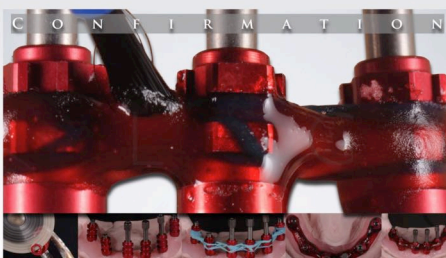
## Technical Complications - Framework Passivity

### • Cantilevered Restorations - Passivity



## Technical Complications - Framework Passivity

### • Cantilevered Restorations - Passivity



## Technical Complications - Restorative Materials

A systematic review of the survival and complication rates of implant-supported fixed dental prostheses (FDPs) after a mean observation period of at least 5 years.



- **Failure** of veneer material
- 13.5% After 5 years



Pjetursson et al., 2012

## Technical Complications - Restorative Materials

- **Failure** of veneer material
- **Patient-centered**
- **Design & fit** of the framework
- Laboratory **materials/procedures**
- **Occlusal contacts** of marginal ridges/transversal planes
- **Polishing process** after adjustment



Pjetursson et al., 2012

## Technical Complications - Restorative Materials

- **Wear** of denture teeth (acrylic-resin hybrid restorations)



Delivery

Pjetursson et al., 2012

## Technical Complications - Restorative Materials

- **Wear** of denture teeth (acrylic-resin hybrid restorations)



Pjetursson et al., 2012

## Technical Complications - Restorative Materials

- **Failure** of denture teeth (acrylic-resin hybrid restorations)

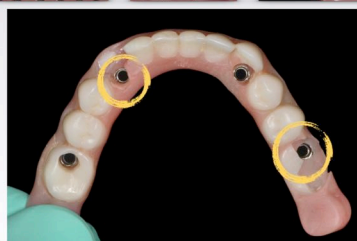


Pjetursson et al., 2012

## Technical Complications - Restorative Materials

- **Possible reasons for fracture:**

- limited restorative space
- decreased proprioception
- progressive wear
- parafunctional habits
- compliance



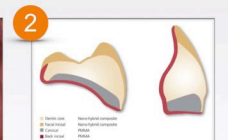
## Technical Complications - Restorative Materials

- **Possible reasons for fracture:**

- limited restorative space
- decreased proprioception
- progressive wear
- parafunctional habits
- compliance



Occlusal Guard



Nano-hybrid composite Teeth



## Hybrid Retread



## Hybrid Retread

### The Retread: A Definition and Retrospective Analysis of 205 Implant-Supported Fixed Prostheses

Thomas J. Balshi, DDS, PhD<sup>1</sup>/Glenn J. Wolfinger, DMD<sup>2</sup>/Stephen G. Alfano, DDS<sup>3</sup>/Stephen F. Balshi, MBE<sup>3</sup>

**Table 2** Distribution of Opposing Dentition and Mean Retread Time

Opposing dentition	n	Mean retread time (y)	Statistically significant (P < .05)
1) Implant-supported ceramometal fixed prosthesis	103	6.06	3, 4, 5, 6, 7
2) Natural tooth-supported ceramometal fixed partial dentures	6	6.81	5
3) Mixed dentition	15	7.68	1, 5, 6, 7
4) Implant-supported fixed hybrid prosthesis	19	9.22	1
5) Removable complete denture	35	10.26	1, 2, 3
6) Natural dentition	8	10.3	1, 3
7) Transitioned dentition	19	11.94	1, 3



## Hybrid Retread



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**Center for  
Implant  
Dentistry**

## Hybrid Retreads

### Option 1 -

When patient presents with worn hybrids  
 Three-visits required.

## Hybrid Retreads

### Patient Presentation - Option 1



### Patient Presentation - Option 1



UF

### Patient Presentation - Option 1



Hybrids on master casts - pin @ 0

UF

### Patient Presentation - Option 1



UF

### Patient Presentation - Option 1



UF

### Option 2 -

Initiated prior to delivery of original (non-worn) hybrids  
This allows for a two-visit retread

**Archiving for Hybrid  
Retread**

UF

### Archiving Patient Information - Hybrid

① Interim Hybrid Restorations - Resin-based





## Archiving Patient Information - Hybrid

### 2 Articulated Master Casts



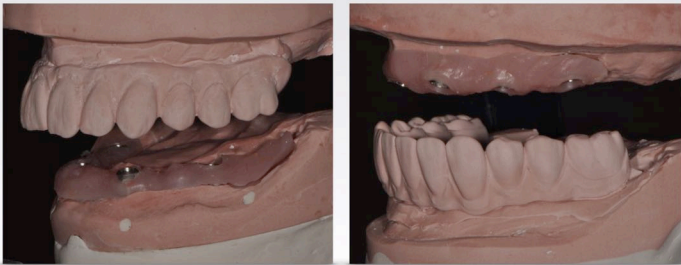
## Archiving Patient Information - Hybrid

### 3 Articulated Hybrid Duplicates



## Archiving Patient Information - Hybrid

### 4 Cross-articulated Duplicates to Master Casts



## Archiving Patient Information - Hybrid

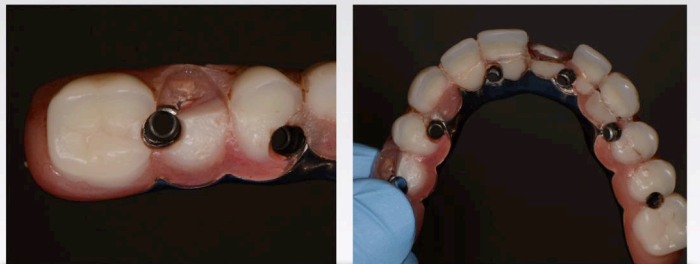
### 5 Articulator Serial # & Tooth Molds



## Hybrid/Hybrid - Retread Initiated

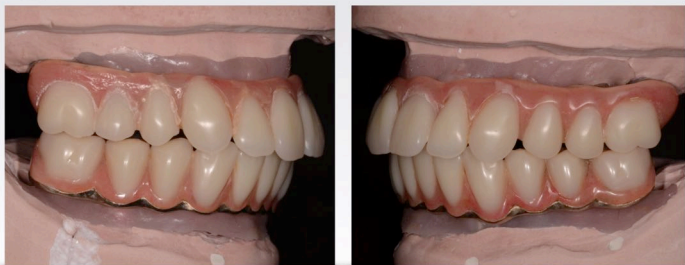


## Hybrid/Hybrid - Retread Initiated



## Retread Procedure - Option 2

- ① Hybrids on master casts - pin @ 0



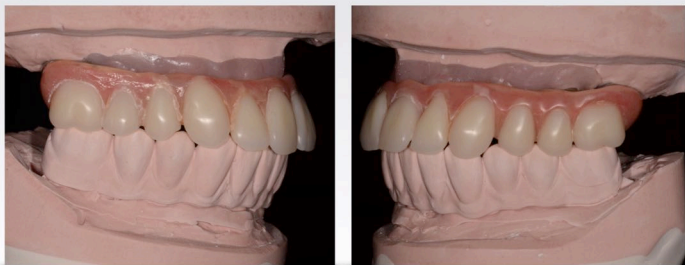
## Retread Procedure - Option 2

- ① Hybrids on master casts - pin @ 0



## Retread Procedure - Option 2

- ② Cross-articulated hybrid (worn) with opposing from delivery



## Retread Procedure - Option 2

- ② Cross-articulated hybrid (worn) with opposing from delivery



## Hybrid/Hybrid - Retread Delivered

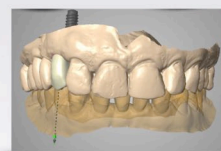


## Technical Complications - Framework Design

- Framework Design (analog and digital)



Analog

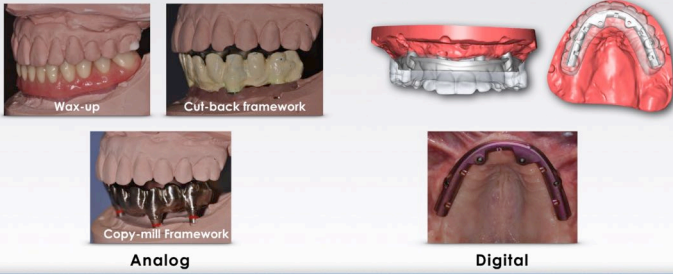


Digital



## Technical Complications - Framework Design

### • Framework Design (analog and digital)



## Technical Complication - Interproximal Contact Loss

### Prevalence of Interproximal Open Contacts Between Single-Implant Restorations and Adjacent Teeth

Spyridon Varthos, DDS, PhD<sup>1</sup>/Anthony Randi, DDS<sup>2</sup>/Dennis P. Tarnow, DDS<sup>3</sup>



## Clinical Service - Interproximal Contact Loss

- Retrospective, cross-sectional study
- 128 patients, (174 single-implant restorations)
- Evaluation period - 3-months through 11-years
- ICL = interproximal contact loss
- 52.8% ICL between single-implant restorations & teeth
- 57.9% in maxilla and 49% in mandible
- 40% were aware of ICL and food impaction
- Recommend informed consent, Essix retainer, further research

### Prevalence of Interproximal Open Contacts Between Single-Implant Restorations and Adjacent Teeth

Spyridon Varthos, DDS, PhD<sup>1</sup>/Anthony Randi, DDS<sup>2</sup>/Dennis P. Tarnow, DDS<sup>3</sup>



Varthos et al., JOMI 2016

## Anyone observing these outcomes?



## Anyone observing these outcomes?



### Lifelong Craniofacial Growth and the Implications for Osseointegrated Implants

Fereidoun Daftary, DDS, MSD<sup>1</sup>/Ramin Mahallati, DDS<sup>1</sup>/  
Oded Bahat, BDS, MSD, FACD<sup>1</sup>/Richard M. Sullivan, DDS<sup>2</sup>



Patient age range: 30 - 72 years - all prostheses ≥10 years in function

dr anthony dickinson  
prosthodontist | melbourne australia

How about this?



How about this...



### Presentation Conclusions

- **Plan for success** - not failure and complication (3-D implant placement, appropriate principles in laboratory and clinic, follow-up)
- **Respect space** - embrace a restoration-driven process in planning and treatment
- **Regular maintenance** to intervene potential complications
- **Beware of prevailing conditions** - eg. smoking, compliance, bruxism, framework design and restorative materials

**Thank you for the kind attention.**

The **recorded presentation** will be available on **April 25, 2020** at: [vimeo.com/showcase/martin-complications](https://vimeo.com/showcase/martin-complications)

**Password** : WMCOMP2020

**Lecture Notes** (with extra information)

[http://bit.ly/VIP\\_notes](http://bit.ly/VIP_notes)



Dr. Will Martin

