AMERICAN ACADEMY OF IMPLANT DENTISTRY

Southern District Meeting

Making the Screw-in Prosthesis Installation System Safer

April 13, 2024

Emil LA Svoboda, DDS, PhD, FAAID, DABOI/ID

Generating Implant Longevity: Engineering Excellence

AMERICAN ACADEMY OF IMPLANT DENTISTRY

Generating Implant Longevity:
Engineering Excellence

2024 Southern District Meeting

Sonesta Nashville Airport
April 12-14

Making Treatment Safer by Using Dr. Svoboda's Two Rules

that are so very important for dentists and their patients

April 13, 2024

Making treatment results safer requires dentists

to understand and acknowledge
the Risk Factors for
Mechanical and Biological Complications
that cause
the premature failure of dental implants
and their attached prosthetics
&
to have a strong desire to protect their patients

This slide presentation has been annotated to make it easier to follow the logic as a self-driven slide presentation.
I welcome your questions and comments at **drsvoboda@rogers.com**

Dr. Murray Arlin (Periodontist): "Implant dentistry has many risk factors for peri-Implant disease"

Host / Systemic
- Patient Age
- Health / Medications
- Periodontitis History
- Smoking / Dosage
- Genetic Factors

Host / Local
- Bone: Quality/Quantity
- Soft Tissue: Biotype /Keratinization
- Plaque Control
- Excessive Load

Host

Dentist/Operator
- Experience/Expertise
- Surgical Techniques/Protocols
- Prosthetic Systems
  - Screw-in (Hygiene Access /Fit)
  - Cement-in (Cement/Fit)

Dentist

Biomaterial
- Biocompatibility
- Implant Material
- Implant Surface
- Implant Design

Industry

Excessive Load
- Host Related
  - Transmucosal
  - Parafunction/Bruxism
- Prosthetic Systems
  - Implant: Size / # / Distribution
  - Materials / Occlusion
  - Splints / Cantilevers / Ratio /
  - Fit / Hygiene Access
- Early vs Late Effects
- Mechanical Effects
- Biological Effects

Surgical Techniques
- Sterile vs Aseptic
- Prophylactic Antibiotics
- Surgical Incision
- Surgical Trauma
  - Excess Heat
  - Excess Compression
  - Inadequate Congruency
- -Malpositioned Implants
  - Oro-facially
  - Mesio-distally
  - Apico-occlusaly
  - Invasion of Anatomy

Surgical Protocols
- -Flap vs. Flapless
- -1 vs 2 stage
- -Immediate Placement
- -Early Placement
- -Delayed Placement
- -Failed Replacement
  - immediate / early / delayed
- -Immediate Loading
- -Number of Implants
- -Implant Connection to Natural Teeth

Implant Design
- -Crestal Module
- -Platform Shift
- -Fracture Risk
  - Material
  - Diameter
  - Load
  - Connection
- -Narrow Implants
- -Wide Implants
- -Tapered Implants

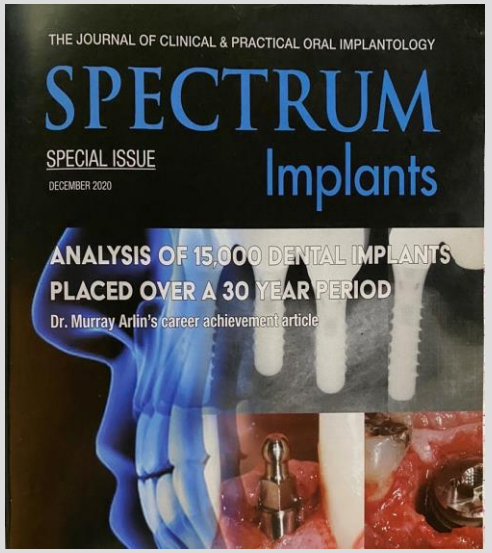
It's so complicated – What can Dentists do?

Implant survival rate (still in mouth) over 10 years

5 % failed by 2 years

8 % by 10 years

1999 Group ~ 2019 Group



Why didn't the survival rate of his 15,000 implants improve over 30 years?
Didn't he, his restorative dentists and technology get better over time?

ARE DENTISTS MISSING SOMETHING VERY IMPORTANT?

Also: 65% of the Full Arch Prostheses were replaced within 10 years

What is the Patient's Experience over 10 years?

Implant Failures (Patients average more than 1 implant)	**14%**
Peri-implantitis	20%
Mucositis	47%
Peri-implant Disease &/or Failure	**81%**

Same for Cement-in and Screw-in Installation

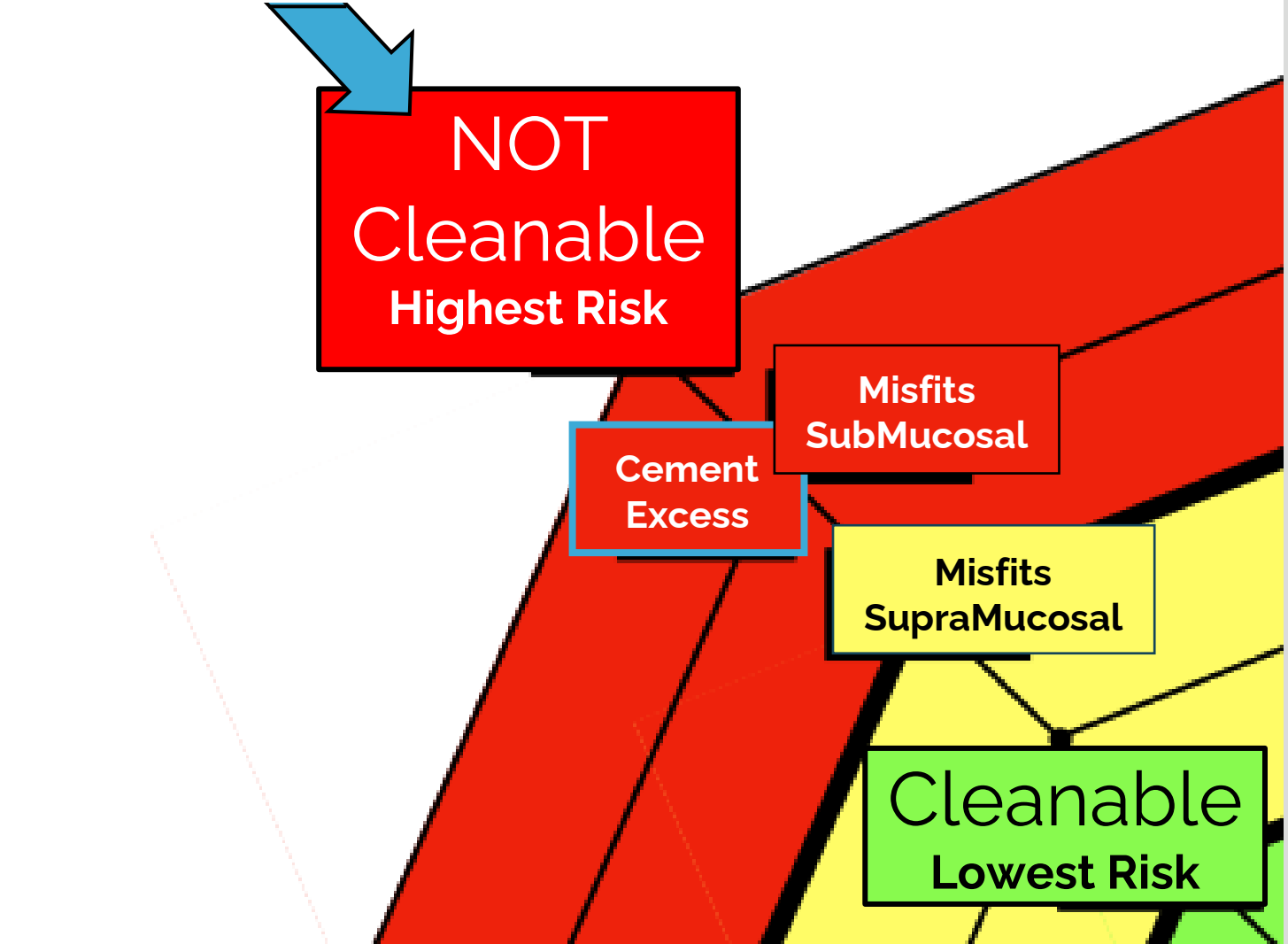
Evidence Based Results - Rokaya D et al. Peri-implantitis Update: Risk Indicators, Diagnosis, and Treatment. European J of Dentistry 2020: V14, No.4:672-682. A Review

WHAT CAN THE DENTIST DO TO PREVENT THESE PROBLEMS?

THESE ARE THE RISK FACTORS FOPR PERI-IMPLANTITIS

Dentist's Responsibility

Prosthesis design & installation process

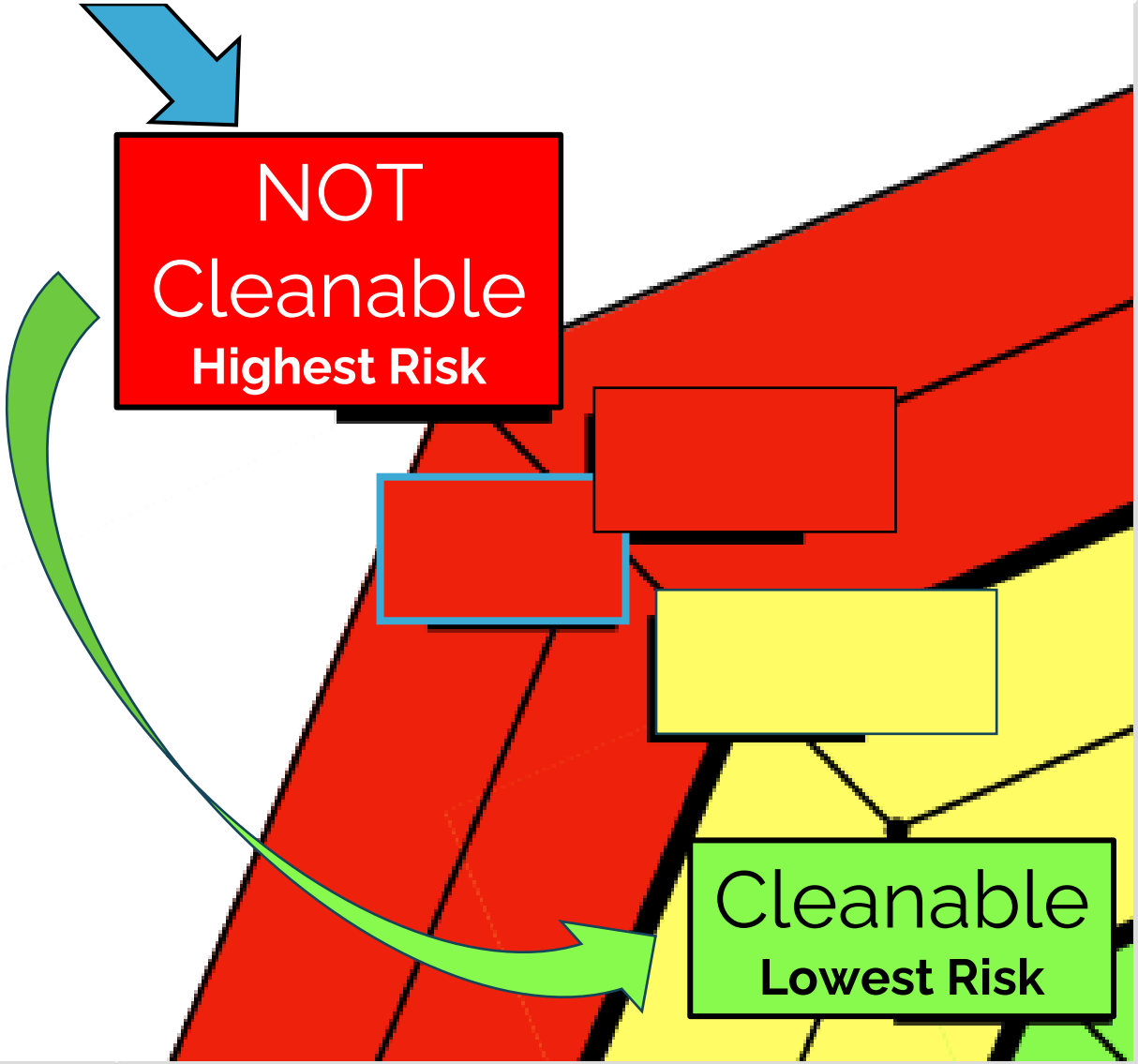


These unfavorable Mechanical Conditions can all be controlled by the DENTIST

Heitz-Mayfield LJA, Heitz F, Lang NP. Implant Disease Risk Assessment IDRA - a tool for preventing peri-implant disease. Clin Oral Impl Res. 2020;31:397-403.

Dentist's Responsibility

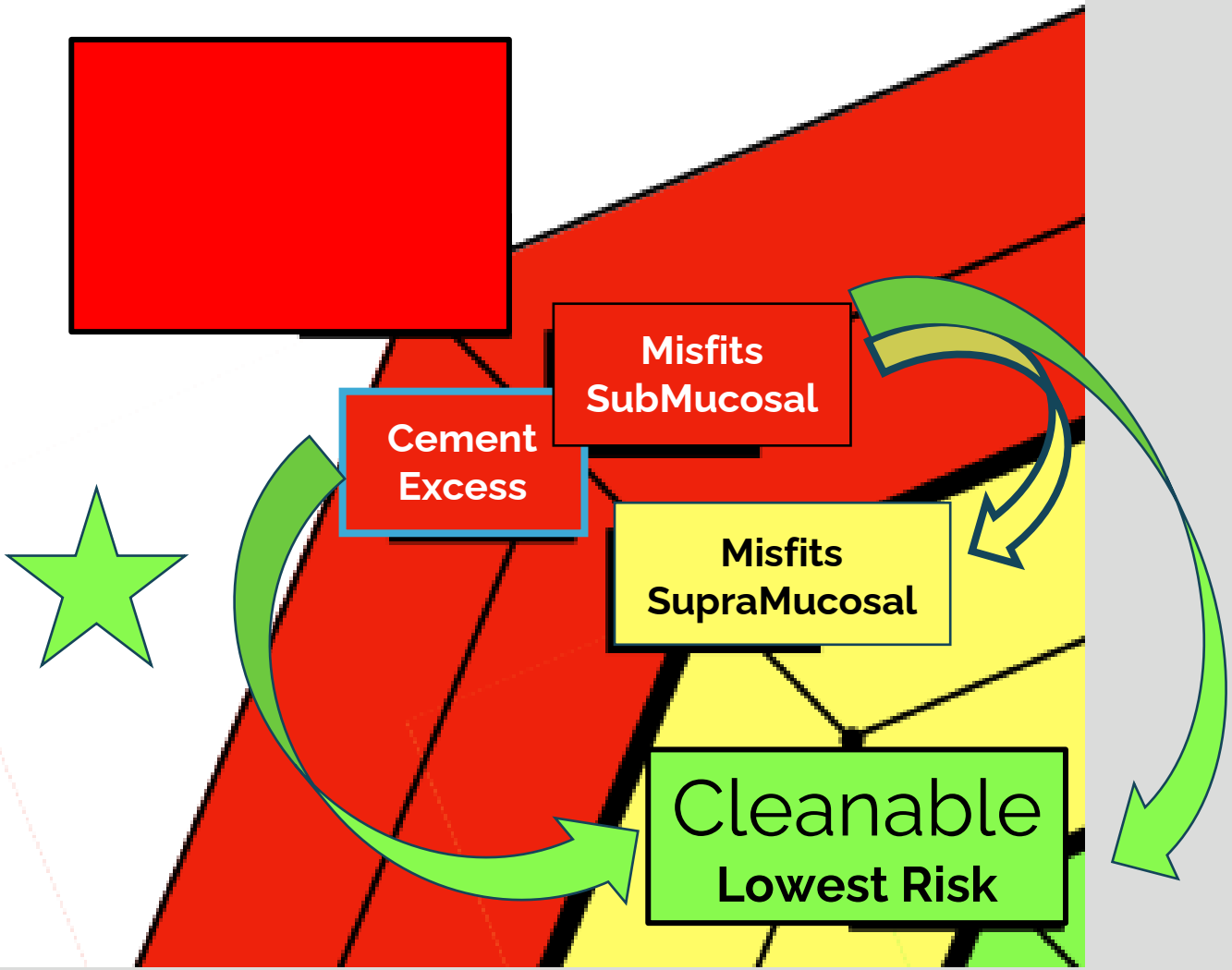
Making the peri-implant environment cleanable



DENTISTS
Can make the
Prosthesis
Cleanable
To Reduce
Peri-implantitis

Dentist's Responsibility

Preventing misfit joints & subgingival cement



DENTISTS
Can
Prevent
Misfits &
Subgingival
Cement
To Reduce
Peri-implantitis

Heitz-Mayfield LJA, Heitz F, Lang NP. Implant Disease Risk Assessment IDRA - a tool for preventing peri-implant disease. Clin Oral Impl Res. 2020;31:397-403.

T.G. Wilson who removed subgingival cement to achieve a 60% decrease in peri-implant disease

Wilson,T.G. The positive relationship between excess cement and peri-implant disease: a prospective clinical endoscopic study. J Periodontol 2009;80:1388.

Therefore: Dentists

Preventing Residual Subgingival Cement

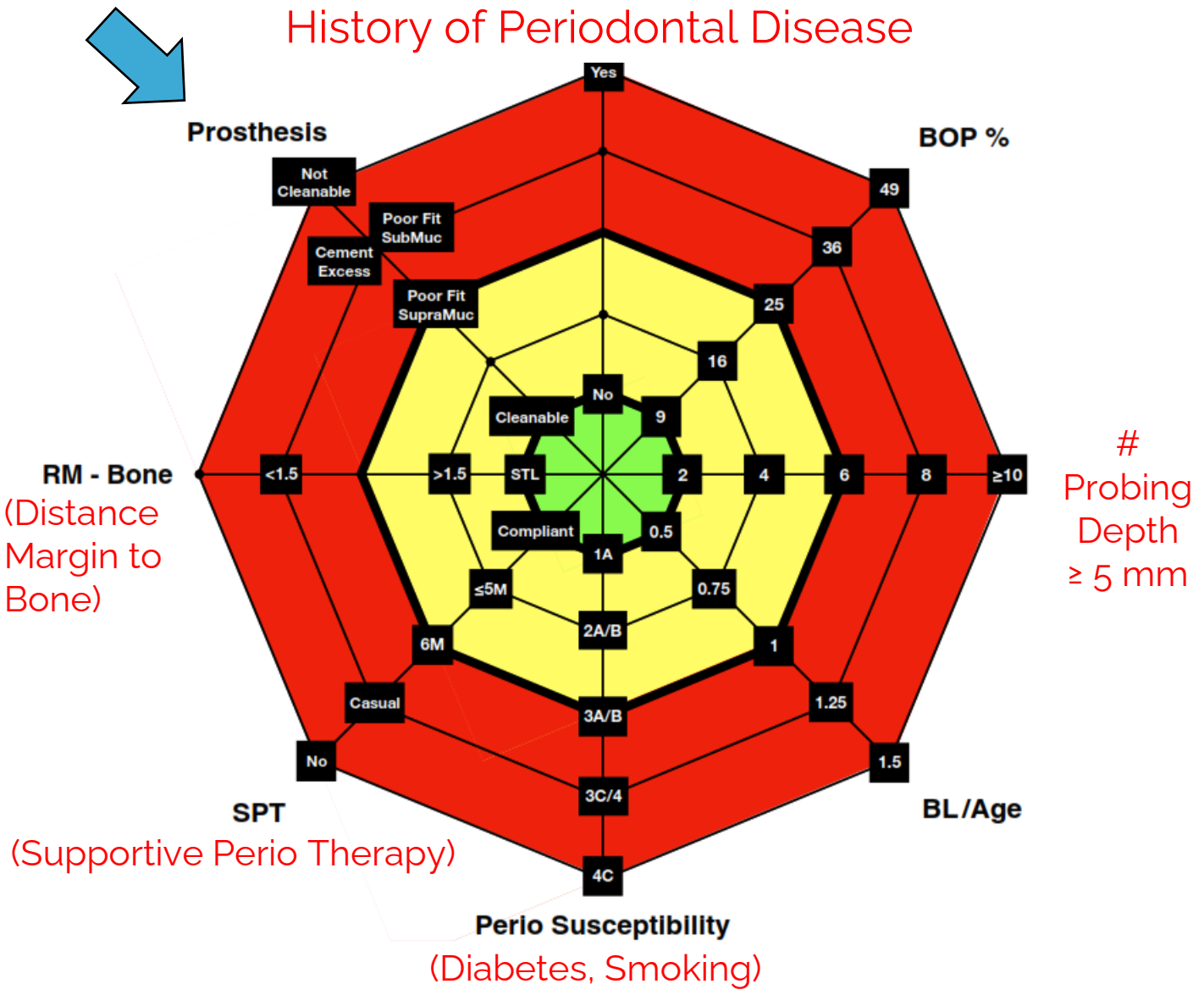
Can reduce Peri-implant Disease by *60%

Intra-oral cementation provides the dentist with a means of preventing misfit connections, as I will show later. This study provides us with a clue that “preventing misfits and subgingival cement” may be a significant contributors to this observed large reduction in peri-implant disease.

Making a Prosthesis that is Not Cleanable, or with Misfit Parts or with Subgingival Cement

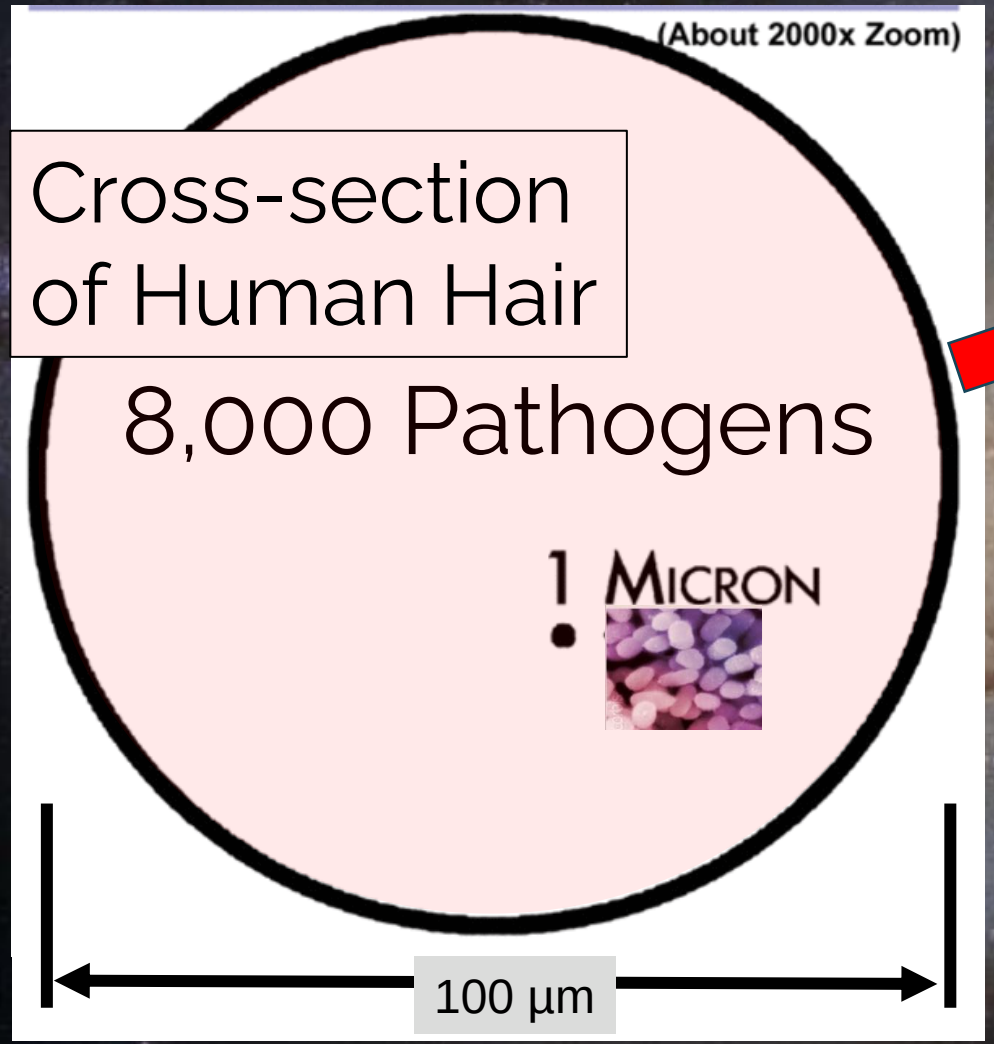
Clearly Makes the Treatment Prognosis Worse

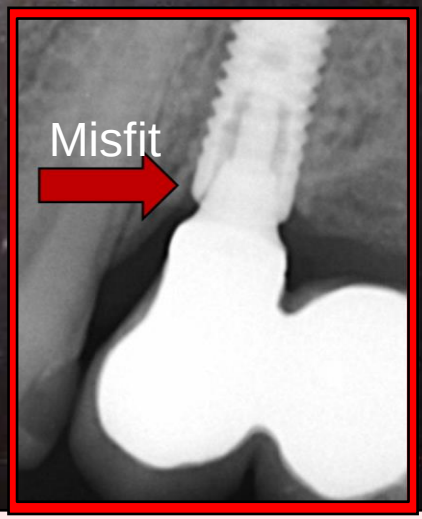
for the patient



Our Enemy is Microscopic

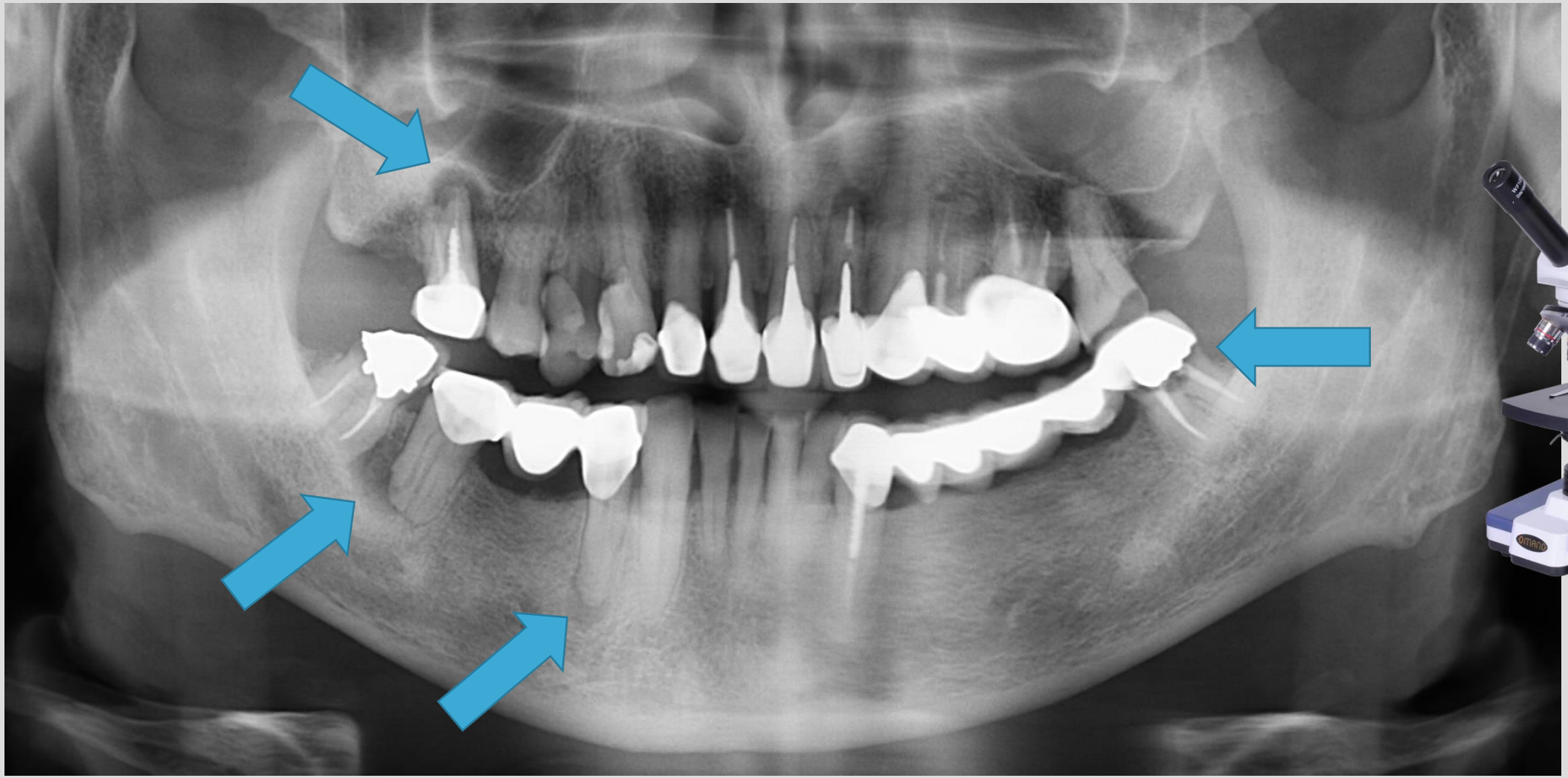
8 million pathogens/mm





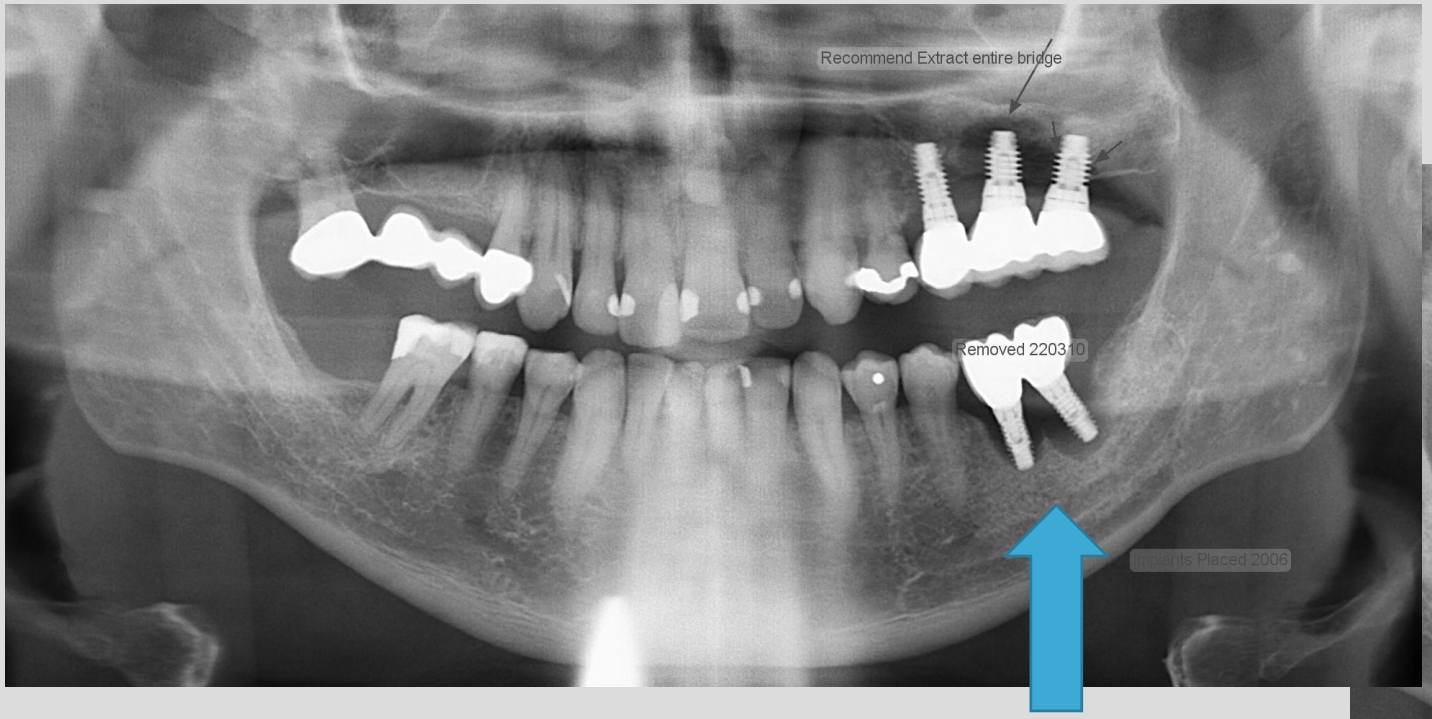
Billions of pathogens fit under bad margins & between parts!

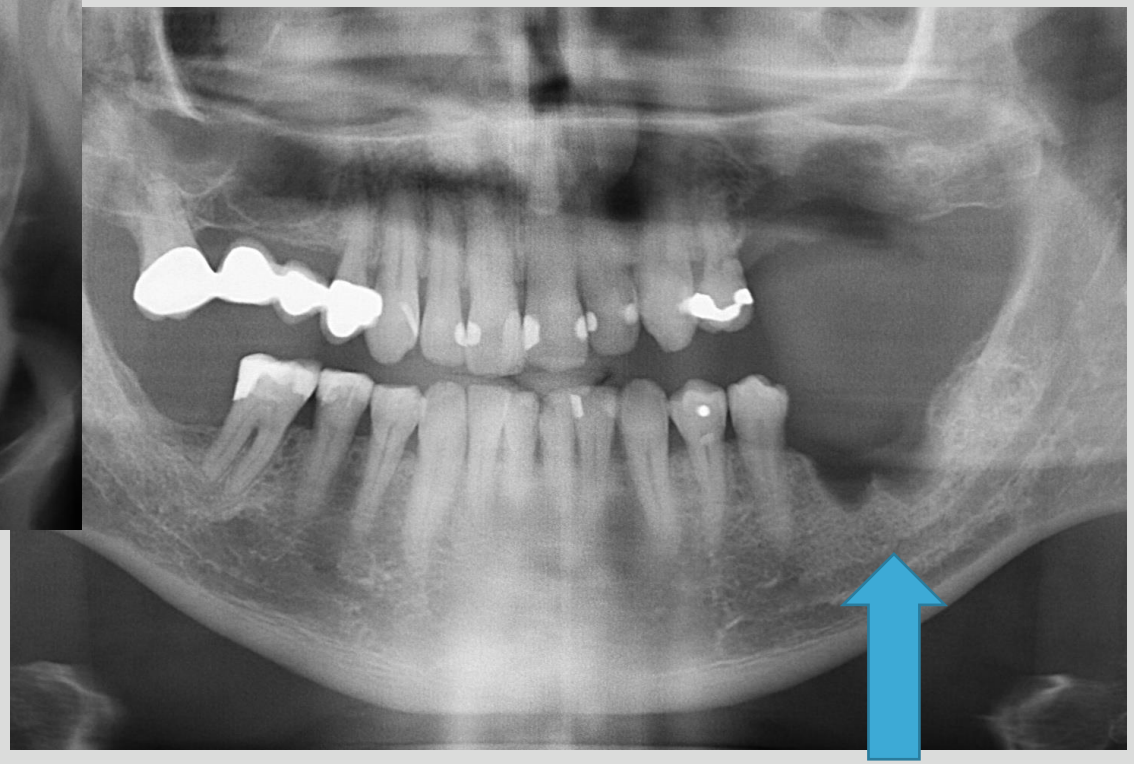
All these dental diseases originate **MICROSCOPICALLY**



Their extensive damage is easy to see

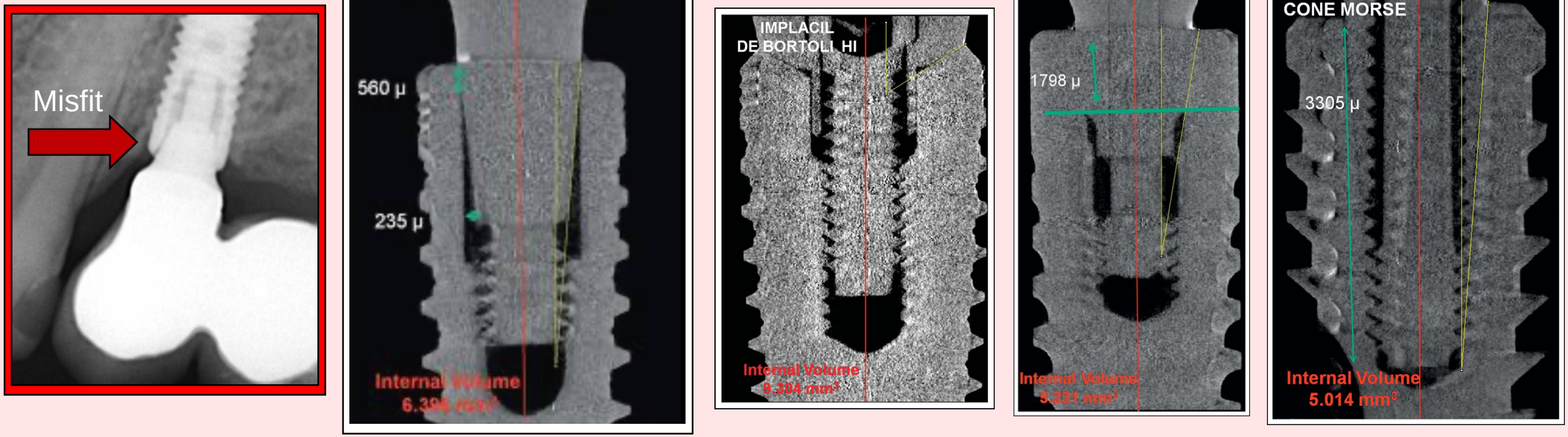
Peri-Implant disease originates **MICROSCOPICALLY**





Its extensive damage is easy to see

Misfit connections provide microbes and their toxic byproducts a large passageway to & from space between parts



5 to 9 mm³ = space for billions of pathogens per implant

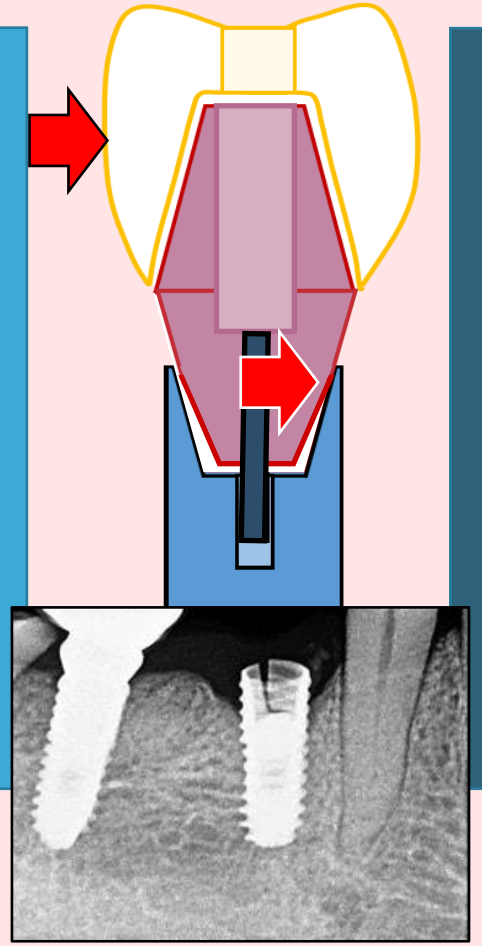
Scarano A et al. Implant-Abutment Contact Surfaces and Microgap Measurements of Different Implant Connections Under 3-Dimensional X-Ray Microtomography. Implant Dentistry, October 2016, Volume 25, Number 5, pp. 656-662

Periodontist observes

"Rapid bone loss around implants from one visit to the next"

Related to
a surprising number of
***Fractured/flowered implants**

Dr. B. Longbottom
DocMatter Discussion Site 2022



Misfits are common to the legacy Screw-in System

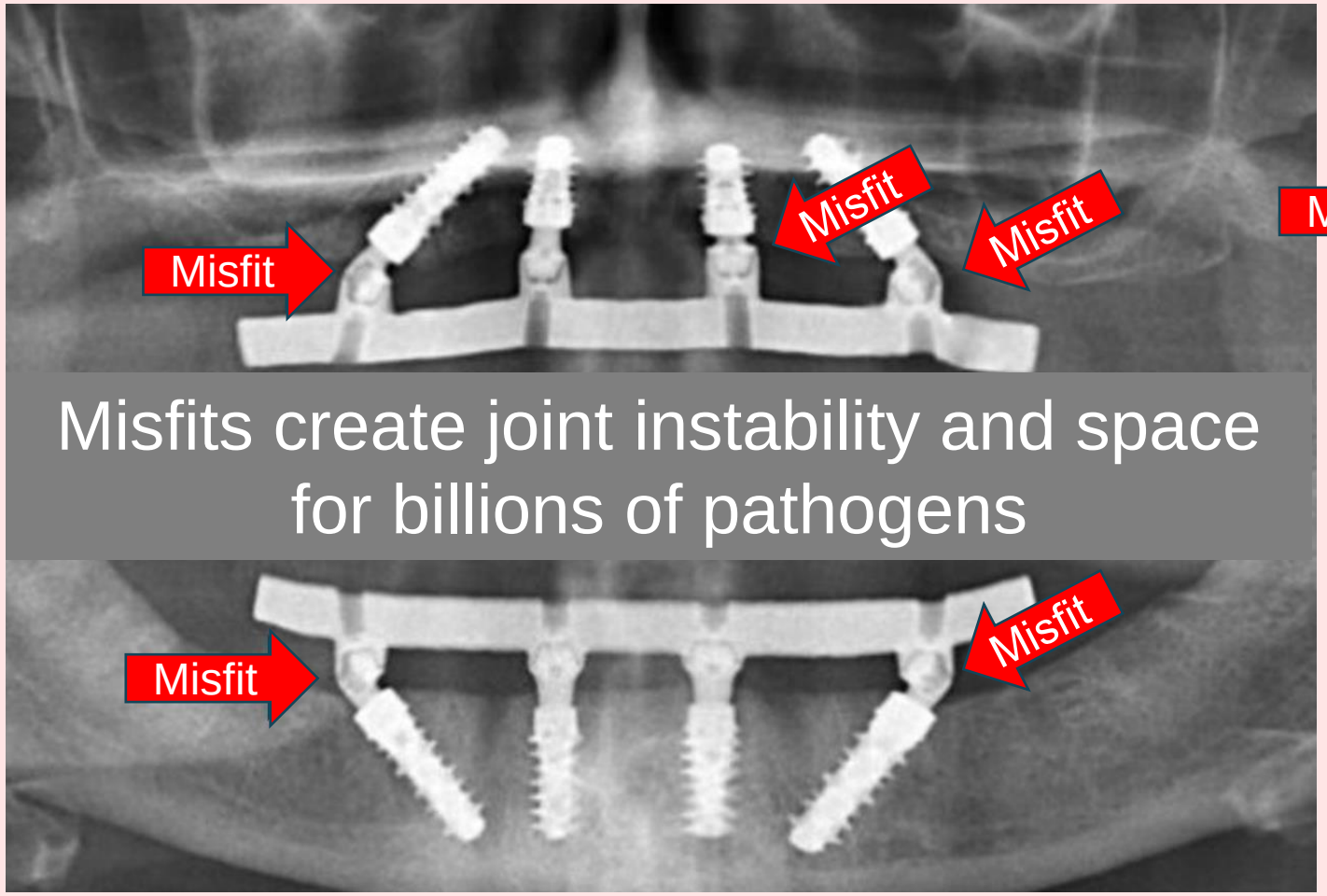
Fractured implants and peri-implantitis should be no surprise!

ELA Svoboda PhD, DDS 2024

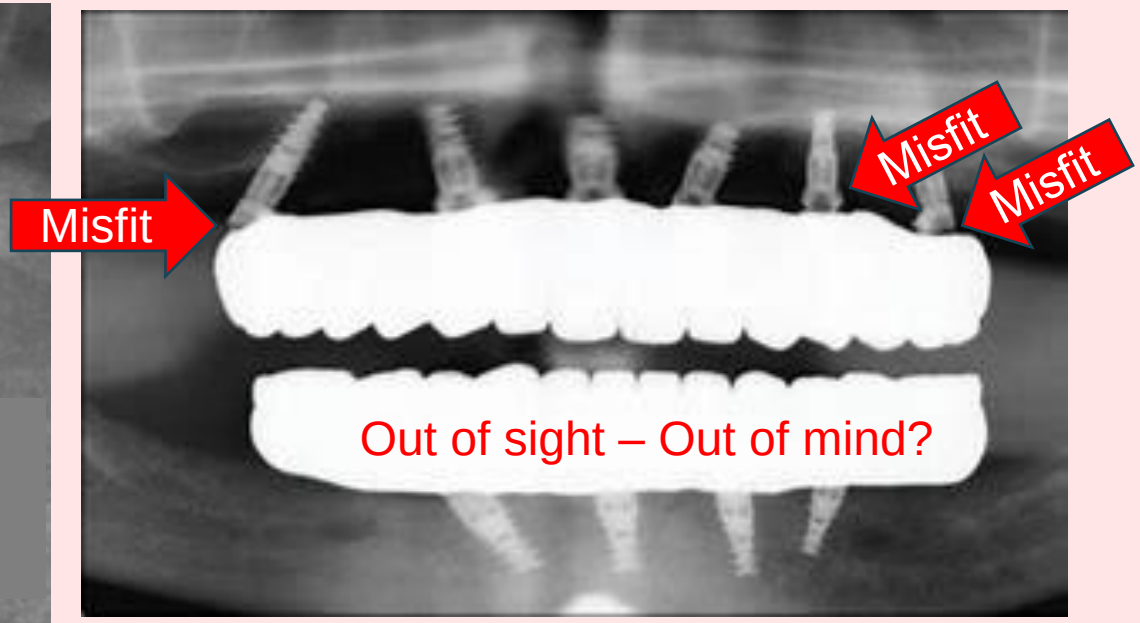
Shemtov-Yona, Rittel D. On the mechanical integrity of retrieved dental implants. J of Mech Behavior of Biomedical Materials 2015;V49:290-299.

***62% of failed implants contained crack-like & full cracks in their connectors**

The Prosthetic Connector is “Super Sloppy” to make installation easier. It was originally placed way above the gingiva (**High Water Systems**)



Misfits create joint instability and space for billions of pathogens



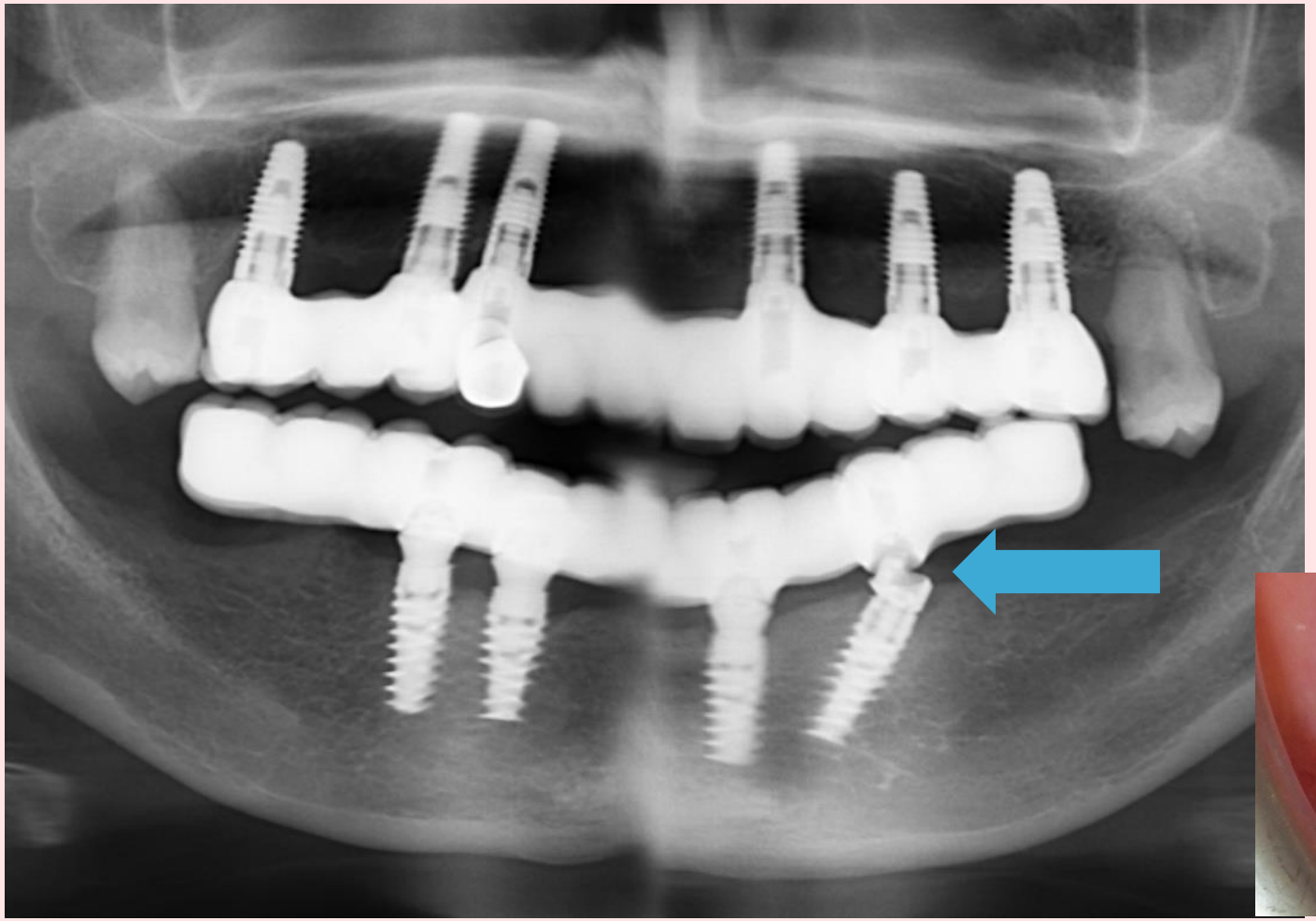
This part is often Misfit. Should it be placed adjacent to tissues?

Super Sloppy Fit

Torqued to 15 Ncm & designed to fail first

Space for billions of pathogens per joint

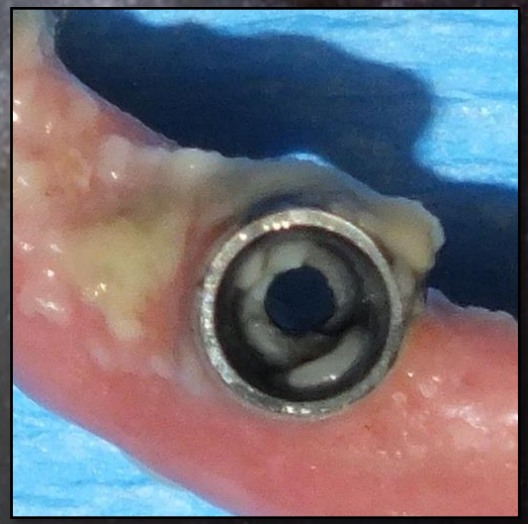
Bigger the Screwed-in Prosthesis - Bigger the Misfits



See the misfits & plaque? Are these connections way above the gingiva?

Uncleanable space for billions of pathogens per joint and under the prosthesis

Eliminating unstable joints & uncleanable plaque traps Prevents Disease



★ Size of Inoculum

Host Resistance ⟷ Pathogen Virility

Disease
too much
too weak
too strong

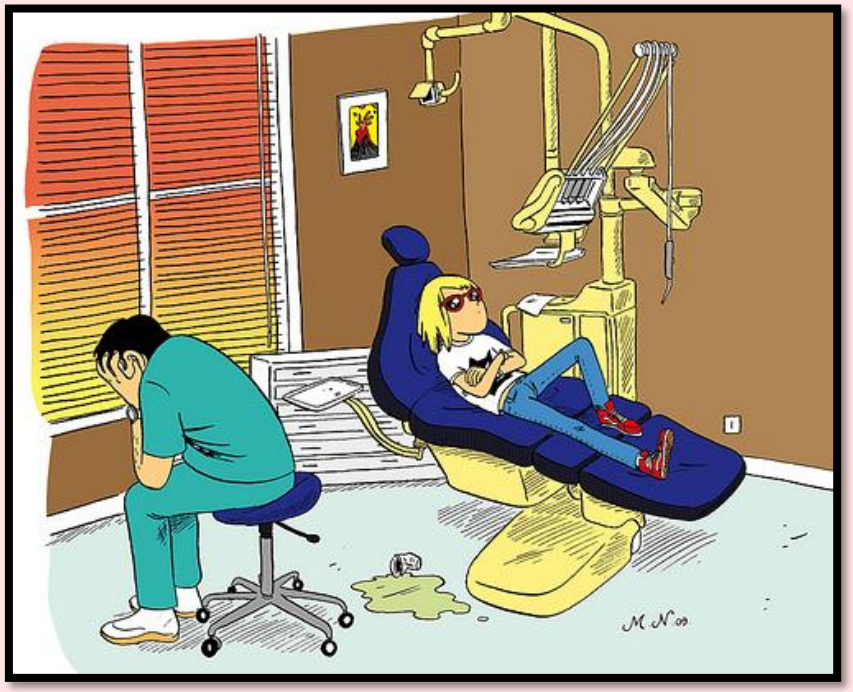
"I have placed and restored thousands of dental implants. Some of my treatments have lasted 20 - 30 years?

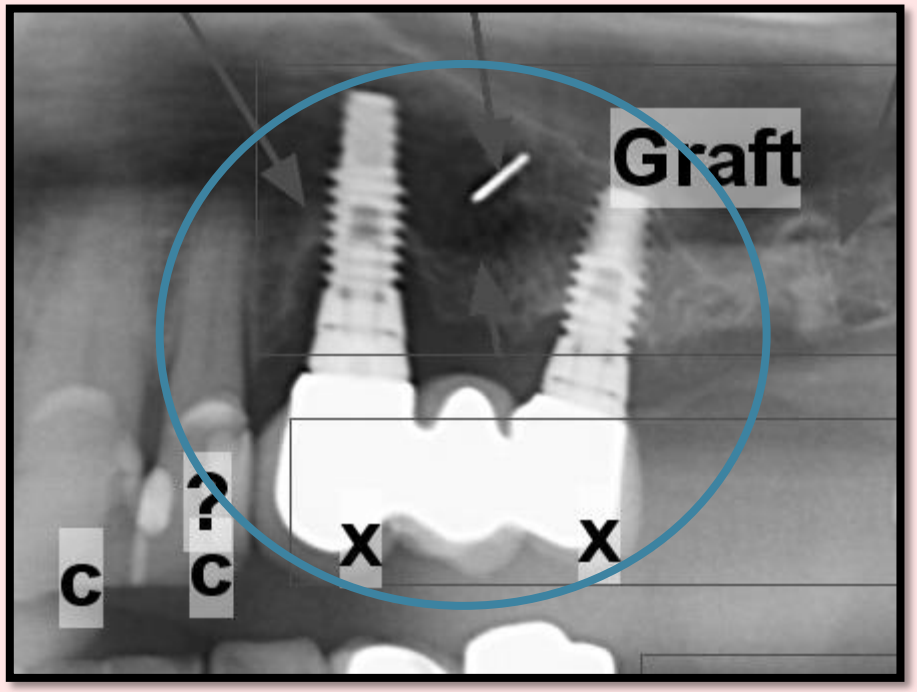
I now believe that my long-term successes are more a result of my patients' robust immune systems, the low virility of their microbial flora and their effective daily maintenance, than my earlier treatment skills.

I expect that my success rates have improved over my latest 10 years, as I have implemented treatment changes that enable me to mitigate several known risk factors for disease.

I hope I can motivate you to make some changes too."

Complications disappoint patients & are not good for business …





…. & they stimulate a whole torrent of liabilities for dentists, their referral sources, labs, implant company sales.

Implant treatment now tops the list for patient-initiated litigation.

My research into making prosthesis installation safer has found that the existing dental vocabulary does not include adequate terminology to identify and discuss the root causes of the mechanical complications in prosthetic dentistry. I published to introduce this important new terminology.

Svoboda ELA. New Dental Implant Terminology for Exposing and Mitigating the Root Causes of Installation Related Treatment Complications. Spectrum Implants 2021;Vol.12, No.2: 28-43. (also at www.ReverseMargin.com)

Svoboda ELA. Making Fixed Prosthesis Installation Safer by Preventing Several Risk factors for Peri-implant Disease. Dec 2022, www.Reversemargin.com, Slides 1-131.
On slides 38,41 & 42, I identify and discuss the concept of Incongruent Paths of Insertion as being another root cause of mechanical complications.

I will now review these important concepts.

What are the ROOT Causes of these Mechanical Problems …

Misfit implant parts

joint instability, ***implant & screw breakage**, more space for oral pathogens to breed & infect adjacent tissues

Poor prosthesis margins

open, overhanging & over extended margins

Loose and tight contacts

food impaction, unwanted tooth drift

Subgingival cement

Is the rough cement surface a competitive advantage for microbes?

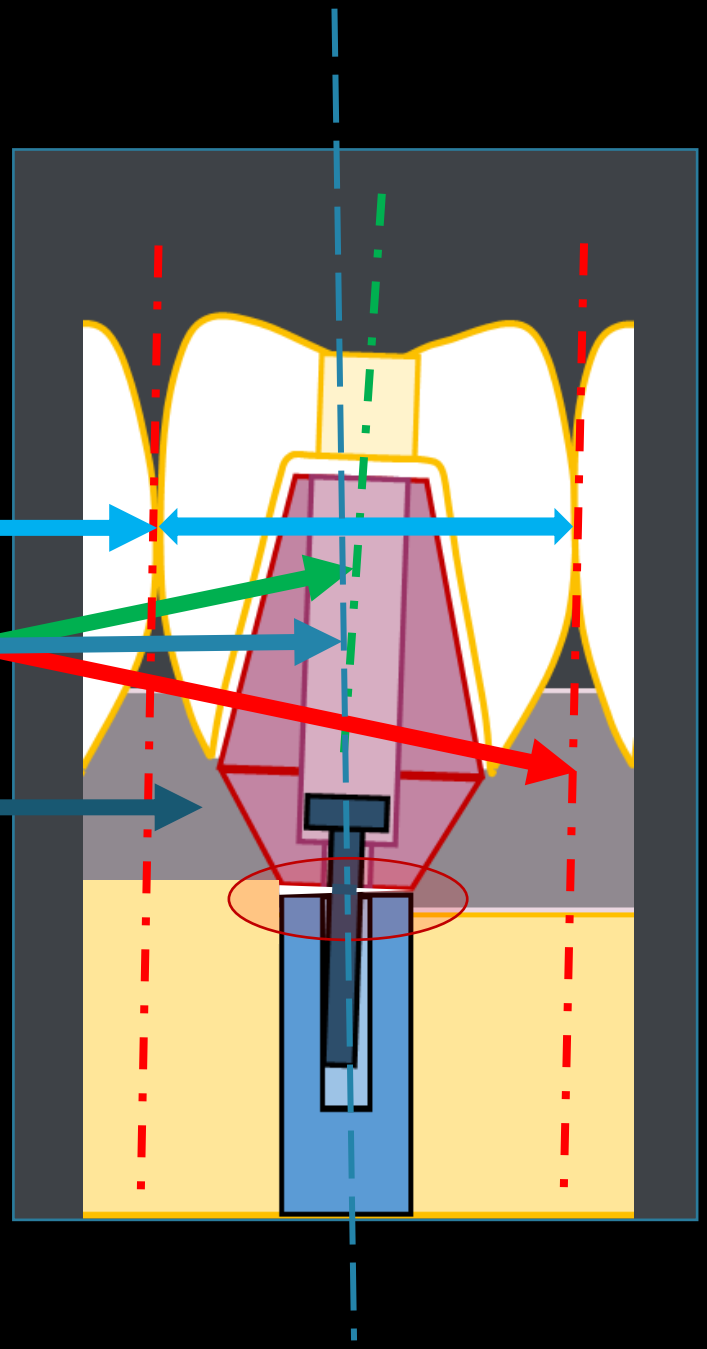
Poor access to care

poor ability for patients and professionals to effectively monitor and maintain the peri-implant environment

… that predispose patients to Peri-Implant Disease?

The ROOT causes of Mechanical Complications

1. **Prosthesis Dimensional Error**
2. **Incongruent Paths Of Insertion**
3. **The Tissue Effects:**
   Resistance to Displacement Effects &
   Gingival Effects



They must **ALL** be mitigated to prevent mechanical & related biological complications

Digital vs Reality
Tolerances

Henrik Andersen
PhD

1 Prosthesis Dimensional Error (PDE) is **3-D**

Passive fit of a dental restoration is influenced by the following tolerance stack up:

- Position tolerance of Scan Body in implant. +/-5 µm
- Tolerance of Scan Body. +/-8 µm
- Scanning tolerance. +/-15 µm
- Print tolerance of 3D printer. +/-75 µm
- Position tolerance of Model analog in 3D printed model. +/-25 µm
- Tolerance of Model Analog. +/-10 µm
- Position tolerance of Hybrid base in Model analog. +/- 5 µm
- Milling and sintering tolerance of ZrO_2 bridge. +/-15 µm
- Hybrid base on implant. +/- 5 µm

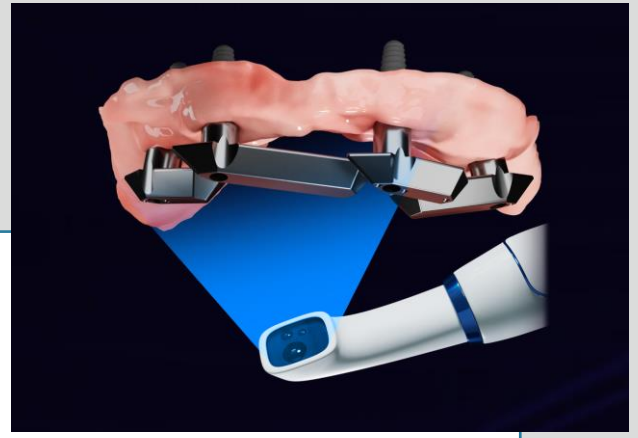
PDE ±50 to 163 µm

ELOS MEDTECH Lab Study
Huge Implant Manufacturing Co.

Some parts of the tolerance chain <u>can</u> cancel each other out

Andersen, Henrik. PhD. Influences Affecting Print. 2021 Webinar: https://www.dropbox.com/s/3t1jqlgzp6owwdx/influences%20affecting%20print%20%281%29.mp4?dl=0

1 Prosthesis Dimensional Error (PDE)



Scanning improvements are good but only affect a part of PDE

- Position tolerance of Scan Body in implant. +/-5 µm
- Tolerance of Scan Body. +/-8 µm
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PDE ±50 to 163 µm

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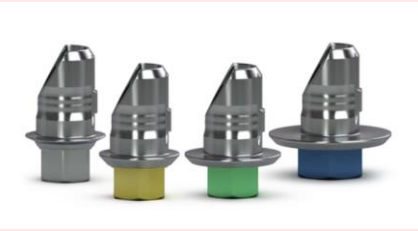
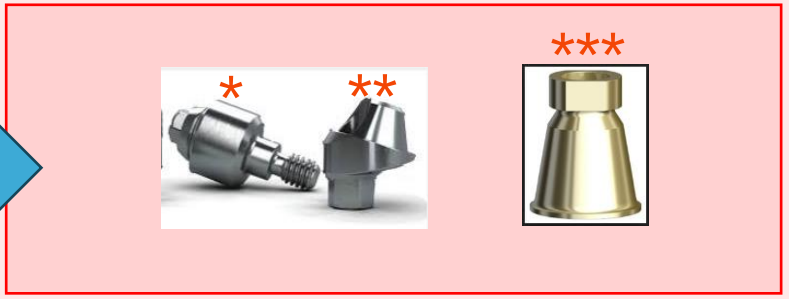
Andersen, Henrik. PhD. Influences Affecting Print. 2021 Webinar: https://www.dropbox.com/s/3t1jqlgzp6owwdx/influences%20affecting%20print%20%281%29.mp4?dl=0

Industry can mass-produce connecting parts with verified tolerances ± 5 µM

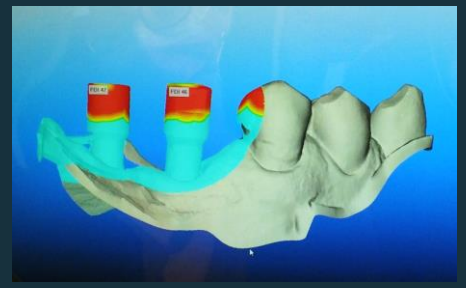


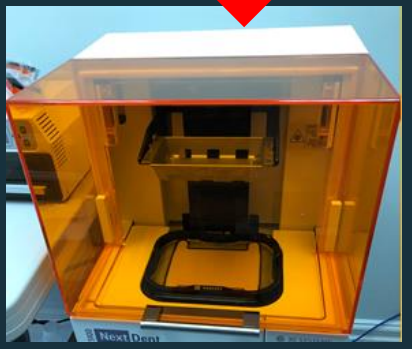
The non-engaging abutment*, multi-unit abutment** to prosthetic connector*** connection are made “sloppy” to make them easier to install in a misfit way



Why doesn’t Industry tell dentists what the tolerances and fit-tolerances of their parts are? Does this block the dentist’s agency to choose the best parts for their patients?

Indirect prosthesis manufacture has many steps & brings the most 3-D PDE (±50-300µM) to the system





Lab makes the prosthesis fit a dental model

The intra-oral environment is much more complex than a dental model and increases the dentist's challenge of optimal prosthesis installation

Manufacturers and sellers of implant parts and prostheses make them to be installed into the mouths of patients.

1) If they do not inform dentists about the tolerances and fit-tolerances of their parts, how can dentists choose the best parts for their patients?

2) If they do not provide dentists with installation instructions that also alerts dentists to their inherent risk factors for mechanical and biological complications, how can dentists provide their patients with a proper informed consent process?

I believe these disclosures by industry, 1) & 2), would help dentists improve the predictability and longevity patient treatment outcomes.

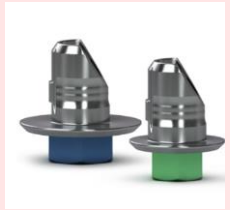
Otherwise …. shouldn't industry share greater liability for treatment complications?

1 PDE & the Screw-In System of Installation

Flawed Concept:

Let's embed these *highly precise and accurate* abutment connectors in a ***less precise and accurate prosthesis*** & then try to attach them to *highly precise and accurate* implant connectors already fixated in the mouth

±5µM



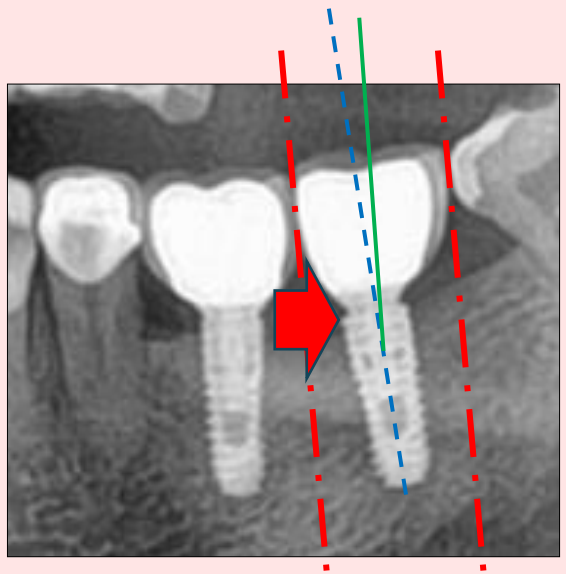
HOW CAN THE FIT OF PARTS BE OPTIMIZED?

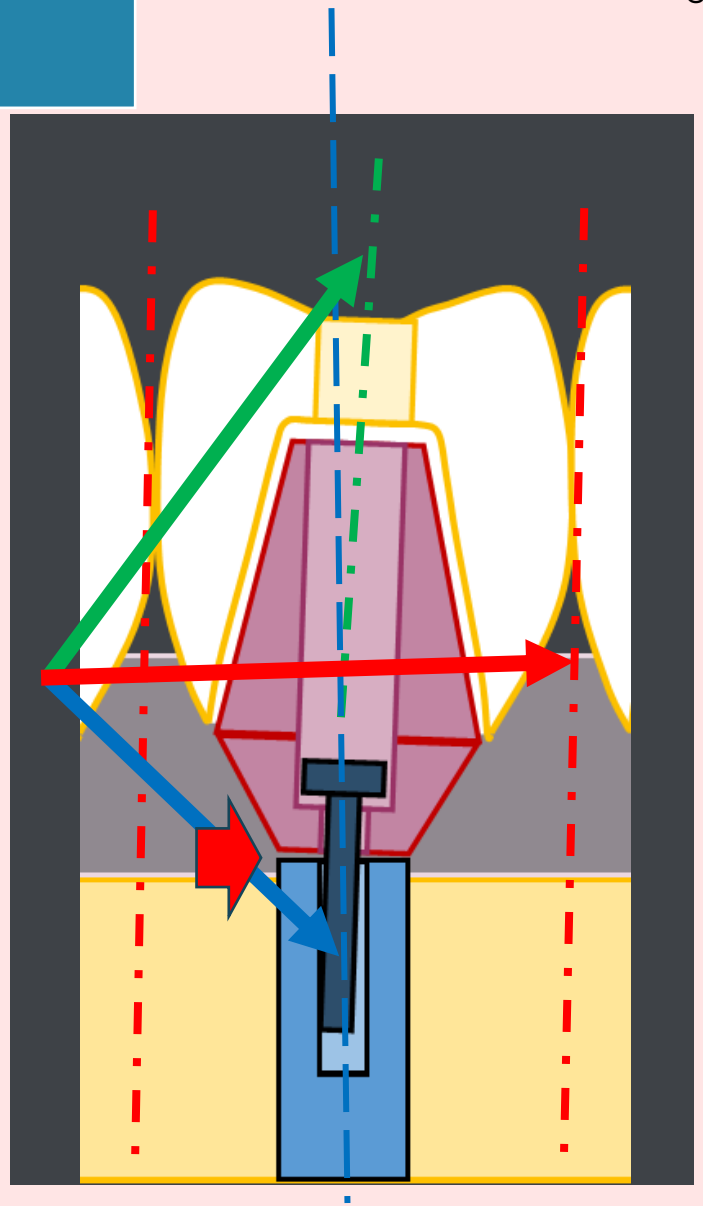
Svoboda E.L.A. Fixed Prosthetics: Position, Yaw, Pitch and Roll. ReverseMargin.com/articles: Spectrum Implants; Oct 2021;1-5.

2 Incongruent Paths of Insertion (ICPOI)

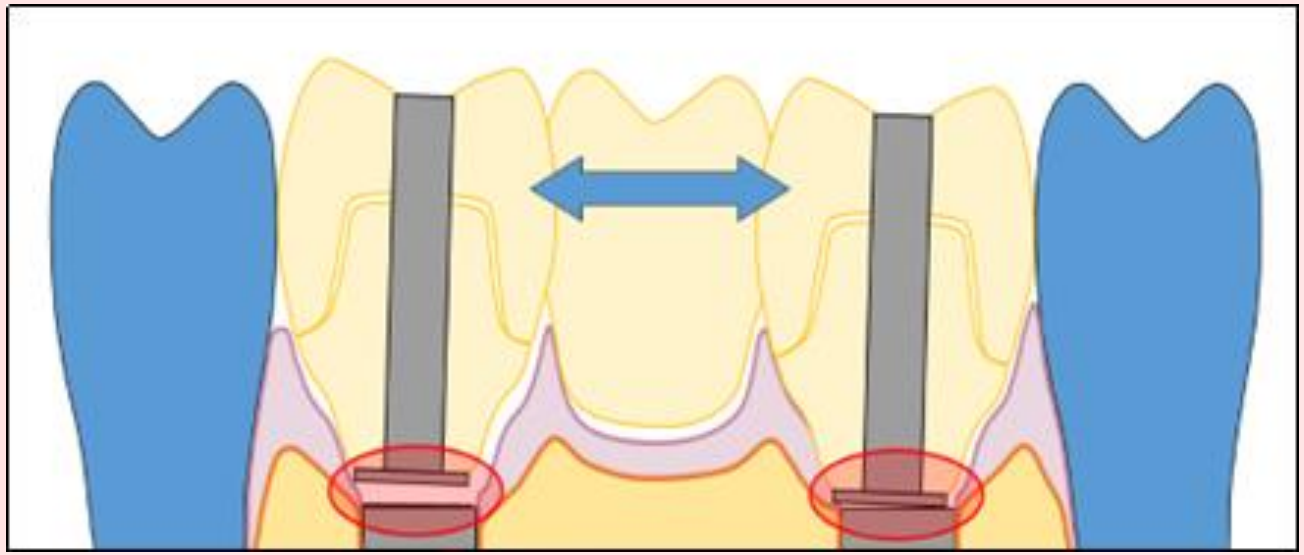
The Screw-in Prosthesis
must accommodate multiple Paths of Insertion
within the tolerance of their I-A connectors (±5µM)
to optimize the implant-abutment (I-A) fit
while managing contact with adjacent tissues.
(Misfit I-A)

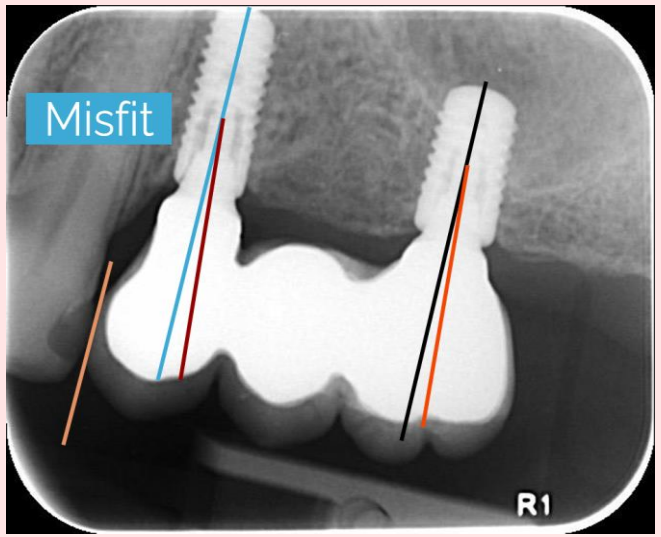
This is difficult for a single crown with only 3 Paths of Insertion (determined by adjacent teeth, implant & abutment)





Legacy Screw-in System 3-unit bridge has at least 5 different Paths of Insertion to manage within ± 5 µM





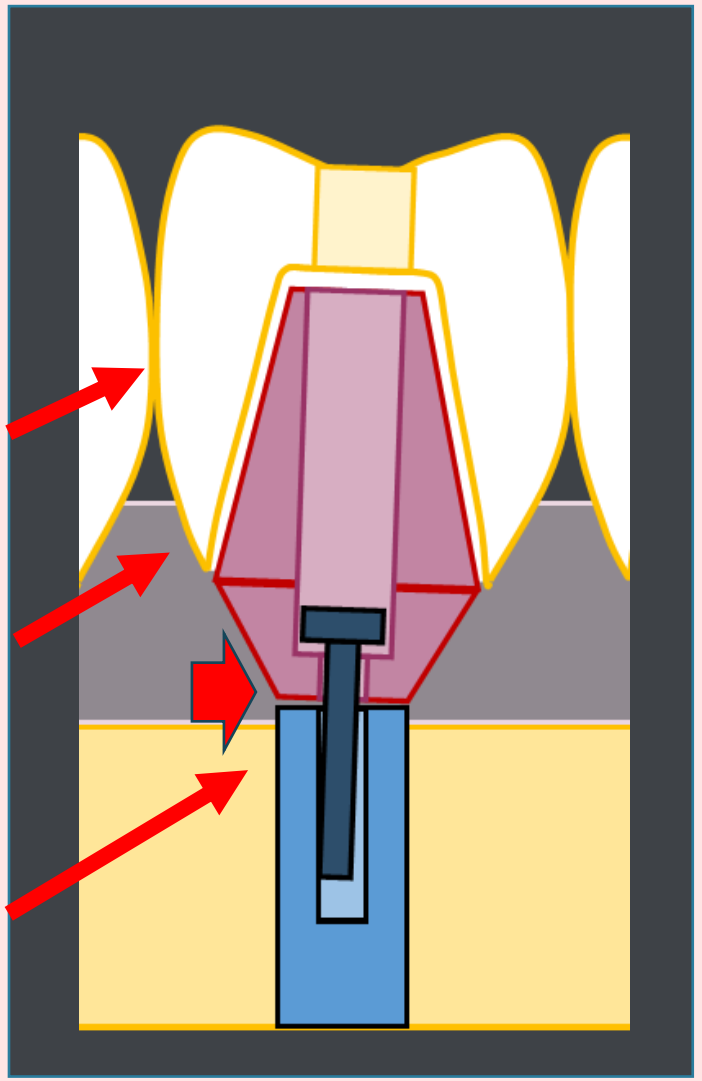
Misfits
100% Guaranteed !

3 Tissue Effects

Resistance to Displacement Effects (RTDE)
by adjacent tissues (tooth, bone, gingiva) can impede the proper seating of the abutment and prosthesis & can become entrapped between connectors to cause misfit connections.

Gingival Effects (GE)
are a major cause of excess cement being injected into the subgingival environment where it is difficult to locate and clean away.

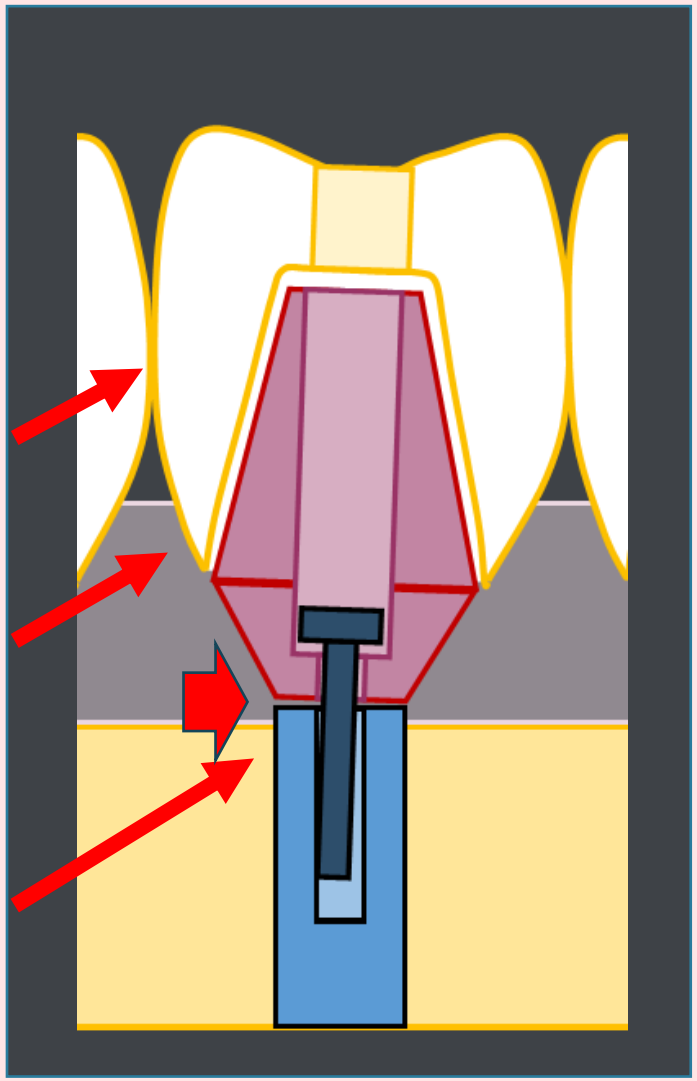
(Will Discuss this in detail later)



*Svoboda ELA. Making Fixed Prosthesis Installation Safer by Preventing Several Risk factors for Peri-implant Disease. Dec 2022, **www.Reversemargin.com**, Slides 1-130.*

3 Tissue Effects

Resistance to Displacement Effects (RTDE) by adjacent tissues can impede the proper seating of the abutment and prosthesis & can become entrapped between connectors to cause misfit connections.

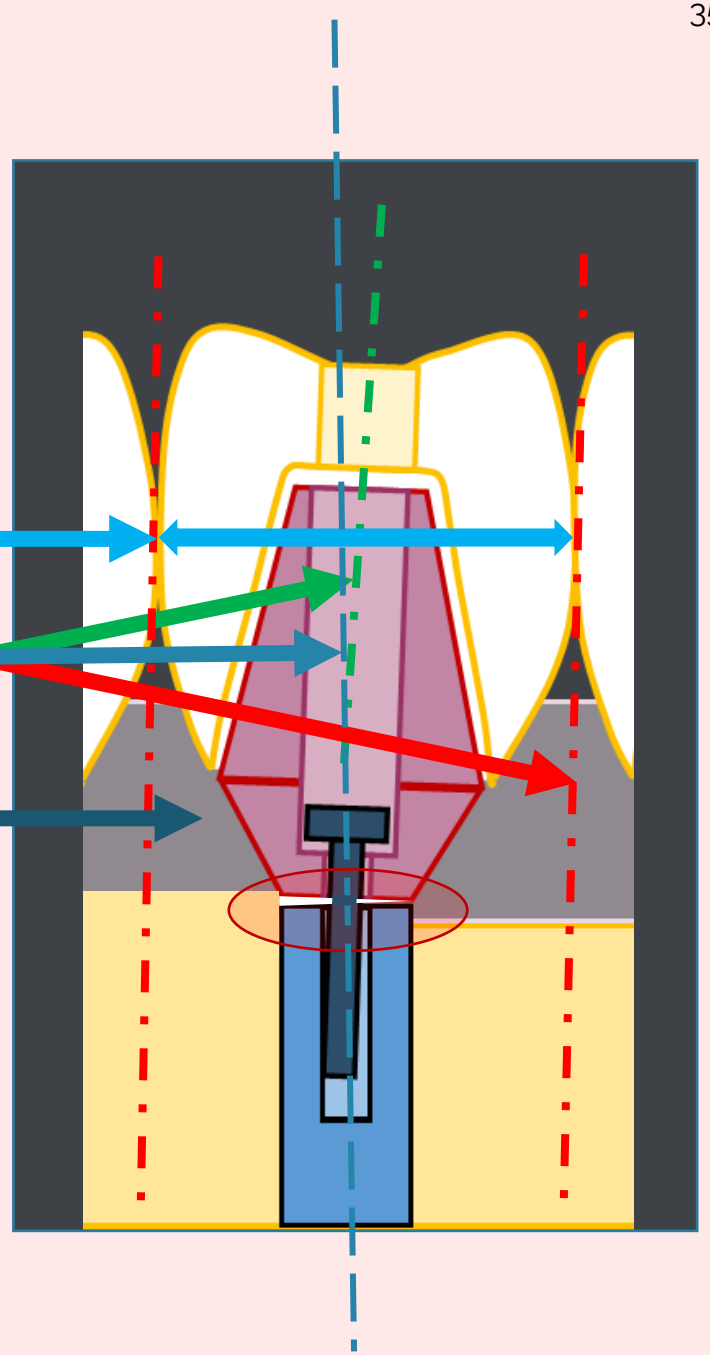


The Legacy Screw-in System has the abutments embedded in the prosthesis by the lab. This makes it more difficult to for the dentist to ensure the optimal seating of the abutments into the implant connectors, especially when they are placed deep to the gingival and alveolar bone. Indeed, both the abutments and the prosthesis must effectively displace adjacent tissues during their installation.
Yes, tooth material, bone and gingiva can be very difficult to displace effectively when the dentist's control is compromised unnecessarily by the inclusion of the prosthesis during abutment installation.

Svoboda ELA. Making Fixed Prosthesis Installation Safer by Preventing Several Risk factors for Peri-implant Disease. Dec 2022, www.Reversemargin.com, Slides 1-130.

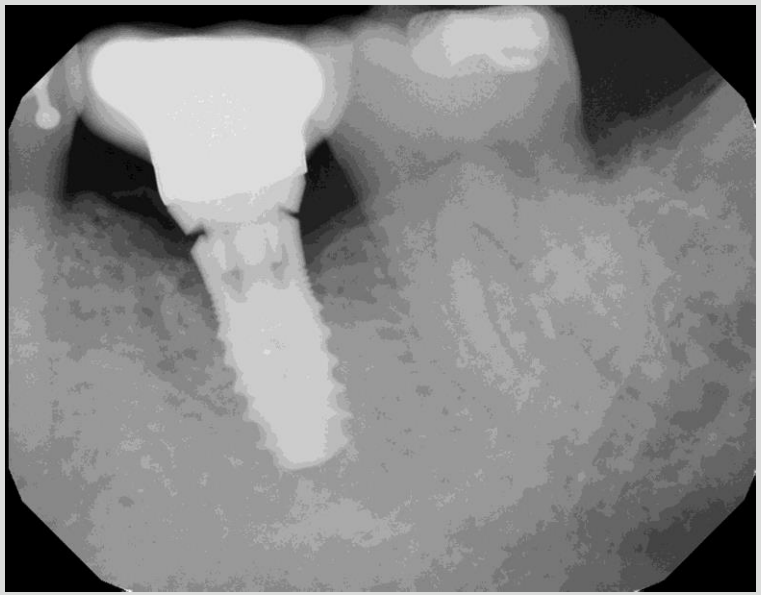
ALL the ROOT causes of Mechanical Complications Must be Effectively Mitigated …

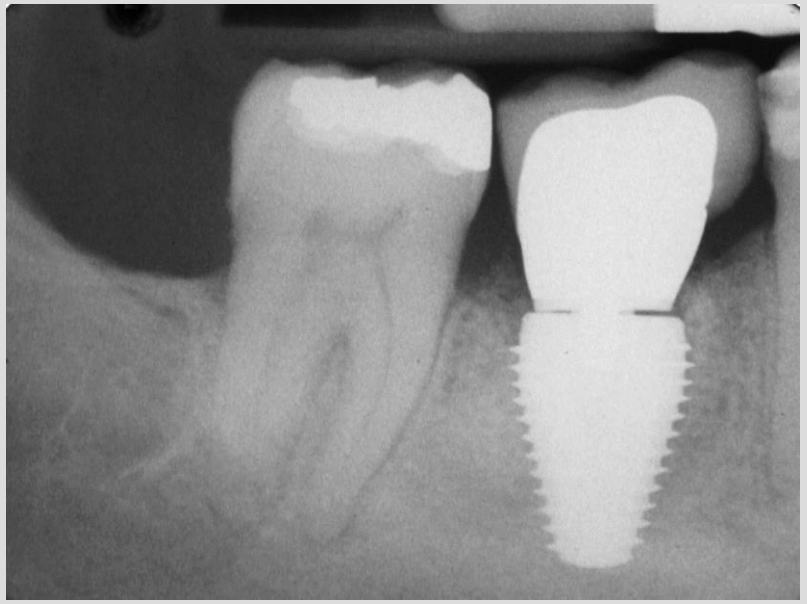
1. **Prosthesis Dimensional Error**
2. **Incongruent Paths Of Insertion**
3. **Tissue Effects:**
   Resistance to Displacement Effects
   Gingival Effects



… to prevent mechanical & related biological complications

These Misfit Connections are easy to see in x-ray images

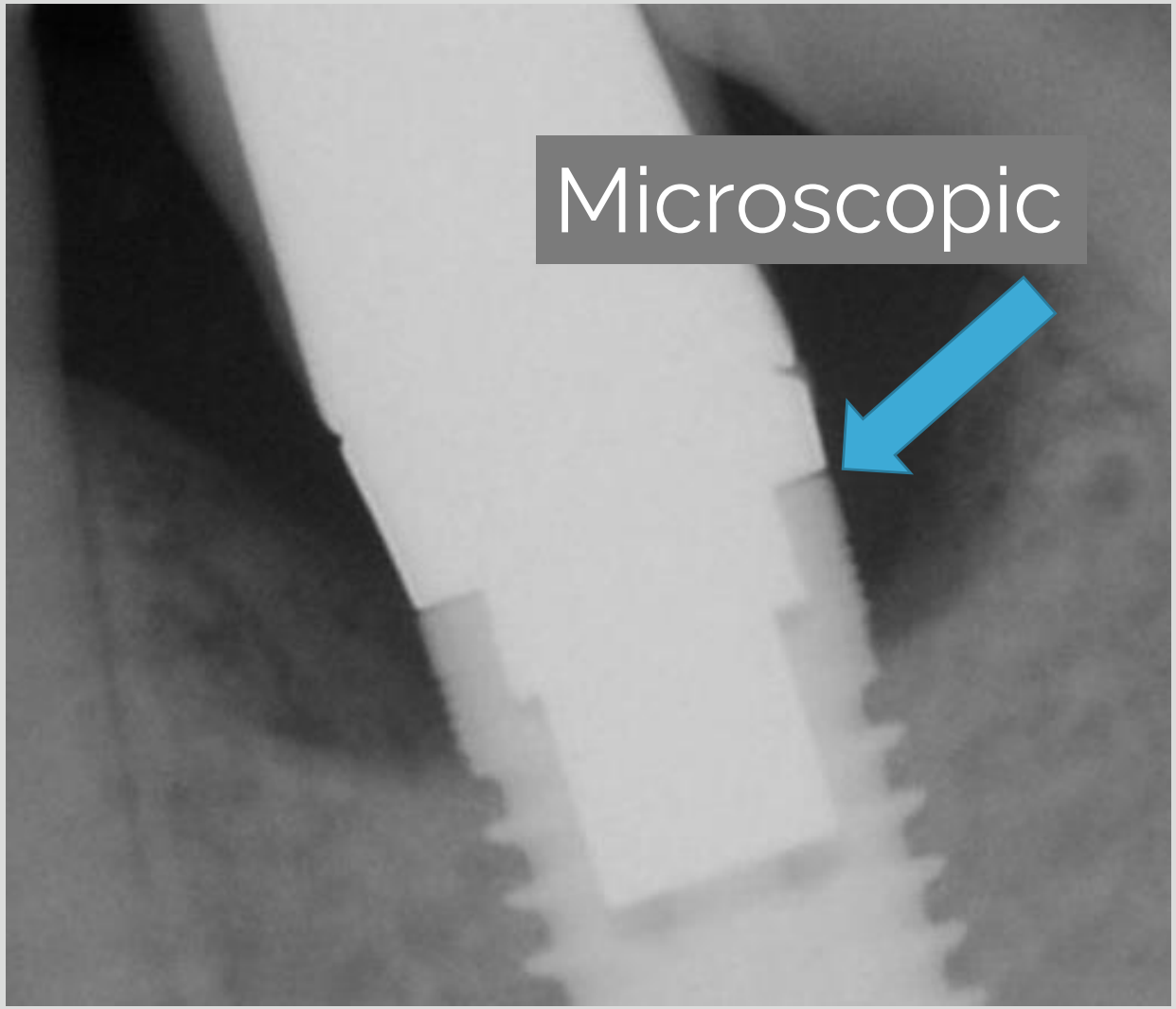




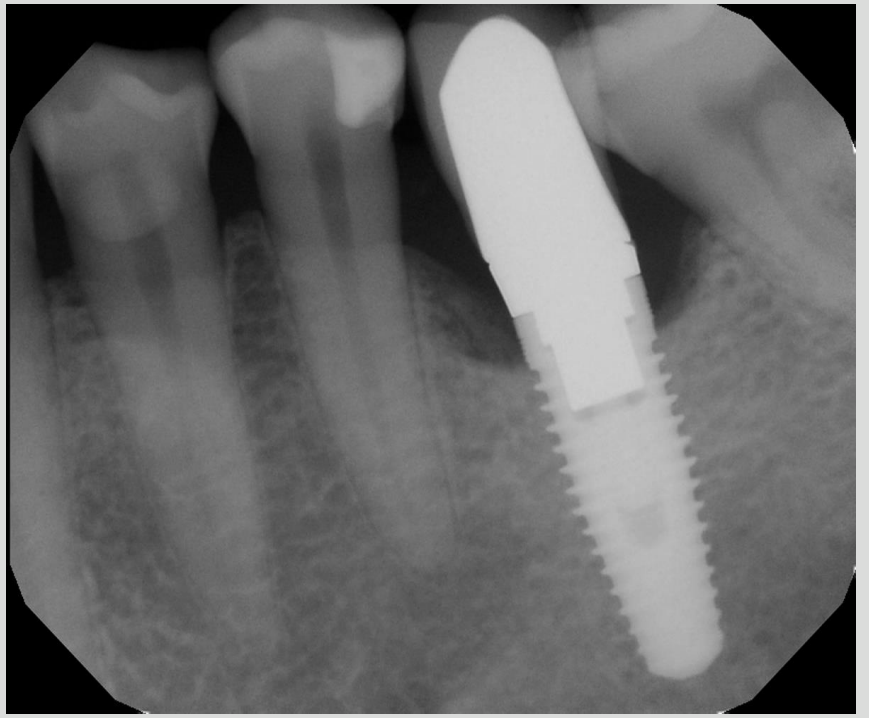
- **PDE**
  Tight contact(s)?
- **ICPOI**
  Tight contact(s)?
- **RTDE**
  Tissue resistance?

It is difficult to determine
WHICH of the ROOT CAUSES are RESPONSIBLE?
HOW CAN WE PREVENT THESE PROBLEMS?

Most implant-abutment misfits are NOT easy to see



Abutment is Mobile: Pockets = 9mm



BUT their Damage is easy to see

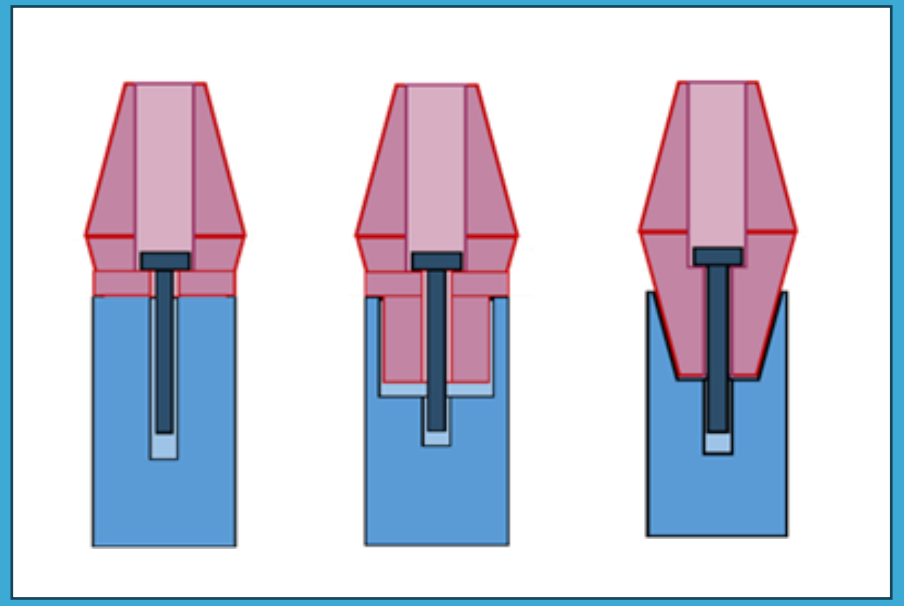
From Dr. Murray Arlin

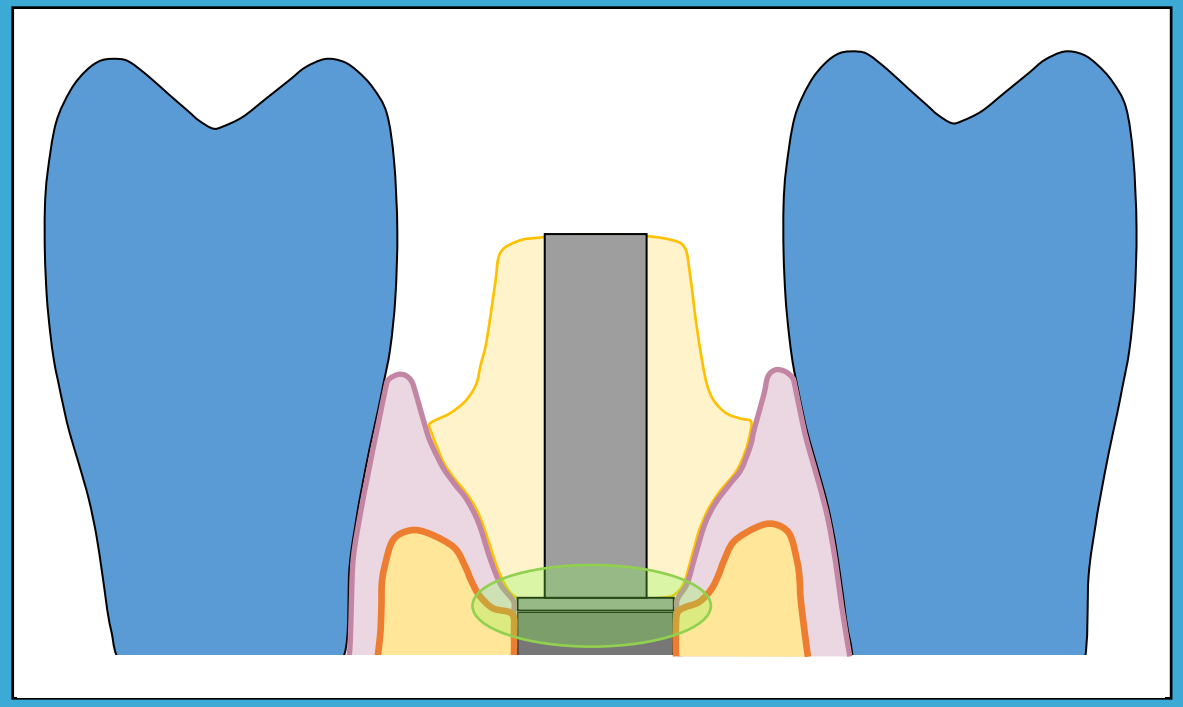
To Make Treatment Better for Patients …

… We need to follow Two Rules

Svoboda Way Rule #1

Install abutments individually without the prosthesis attached



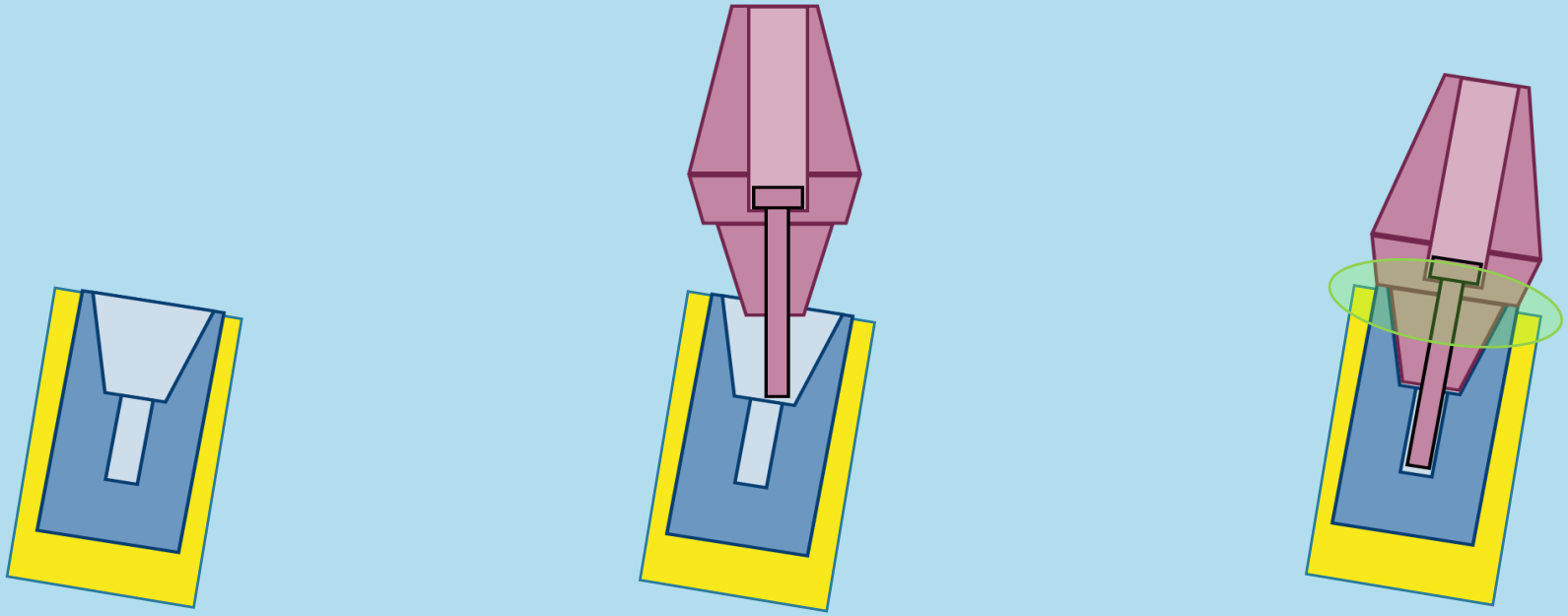


This optimizes the fit of implant-abutment (I-A) connections
to prevents misfit joints and its related biomechanical complications

How does Rule #1 work?

The implant is Fixed in the jaw

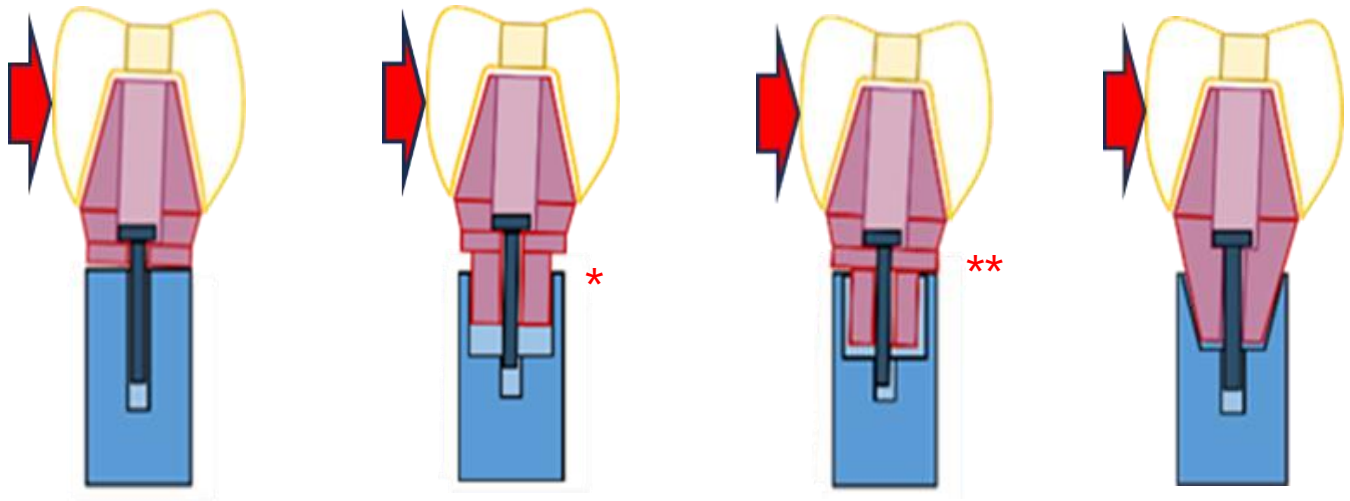
The “abutment is free to move” to align itself with its implant connector



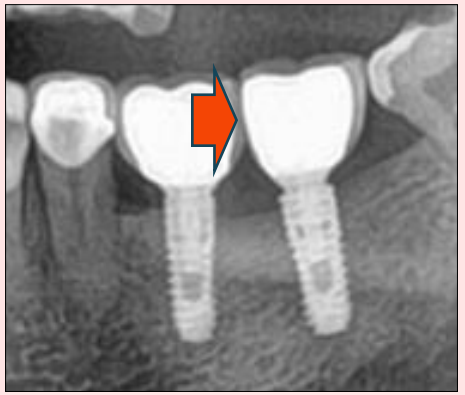
Optimized I-A Connection

There is no prosthesis to restrict access to the peri-implant tissues and further impede the optimized seating of each abutment

With the prosthesis attached, as long as the tight contact (red arrow) remains, the abutments will be misfit



Regardless of design, all these abutments are misfit. However, the non-engaging abutment connector** will seat deeper into the implant than the engaging connector.*



The fit of the I-A depends managing PDE, ICPOI and the RTDE by adjacent tissues within the tolerances of their connectors

Crowns and Bridges

On installation day
Dentists
need to adjust contacts
of screw-in crowns
within ± 5 µM
to prevent
misfit connections and
related complications

DO YOU REALLY THINK DENTISTS CAN ADJUST TOOTH CONTACTS ± 5 µM WITH THESE TOOLS WHILE HOLDING THE PROSTHESIS WITH THEIR FINGERS?

Svoboda Way Rule #2

Install the prosthesis by a SAFER Intra-Oral Cementation System

"Cement to retain the prosthesis &
fill the cement space between parts to exclude microbes"

"Why do we at ELOS MEDTECH recommend cementation in the mouth?"

"Cementation in the mouth actually uses the patient as reference, so you cancel out parts of the tolerance chain … and you will actually have the perfect passive fit"

Why is this Residual Subgingival Cement problem still so prevalent in 2024?

What do dentists and their teachers still need to understand?

Why is the Residual Subgingival Cement problem still so prevalent in 2024 for the restoration of natural teeth and dental implants with crowns and bridges?

I am not sure whether the concepts underlying the nature of intra-oral cementation are too hard for our Key Opinion Leaders (KOLs) to grasp, or whether manufacturers are controlling the rhetoric by withholding support from those not on the “faulty Screw-in Installation System train.” Indeed, I believe, the faulty presumption that the Screw-in Installation is safe, is encouraging dentists to engage in aggressive treatment without proper regard to their inherent risk factors for peri-implantitis. This likely leads to the sale of more implants at the expense of patient complications. However, the expense of treatment complications do not appear to sufficiently impact manufacturers, as dentists absorb the brunt of litigation costs launched by unhappy patients. This is a problem!

Even, well respected Prosthodontists, who should understand or recognize the strengths and weaknesses of both legacy installation systems are supporting the flawed Screw-in System. They do not seem to understand the relationship between mechanical complications and treatment failure, nor why the Legacy Screw-in Systems they promote do not prevent the known risk factors for peri-implantitis. I must ask, “Do they really not understand, or is it just bad business to understand?”

I will now discuss a **Safer Intra-oral Cementation System** that can help to mitigate several longstanding risk factors for peri-implantitis inherent to the Legacy Screw-in and Cement-in Prosthesis Installation Systems. The concepts and new dental language I have proposed underpins the improvements to the safety of prosthesis installation that can be applied to improve the restoration of both natural teeth and dental implants.

Intra-oral cementation is a hydraulic event*

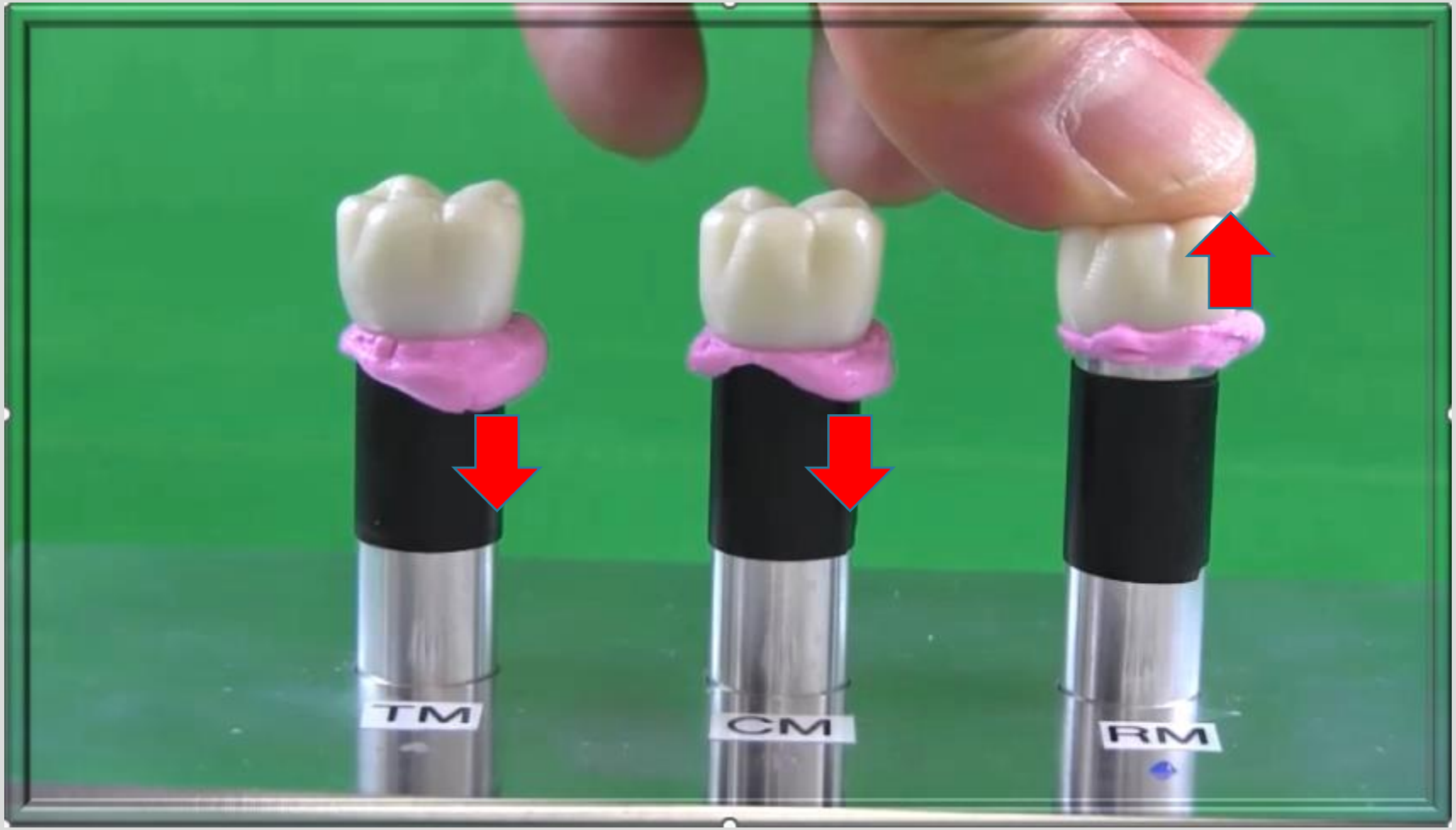
Can dentists redirect cement flow away from tissues by changing the shape of the crown margin and its complementary retainer?

1) Testing the Effect of Margin Design on the Direction of Cement Flow

TM-Tapered/Feather Margin
CM-Chamfer Margin
RM-Reverse/Inflected Margin

*Prosthodontists: Wadhwani C & Pineyro A. Svoboda ELA. Controlling Excess Cement During the Process of Intra-Oral Prosthesis Cementation: Overcoming the Gingival Effects. OCT. 2015 www.oralhealthgroup.com:52-66.

YES - Margin Design Effects the Direction of Cement Flow

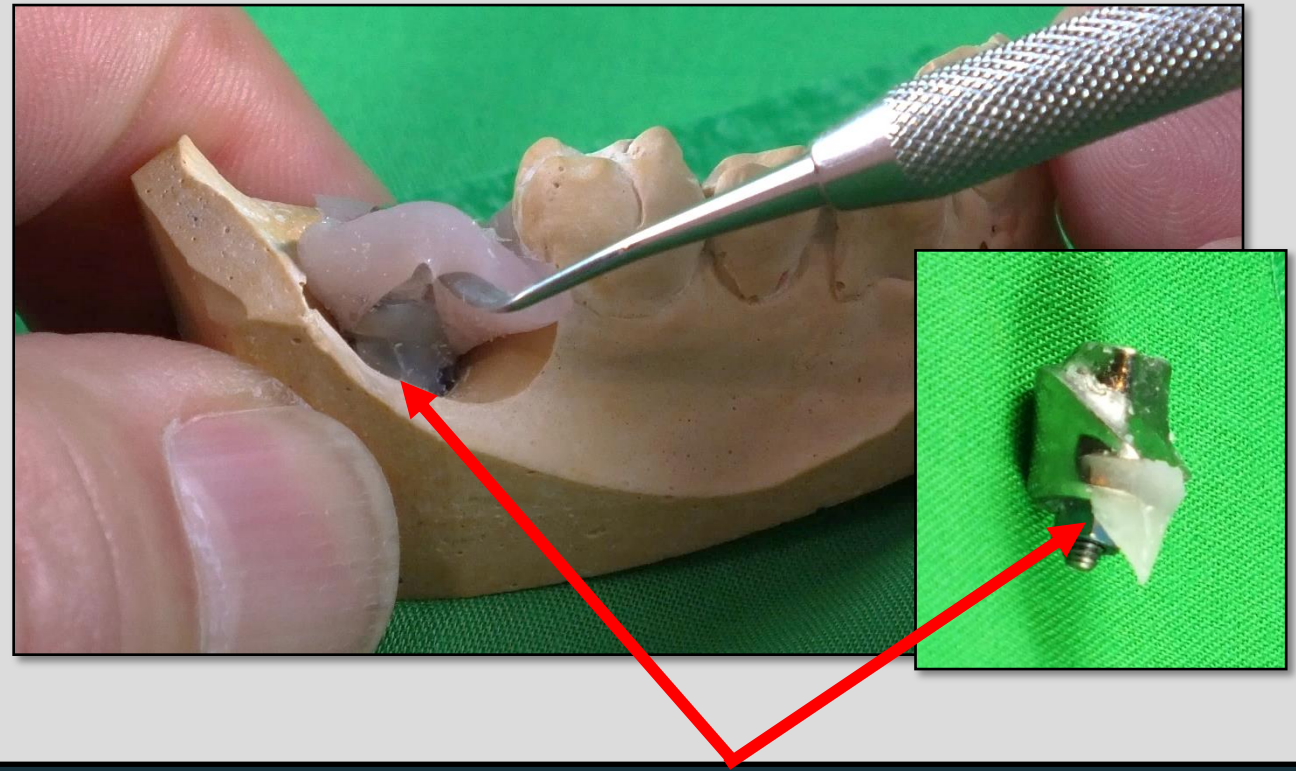


During crown cementation the Tapered (TM) & Chamfer Margin (CM) shapes direct cement towards the tissues.

The inflected Reverse Margin (RM) shape directs cement away from tissues.

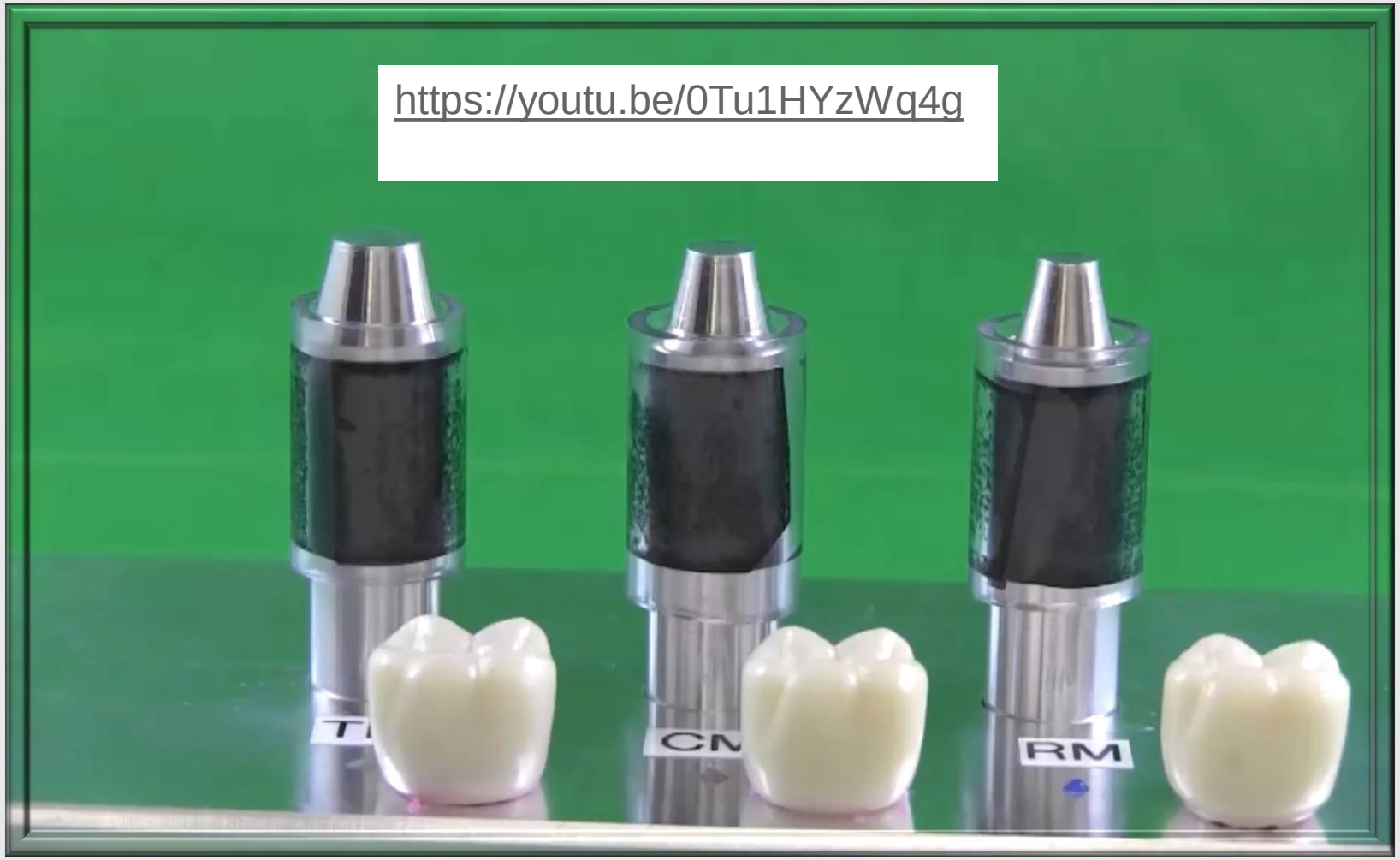
Do dentists want to direct cement into or away from tissues?

2) Gingival Effects Discovered



WHEN “GINGIVA” WAS PRESENT – EXCESS CEMENT WAS SEEN UNDER THE GINGIVA, REGARDLESS OF MARGIN DESIGN!

Testing the Gingival Effects (GE) on Cement Flow



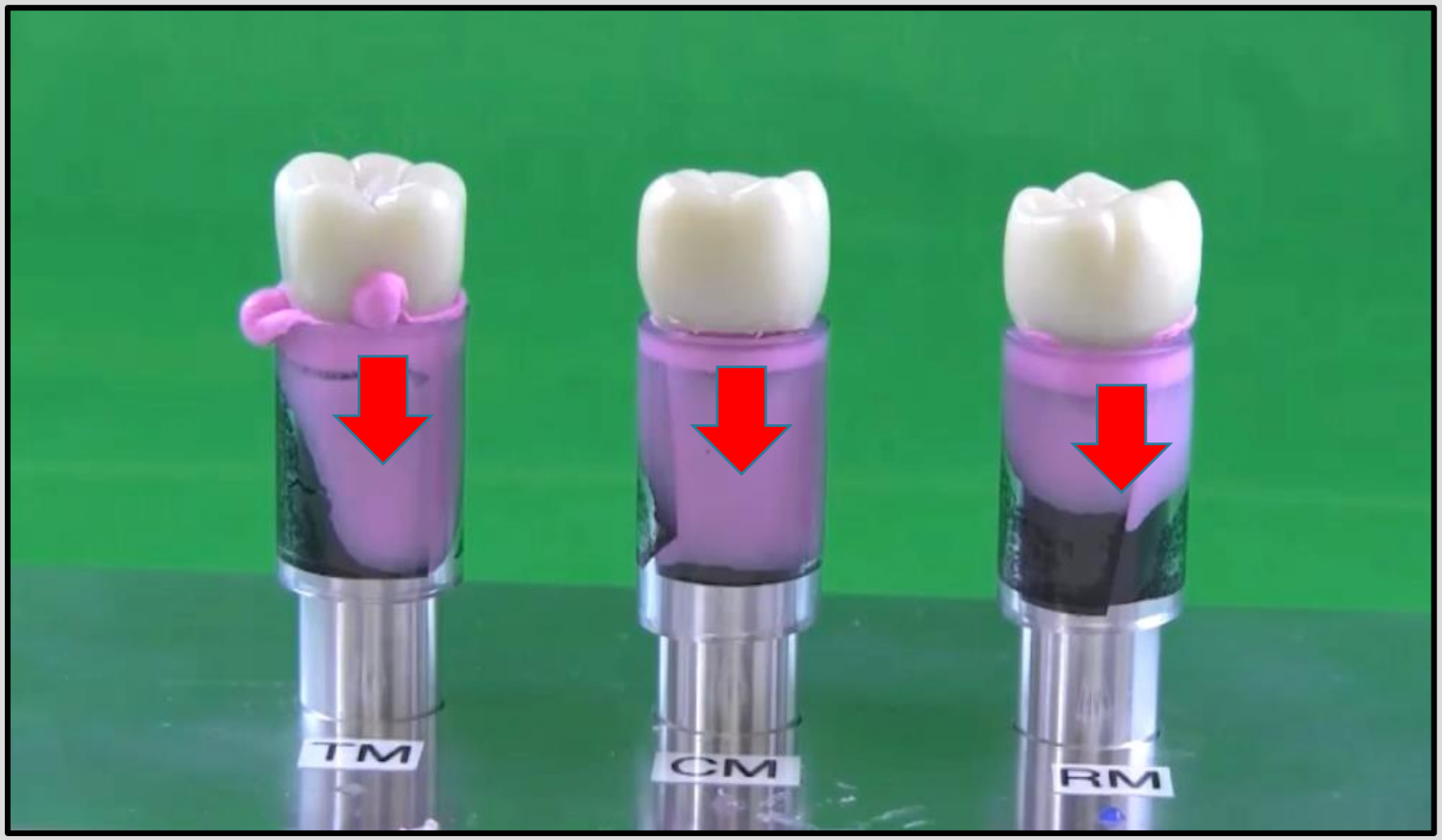
During cementation, **Legacy Crown shapes** contact the gingiva prior to being seated.

This creates a seal that prevents the excess cement from escaping the tissues and forces the trapped cement deep into the tissue space.

The GE defeated all these margin designs.

Knowing about the GE is important new Knowledge!

The Gingival Effects (GE) can cause the occurrence of Abundant Subgingival Cement



The GE defeated all margins in this experiment.

This is important New Knowledge that has implications for both dental implants and natural teeth!

How many of your patients have gingiva? How often do dentists place margins below the gingiva?

Would dentists like to prevent this subgingival cement?

Svoboda ELA. Controlling Excess Cement During the Process of Intra-Oral Prosthesis Cementation: Overcoming the Gingival Effects. OCT. 2015 www.oralhealthgroup.com:52-66.

3) Testing the Reverse Margin System (RMS) Design using different Crown shapes that do and do not touch adjacent gingiva during installation

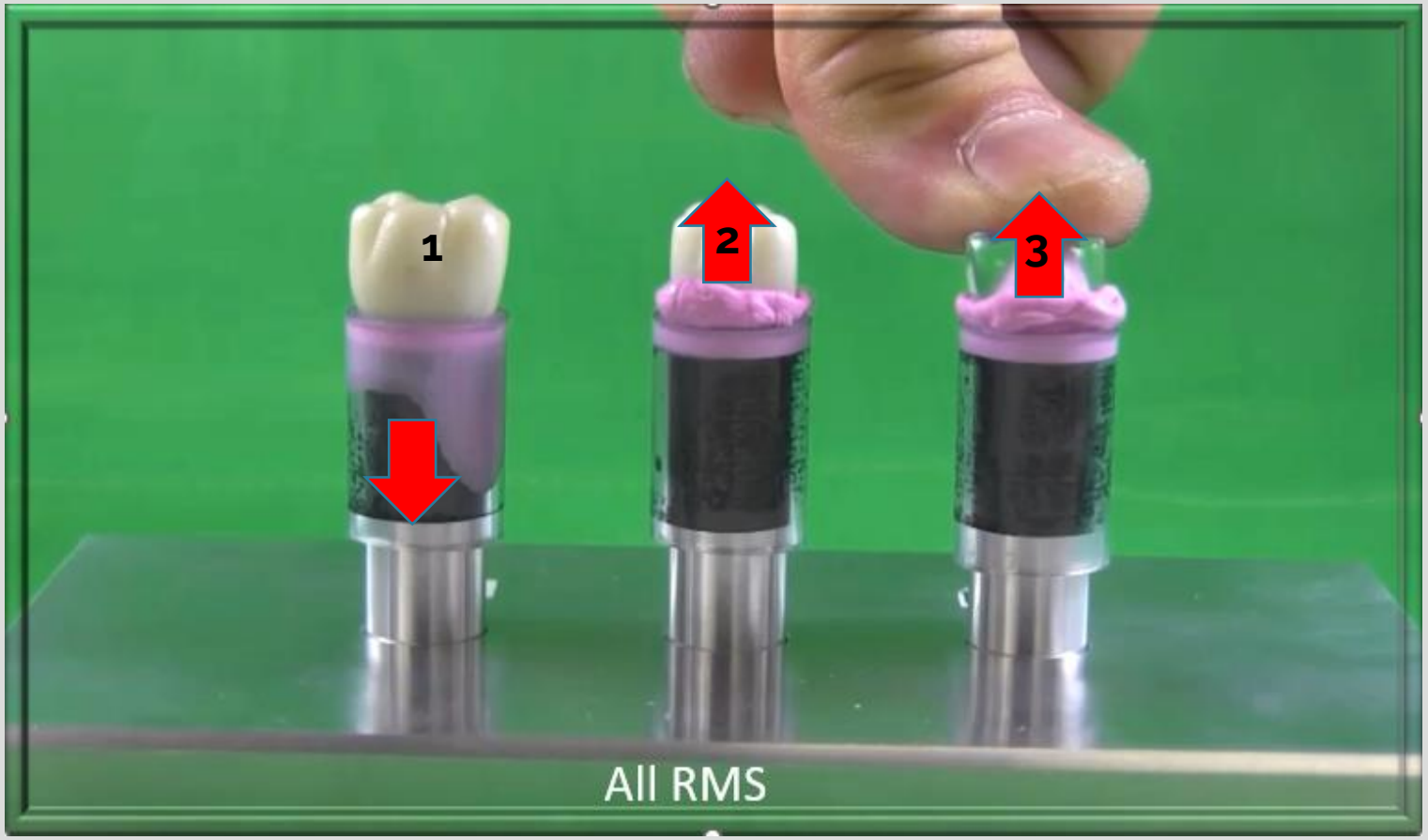
The RM Design redirects cement away from the tissues (Exp. 1)

The **legacy crown shape (1)** interacts with the gingiva & causes abundant subgingival cement.

Narrow crowns (2&3) create space between the crown and gingiva to mitigate the **Gingival Effects (GE)** and provide space to aid the flow of redirected excess cement away from tissues to **prevent the occurrence of subgingival cement.**

If dentists want to prevent subgingival cement, here is a way to do it!

Overcoming both Tissue Effects by RMS Design is a BIG Deal



RMS (2&3) prevents subgingival cement by **mitigating the GE** and since the crown does not touch the gingiva, this system also **mitigates the RTDE** that can prevent the crown from seating properly.

Adjusting contacts is also easier because moving the prosthesis in and out of place does not traumatize adjacent tissues and make them bleed.

Legacy crowns that interact with gingival are not designed to prevent subgingival cement.

If dentists want to make treatment safer, here is a way to do it!

Why is the Residual Subgingival Cement problem still so prevalent in 2024 for the restoration of natural teeth and dental implants with crowns and bridges?

I am not sure why our KOLs did not pick up on the importance of the clinical implications of these experiments, as the article was already published in 2015. I have also presented this work from the podium numerous times. In any case, a lot of refinement to the research and Reverse Margin System has occurred due to its over 10 years of clinical usage. I am pleased with the results experienced by my patients. There are many prominent clinicians and researchers that have worked on the problem of residual subgingival cement, most notably Prosthodontists Tomas Linkevicius and Chandur Wadhwani. I have reviewed their work and commented upon it in my numerous articles mentioned below.

After many experiments at workshops and with colleagues, I was convinced that the Gingival Effects (GE) and the Resistance to Displacement Effects (RTDE) caused by adjacent tissues, along with the other root causes of Mechanical Complications are the primary causes of subgingival cement and poor margins. I was curious about the effect of pressure on subgingival cement and open margins.

Svoboda ELA, Cheema D, Sharma A. Effect of margin depth, installation pressure & prosthesis design on submarginal cement and open margins. Spectrum Implants March/April 2022: V13 N2: 50-64. Also at www.ReverseMargin.com

Svoboda ELA, Sharma A, Zakari M. Comparing the Chamfer and Reverse Margin Systems at Preventing Submarginal Cement while varying Crown Installation Pressure and Margin Depth. www.ReverseMargin.com. 2020;1-13.

Effect of margin depth, installation pressure & prosthesis design on submarginal cement and open margins

100 Models & Crowns

5 pressure groups

2 margin depths

10 **CMS** & **RMS**/Group

CMS - Chamfer Margin System

RMS - Reverse Margin System

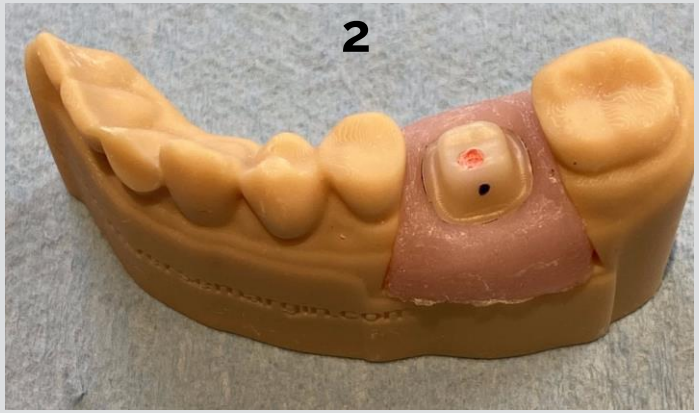
Rely X Unicem 2 from 3M Espe

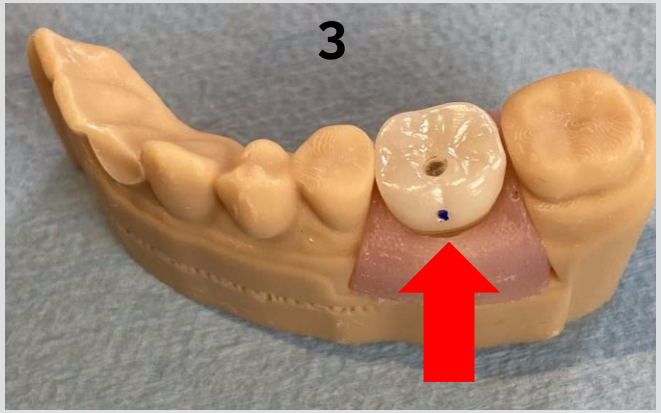
Review the findings of this experiment and discussion in greater detail in the original article: Svoboda ELA, Cheema D, Sharma A. Effect of margin depth, installation pressure & prosthesis design on submarginal cement and open margins. Spectrum Implants March/April 2022: V13 N2: 50-64. Also available for free download at www.ReverseMargin.com

Comparing the legacy Chamfer Margin System (CMS) to the newer Reverse Margin System (RMS)

The **CMS** crown is wider than its retaining abutment (**1**) and thus, when the finish line is subgingival, the crown will interact with adjacent gingiva prior to being seated. This **stimulates both Tissue Effects** – the Gingival Effects (**GE**) & the Resistance to Displacement Effects (**RTDE**).

The **RMS** crown is narrower in profile than its retaining abutment (**1**)in its subgingival location. The abutment shape pushes the gingiva away from the narrowed part of the crown to provide space for the escape of cement excess.(**2)** See small space between crown and gingiva. (**3**)





Unlike **CMS**, the **RMS** crown does will not interact with adjacent gingiva when being seated, so it mitigates the complications caused by both Tissue Effects - **GE** and **RTDE**.

Let’s see the results!

Experiment: Cement, Retrieve, Photograph, Measure

1

2

3

(**1**) Shows the weigh scale and process by which pressure was measured during cementation. I have not seen any previous research showing the effect of pressure on subgingival cement. The scale reads about 40 Ncm or 4 Kg of force – this is about what we learned to use for crown cementation at dental school. (**2**) This cement was used in a previous experiment and shows well to demonstrate how subgingival cement travel was measured. (**3**) Other studies measured subgingival cement as areas or volumes. I found distance travelled by excess cement easier to measure and relate to the clinical observations.

Decreasing pressure reduced submarginal cement for both margin types when 0.5 to 1 mm below gingiva

1

2

3

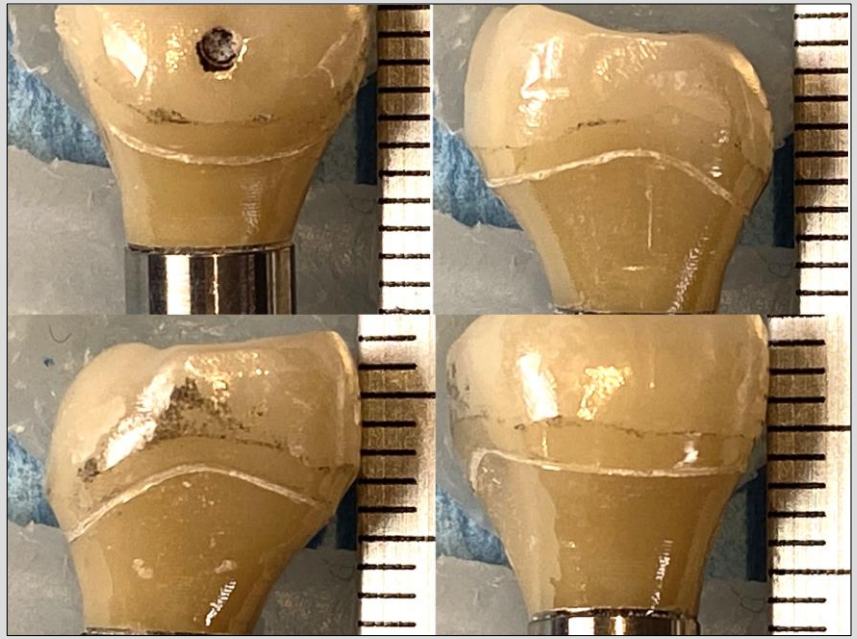
Pressure	Margin	Totals Average	Range
5 Kg	CM	4.1	0 - 10.8
	RM	0.4	0 - 11.6
4 Kg	CM	4.0	0 - 11.5
	RM	0.1	0 - 1.0
2 Kg	CM	2.1	0.1 - 4.2
	RM	0	0
1 Kg	CM	0.7	0 - 3.3
	RM	0	0
0.5 Kg	CM	0.7	0 - 3.8
	RM	0	0

(**1**) **CMS** with submarginal cement marked with black marker. Cement was **rough** to the touch. (**2**) **RMS** without submarginal cement. (**3**) RMS had less submarginal cement under all pressure conditions.

Only RMS had NO submarginal cement at 2Kg or less!

All CMS had Open Margins when 0.5 to 1 mm Subgingival

The Gingiva done it! (RTDE)

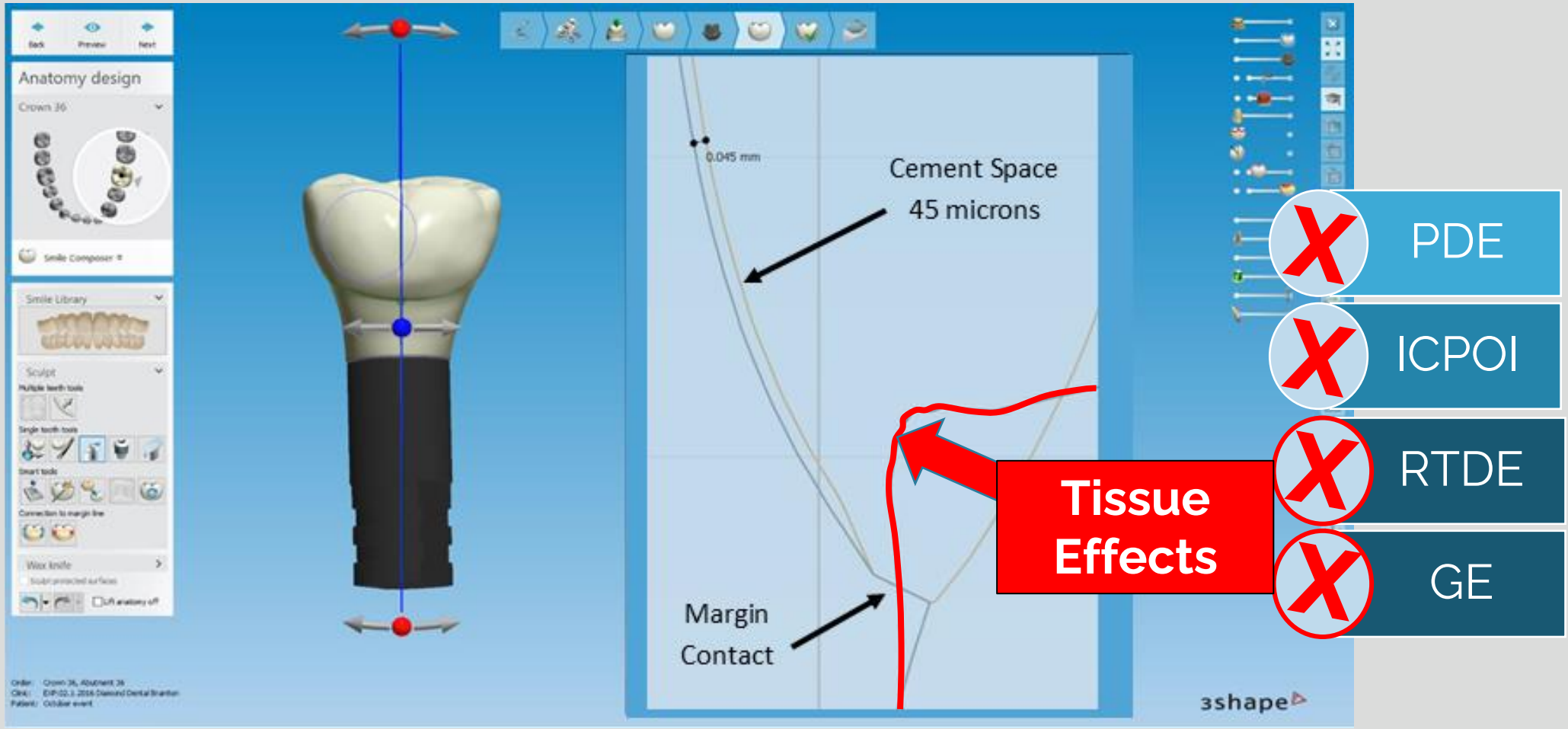


CM	Total	
Pressure	Average	Range
5 Kg	0.1	0-0.3
4 Kg	0.2	0-0.6
2 Kg	0.1	0-0.3
1 Kg	0.3	0-1.0
0.5 Kg	0.3	0-0.7

CMS open margins increased in size with decreasing pressure

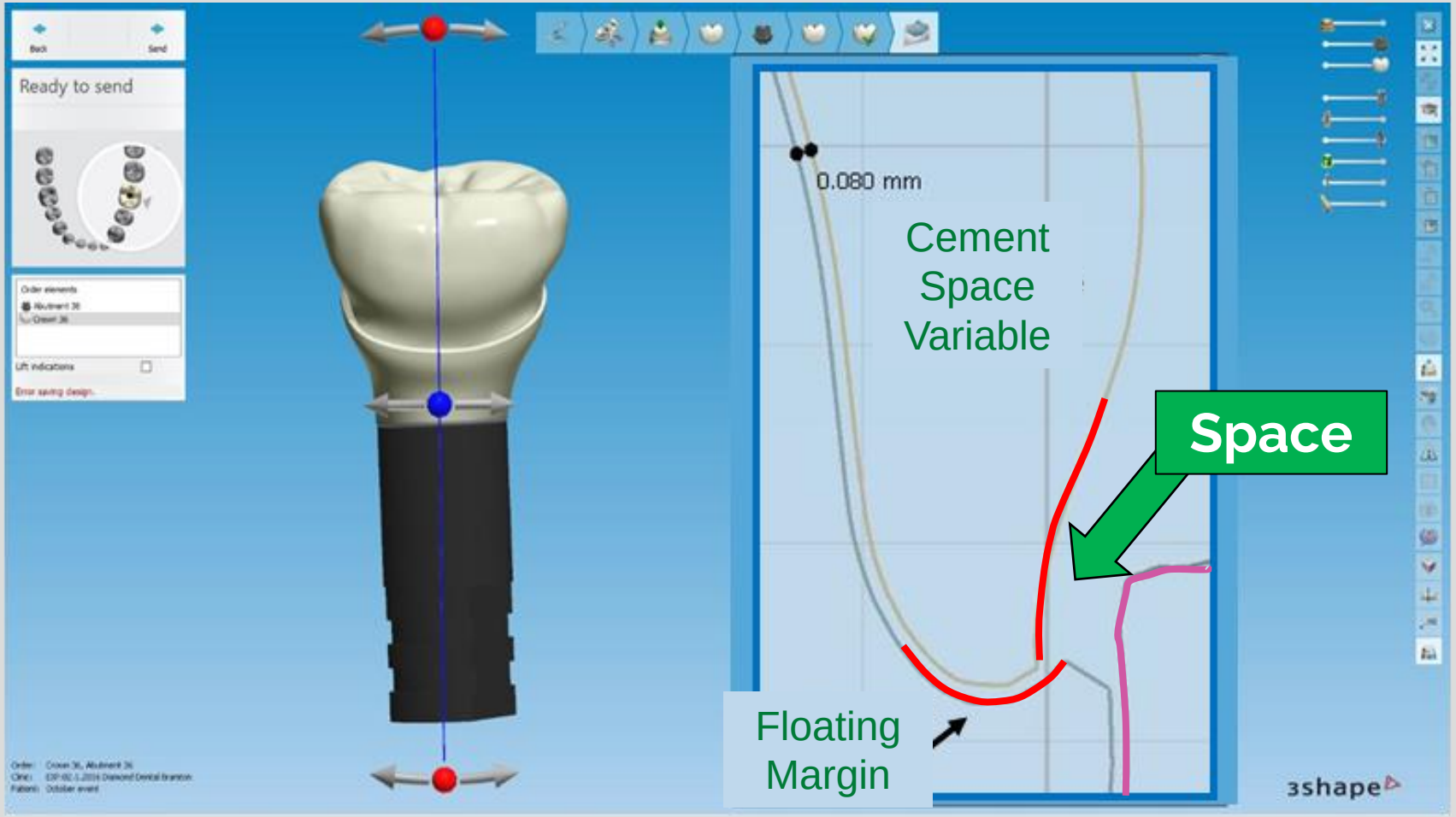
Unlike RMS, Legacy the Chamfer Margin System (CMS) was never designed to mitigate GE or RTDE … design matters!

CMS design stimulates Tissue Effects as Crown is wider than abutment & interacts with Gingiva



Because margins are designed to contact abutment finish lines, they cannot safely tolerate any expected PDE or ICPOI. Even cement space is too small for that.

RMS is designed to mitigate both Tissue Effects (RTDE & GE) because the crown does not interact with Gingiva

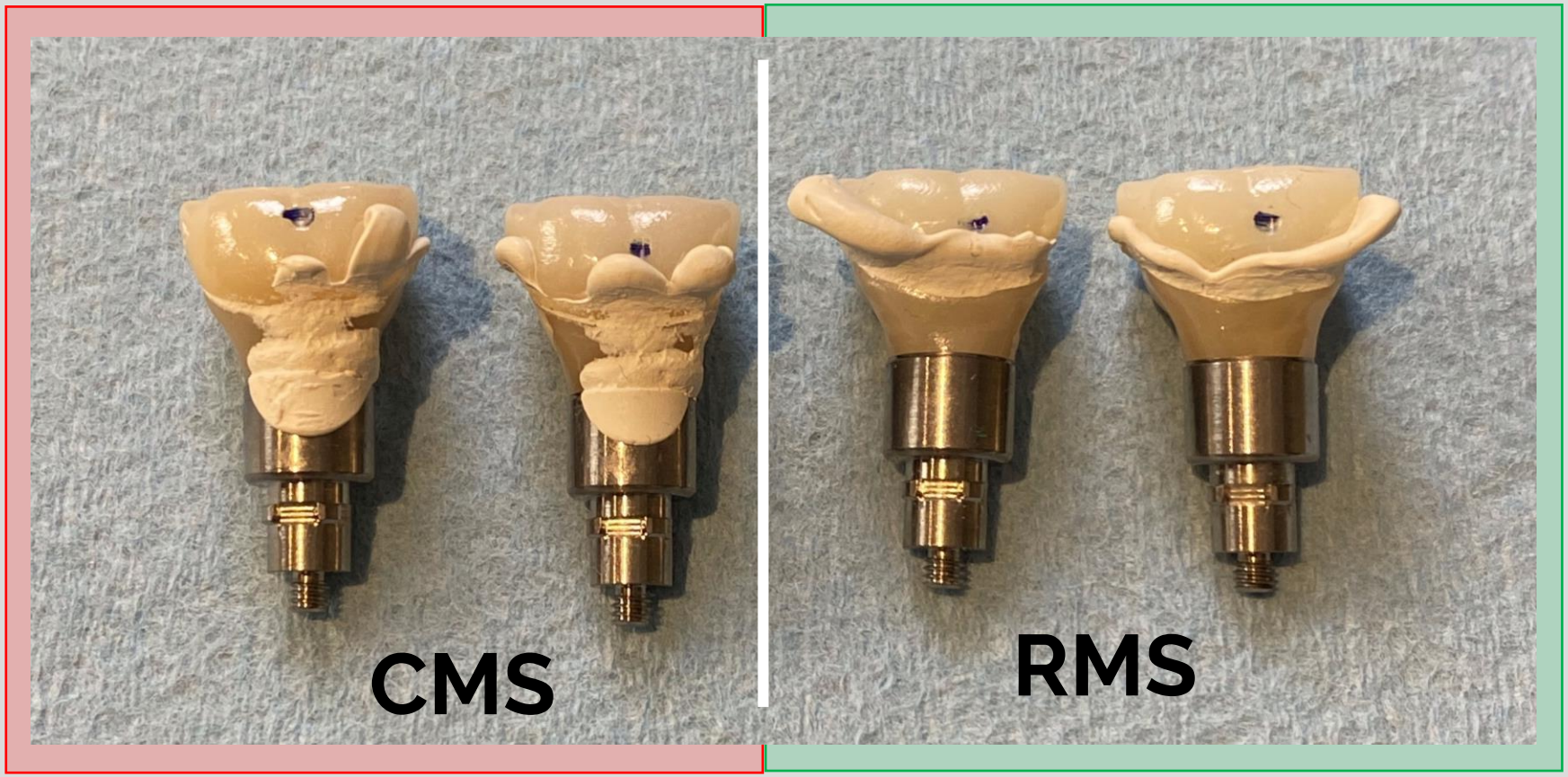


- PDE
- ICPOI
- RTDE
- GE

Also, the cement space can be safely increased to manage expected PDE and ICPOI, as the crown can float within the abutment trough. Excess cement fills the space and is easy to access and clean away. This is a much-needed design update.

RMS works, but can we safely use CMS?

Yes But: Legacy systems need to be retrieved for refinement!

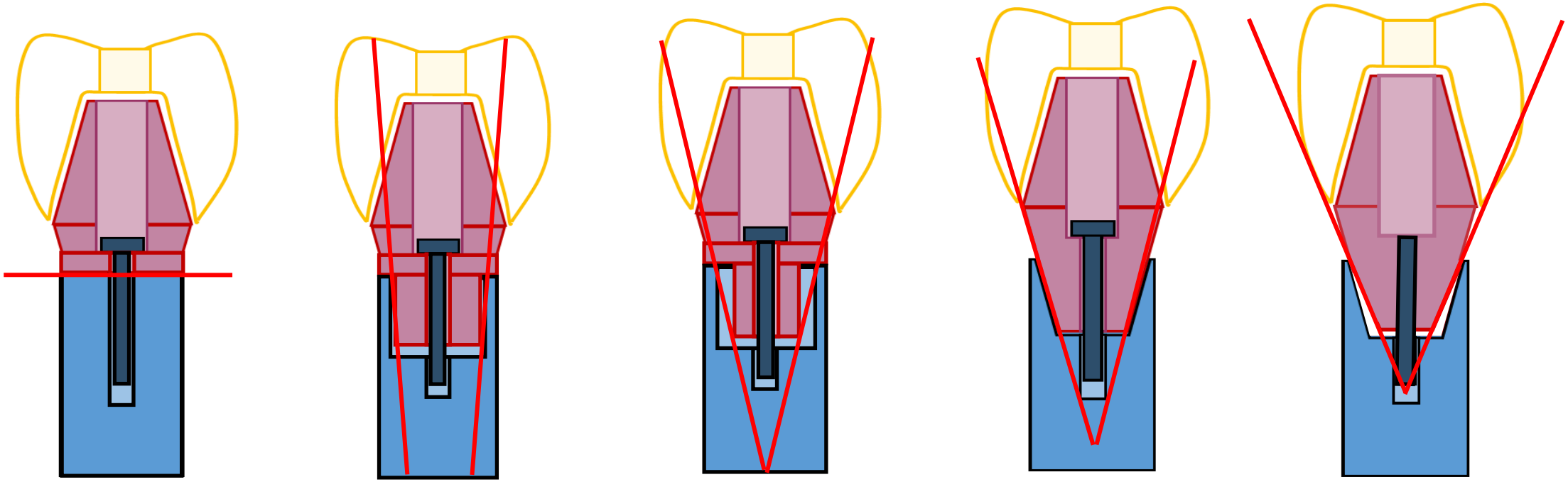


Svoboda ELA. Making Fixed Prosthesis Installation Safer by Preventing Several Risk factors for Peri-implant Disease. Dec 2022, www.Reversemargin.com, Slides 1-130.

Svoboda ELA. Screw versus Cement Debate: Will that be Peri-implant Disease by Misfits and Poor Access to Care or Bad Margins and Subgingival Cement? 2021 Spectrum Implants V12 N4:38-47. Or at www.ReverseMargin.com

Retrievability depends upon the Working Paths of Insertion (WPOI) determined by the Shapes & Tolerances involved in the implant-abutment (I-A) connections

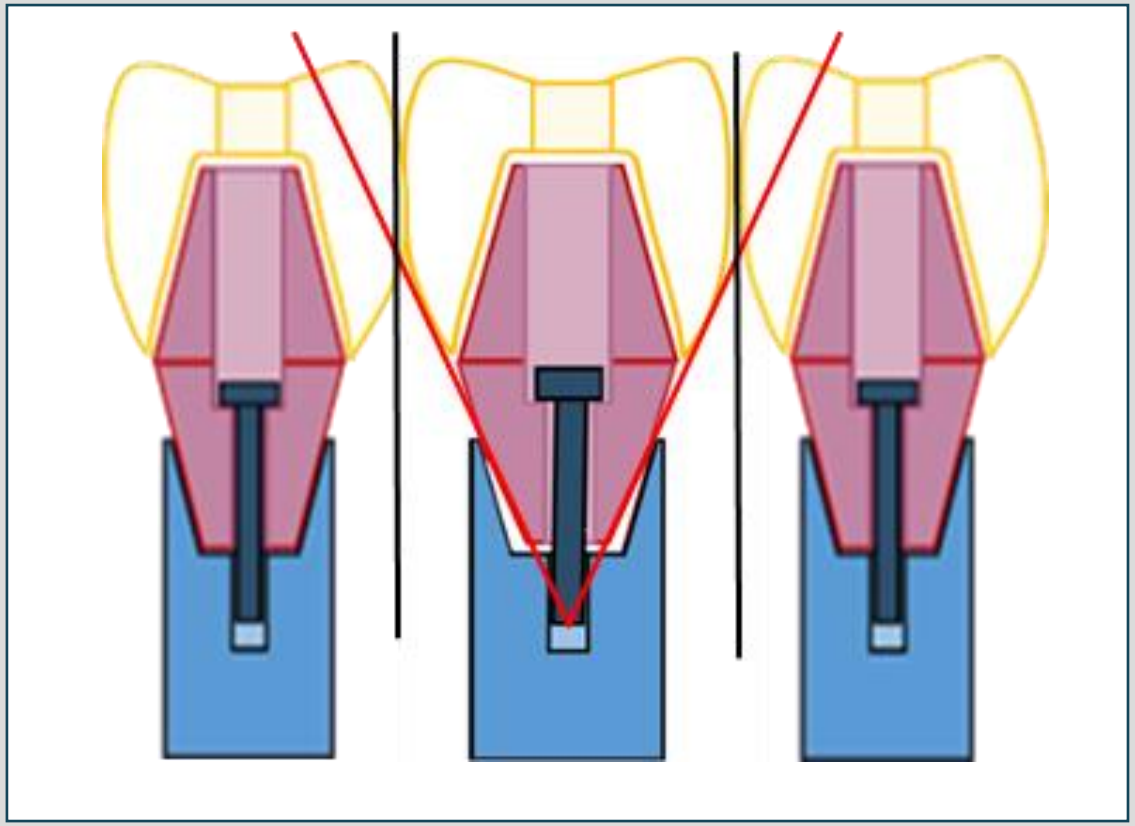
The angle between the red lines is the limit tolerable WPOI



Legacy prostheses need to be retrieved for refinement outside the mouth, before reinstallation

Retrievability also depends upon

the Working Paths of Insertion (WPOI) determined by adjacent teeth. These need to be within the range of the WPOI determined by the I-A connections



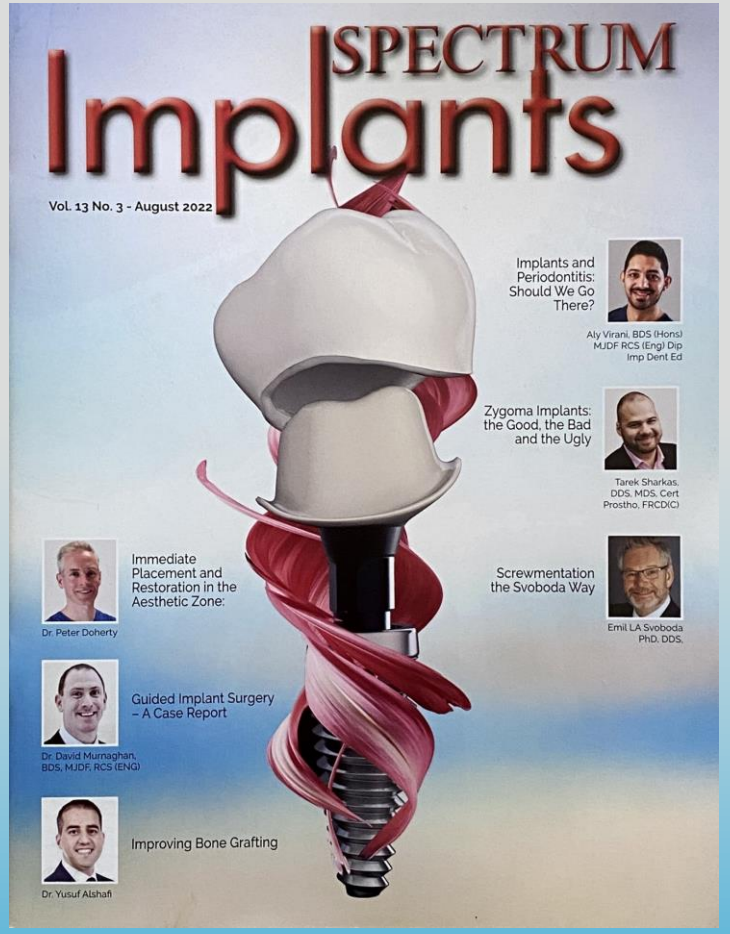
This is difficult to accomplish & assess in the mouth with the Legacy Screw-in System while also managing the other root causes of mechanical misfits like PDE and the RTDE.

What about "Screwmentation?"

The centre abutment-crown complex in this diagram is retrievable

With multiple units, the WPOI are also affected by multiple implant positions

What was the T.S. Mitchell process of Screwmentation?



Recognizing the difficulties with controlling subgingival cement with the legacy Cement-in installation system, Dr. Mitchell wanted to install the abutment first and then cement on the crown, and then retrieve it to remove expected excess cement. However, he found that the abutment crown complex often became stuck and difficult to remove, so he suggested putting the abutment in loosely to improve retrievability. This worked by increasing the WPOI of the abutment crown complex, but also caused I-A misfits. Too BAD!

How does T.S. Mitchell's Screwmentation System differ from its Svoboda Way variation?

Mitchell & *Rajan describe a System for **single crown installation** that **causes I-A misfits** & **requires removal and reinstallation** of the abutment-crown complex to manage subgingival cement.

The Svoboda Way System **optimizes** the I-A connections for **single and multiple unit restorations**, prevents residual subgingival cement and poor margins, and **does not require removal and reinstallation** of the abutment-prosthesis complex to manage excess cement.

RMS IS THE SAFER & MORE EFFICIENT SYSTEM

*Rajan M, Gunaseelan R. Fabrication of a Cement- and Screw-retained prosthesis . J of Prosthet Dent **2004**: V92,N6;578-580.
Svoboda ELA. Screwmentation the Svoboda Way. Spectrum Implants Aug 2022 :V13,N3:54-63.& www.ReverseMargin.com June 2022;1-13.

Svoboda Way Screwmentation for Legacy Systems

Follow Rule #1 – ensure retrievability features are in place
Always torque abutments fully into place

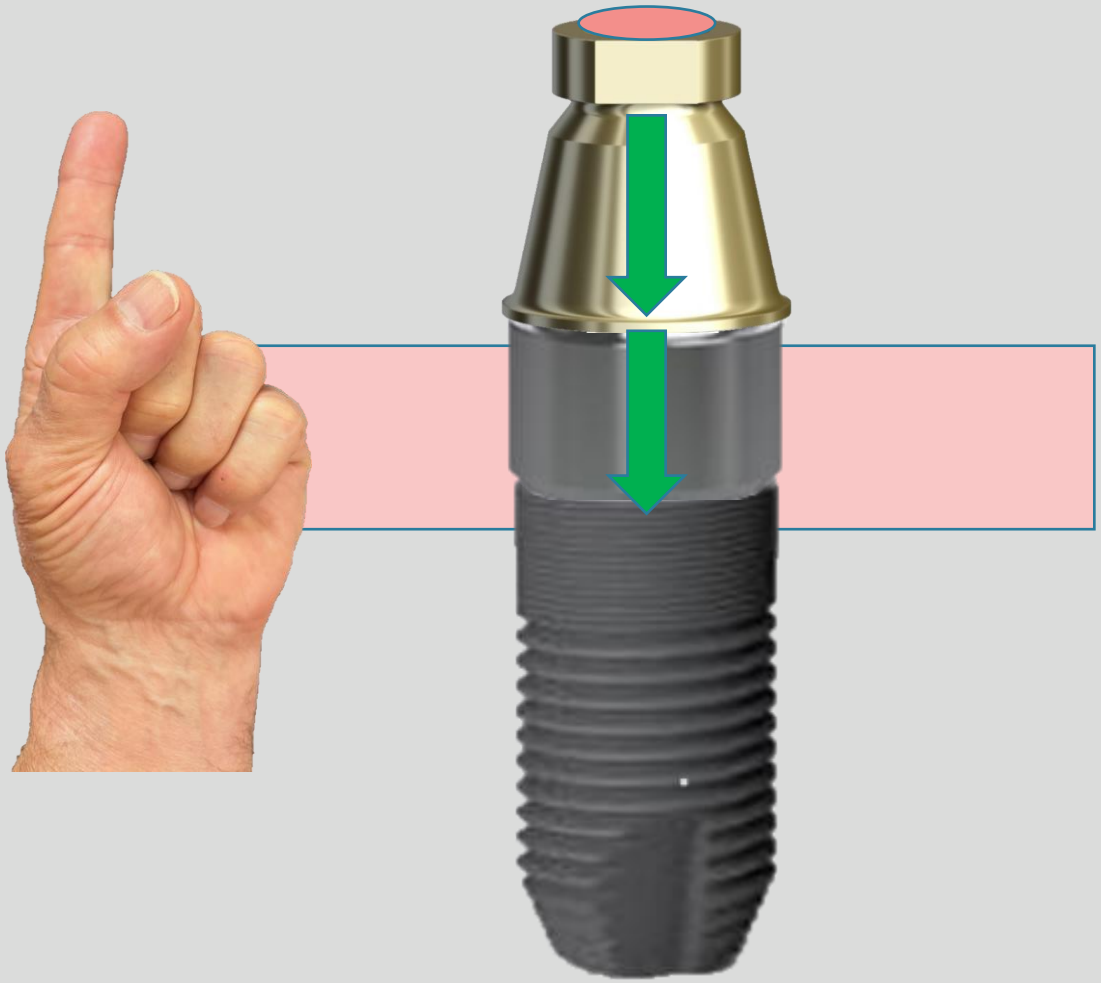
Follow Rule #2 – cement prosthesis
Plastic covered screw access holes
Remove and refine abutment-prosthesis complex
Reinstall abutment-prosthesis complex

Svoboda Way Installation for RMS

Follow Rule #1 – torque abutments fully into place

Follow Rule #2 – cement prosthesis & refine in situ
Plastic covered screw access holes are not required

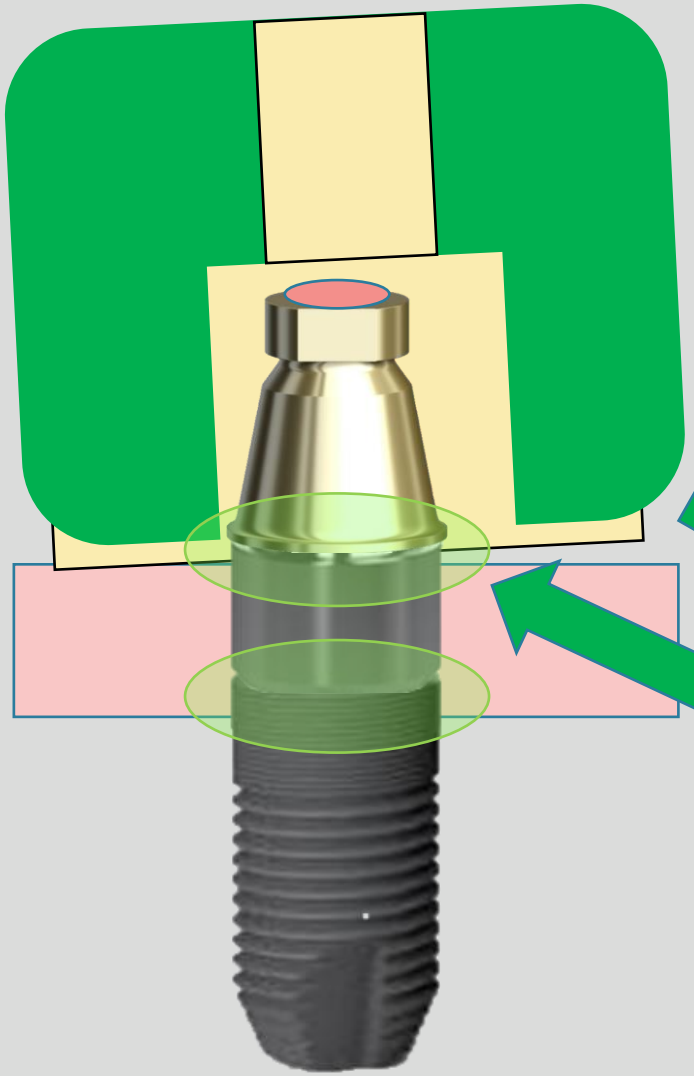
Can the Svoboda Way Rules make All-on-X better?



Rule #1 - Assemble all implant parts in the mouth to optimize their fit

- PDE
- ✓ ICPOI
- ✓ RTDE

Rule #2
Safely cement prosthesis intra-orally



Passive fit of prosthesis

Excess cement extruded from joint
(tolerates error)

The Multi-unit abutment – prosthetic connector joint has a wide range WPOI
(Retrievable)

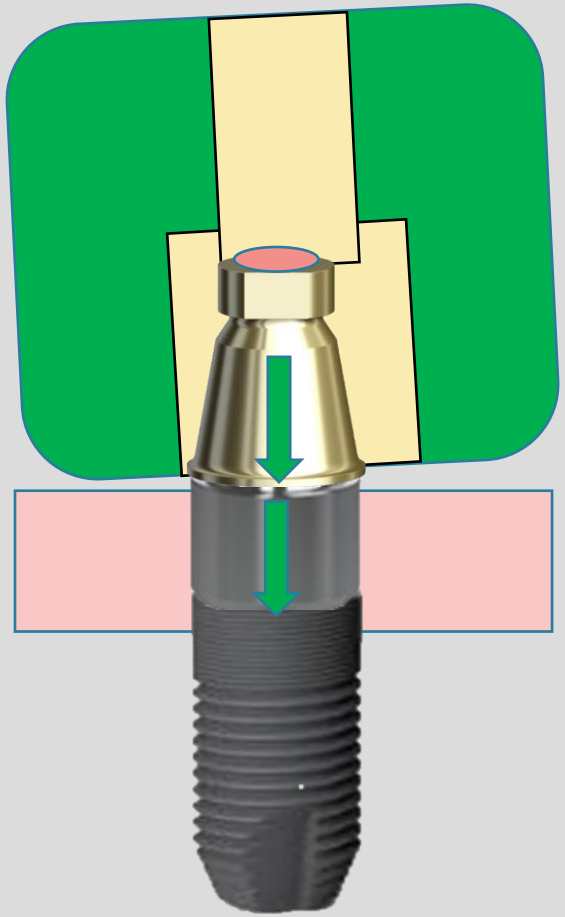
- ✓ PDE
- ✓ ICPOI
- ✓ RTDE

Dentists can now optimize the fit of parts & deliver a passive fitting prosthesis the Svoboda Way

Retrieved

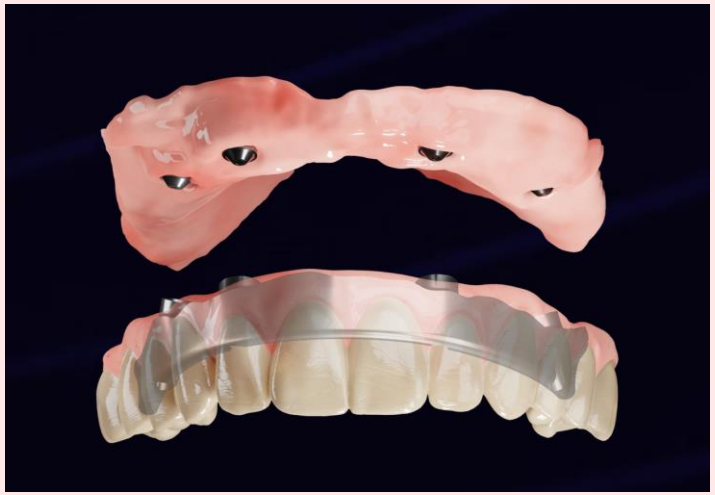
Complex is unscrewed & tissue surface is refined

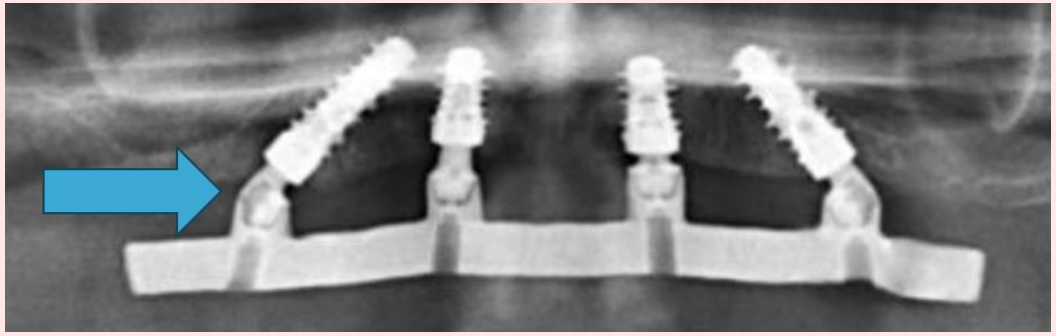
Reinstalled

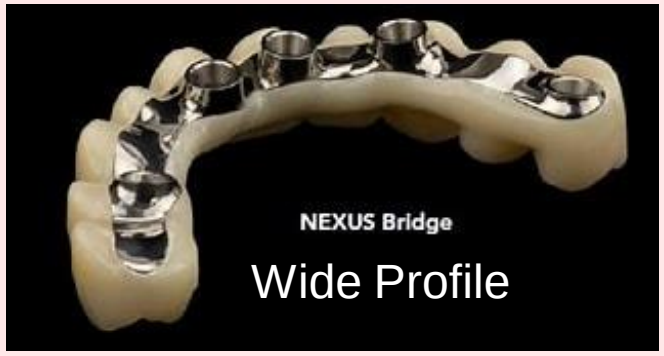


- ✓ PDE
- ✓ ICPOI
- ✓ RTDE
- ✓ GE

iOS Nexus Prosthetics – Access to care? Do they fit?

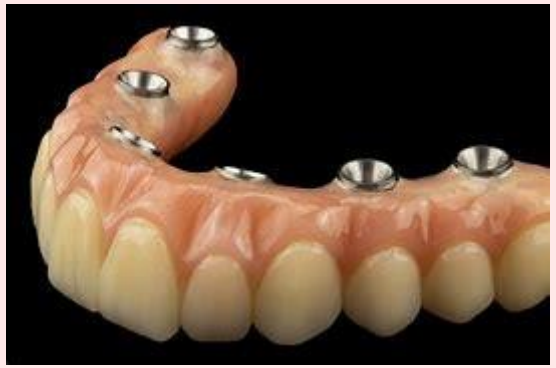




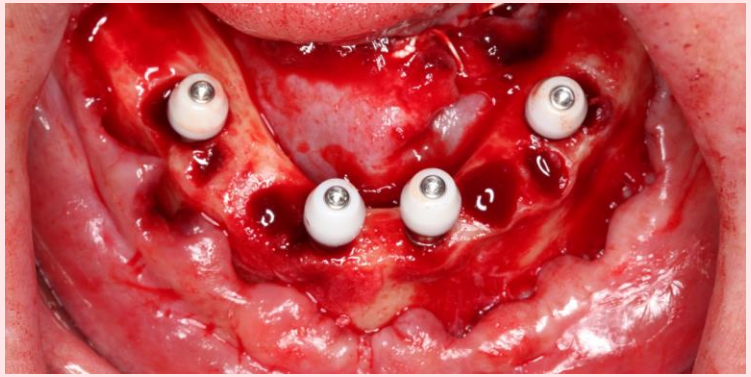


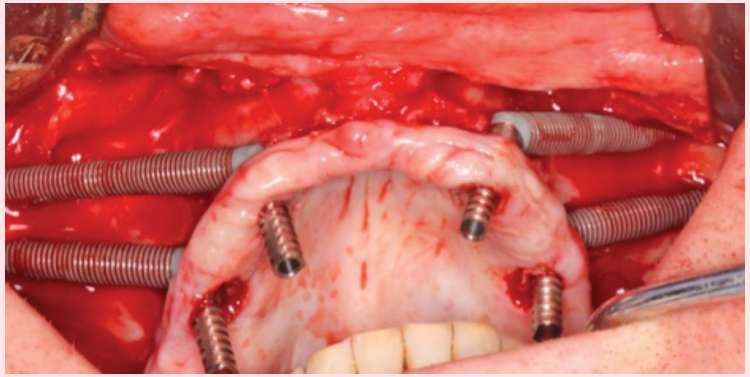
Connectors are embedded in prosthesis

- How do they manage PDE? ICPOI?
- Large space between parts & Misfits likely!
- 15 Ncm prosthetic screw torque
- Prosthetic connection subgingival
- Wide Prosthesis – Is it cleanable?



Shouldn't Dentists Optimize Fit of Parts & Provide Access to Care Before Increasing Risk and Liability?

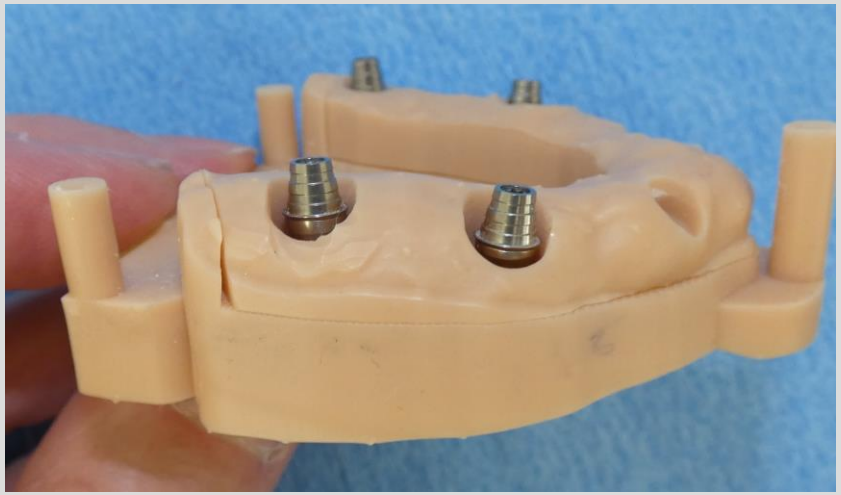




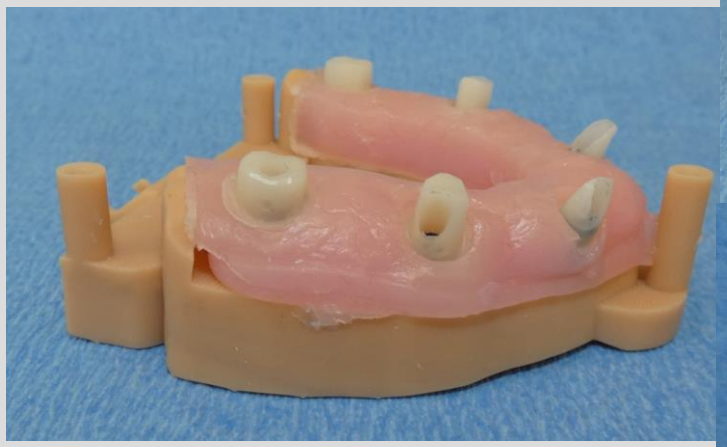
Patients with 4 or more Implants Retaining a Prosthesis had 15X Rate of Peri-Implantitis

Effectiveness of Implant Therapy Analyzed in a Swedish Population: Prevalence of Peri-implantitis. Derks et al. J Dental Research, 2016 Vol 95(1):43-49 (588 patients with 2,277 implants)

All-On-X relies on a limited selection of stock parts while CAD/CAM technology can make "Site Specific Custom Abutments"



Stock Parts =
Compromised Choices



Custom Parts =
Much Better Control

Prosthesis segmentation reduces the consequences of an implant failure!

Two Svoboda Way Rules

Make Prosthesis Installation Much Better for Patients

Install Abutments First

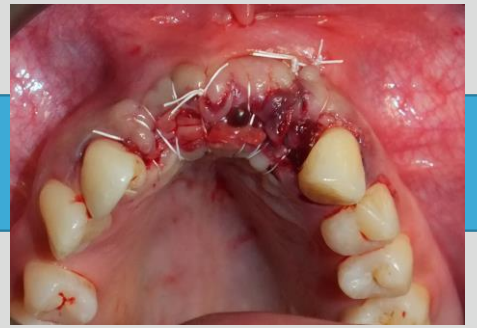
Safely Cement Prosthetics

Abutments first

Better the Treatment - Happier the Patient

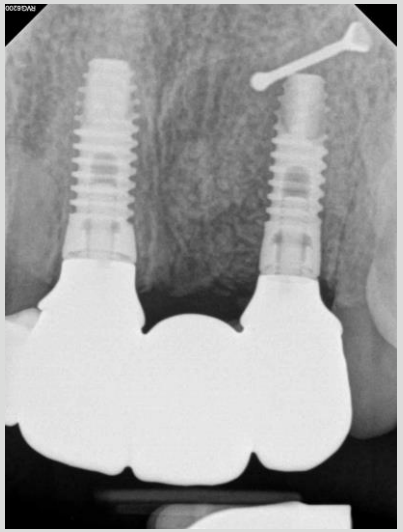
1) Install abutments first 2) Safely cement prosthesis

Smoother the Treatment - Happier the Patient



1

2



WOW!

TWO Svoboda Way Rules Are the Keys

To Better Treatment Results

“I have done over 2000 cases and this design has changed my life”

Dr. James Miller from Oregon

I am serious about
Improving
Treatment Longevity
by
Engineering Excellence

www.ReverseMargin.com

Questions: drsvoboda@rogers.com

The Dental World according to Svoboda

1. **About 10X more prosthetic units are installed by intra-oral cementation onto natural teeth than installed on dental implants. It is very important to improve the safety of intra-oral cementation - preventing subgingival cement and poor margin fit.**
2. **Implantology:** Prostheses installation goes from screw-in to cement-in and now screwed-in again. Is industry driving the implementation of the screw-in system because it increases sales of parts? Is that more important than patient safety? Do manufacturers and sellers care about patient safety? Complication rates for the use of the legacy screw-in system are like legacy cement-in systems. There is little talk from the Key Opinion Leaders (KOLs) about the root causes of misfit parts, poor access to care and related peri-implant disease. Legacy cementation systems are still deemed good enough for attaching crowns and bridges onto natural teeth. What about resulting caries and periodontal disease and endodontic complications? Shouldn't dentists be inspired to learn about making cementation safer for patients?
3. **Carl Misch (Prosthodontist)** writes a whole chapter in his two books about the occurrence of misfit joints. On legacy intra-oral cementation techniques, in 2005 he suggests placing margins 3 mm below gingiva to allow for recession. In 2015, without an explanation says 1.5 mm subgingival is good. Apparently, he and many others did not know how to prevent subgingival cement. He just acknowledged the problems of misfit joints and subgingival cement and proposed status quo techniques with their inherent problems.
4. **Scott Froum (Periodontist)** writes an article about the macrogaps (Implant-Abutment misfits) and related peri-implantitis.
5. **Charlse Goodacre (Prosthodontist)** talks about the evils of subgingival cement but does not like to talk about misfits. He has a strong preference for screw-in systems. Is his stance biased by industry support for education? He offers no solutions for making cementation safer.
6. **Chandur Wadhwani (Prosthodontist)** claims to be "Cementless in Seatle" and writes book about intra-oral cementation. He proposed a safer cementation technique where an abutment analogue is used to express excess cement to reduce subgingival cement. This technique causes both subgingival cement and cement voids at the margins of crowns. He now proposes a rubber dam technique to reduce subgingival cement. Dr. Linkevicius disproved the efficacy of such a technique.
7. **Tomas Linkevicius (Prosthodontist)** shows more subgingival cement with deeper margins and proposes supragingival margins to control cement. He prefers the screw-in technique and ignores misfits. His screw-in technique is just another legacy system.
8. **Randolph Reznick (Prosthodontist)** describes a cementation system for Glidwell that is the cement minimization technique of Wadhwani.
9. **Emil LA Svoboda (PhD, Dentist)** identifies root causes of mechanical error that cause misfit joints, and subgingival cement and proposes some solutions that include the **Reverse Margin System and reduced cementation pressure. He describes 2 rules that can make prosthesis installation safer by preventing the three risk factors for peri-implantitis described by Heitz, Heitz and Lange (2020).**
10. **Henrik Andersen (PhD) at ELOS Medtech** advises intra-oral cementation but does describe a practical way of doing it safely.
11. **The 2 Svoboda Way safer cementation concepts can be applied to implants and natural teeth.** They are expected to work well on natural teeth with the **margin elevation ideas** of **Pascal Magne (Prosthodontist)**. Questions: **drsvoboda@rogers.com**