# MINIMALLY INVASIVE DENTISTRY:

1

***Todd Snyder, DDS, FAACD, FIADFE, ASDA, ABAD***

*Laguna Niguel, CA & Las Vegas, NV*
*Aesthetic Dental Designs®*
*doc@tcsdental.com*

Accredited Fellow, American Academy of Cosmetic Dentistry
Fellow, International Academy for Dental Facial Esthetics
Member of The American Society For Dental Aesthetics
Diplomat of the American Board of Aesthetic Dentistry
Former Faculty, UCLA Center For Esthetic Dentistry
www.LEGION.dentist, Unconventional Training for Dentists
Podcast- Delusional: Winning the Weekly War of Dentistry
Entrepreneur, Software Company Owner, Author/Lecturer, Professional Race Car Driver

2

# BIOACTIVE MATERIALS

- Glass Ionomers
- Resin Modified Glass Ionomers
- Compomers
- Flowable Composites
- Injectable Composites
- Bulk Fill Composites
- Packable Composites
- Topical/ToothPastes
- Varnishes
- Liners
- Cements

3

# WHAT IS BIOACTIVE?

A variety of dental restorative materials are able to promote tooth remineralization and/or inhibit tooth demineralization and/or have antibacterial properties. These remineralizing materials include fluoride- and/or calcium-containing pulp capping materials, bonding agents, resin composites, resin cements, glass-ionomer cements, and sealants.

A **bioactive restorative material** can display one or more of the following actions:
1. Remineralizes and strengthens tooth structure through fluoride release and/or the release of other minerals.
2. Forms an apatite-like material on its surface when immersed in body fluid or simulated body fluid (SBF) over time.4
3. Regenerates live tissue to promote vitality in the tooth.

4

| INCREASING BIOACTIVITY BY MECHANISM → | | MECHANISM OF ACTION | MATERIAL CATEGORY | PRODUCT EXAMPLES | |
|---|---|---|---|---|---|
| | NON-BIO-ACTIVE | INACTIVE FILLING RESTORATION | AMALGAMS | | |
| | | | COMPOSITE RESINS | | |
| | BIO-ACTIVE | REMINERALIZATION | GLASS IONOMERS | *SDI – Riva Self Cure, GC – Equia Forte* | |
| | | | GLASS IONOMER DERIVATIVES | *Pulpdent – ACTIVA BioACTIVE* | |
| | | | GIOMERS | *Shofu – Beautifil II and Flow Plus* | |
| | | DEPOSITION OF HYDROXYAPATITE | CALCIUM ALUMINATES | *Doxa – Ceramir Cement* | |
| | | PULP REGENERATION | CALCIUM SILICATES | *Mineral Trioxide Aggregate (MTA)-based materials* | Endo repair cement Not dentin substitute |
| | | | | *Septodont – Biodentine* | Crown and root dentin restorative substitute. Pulpal healing and endo repair |

5

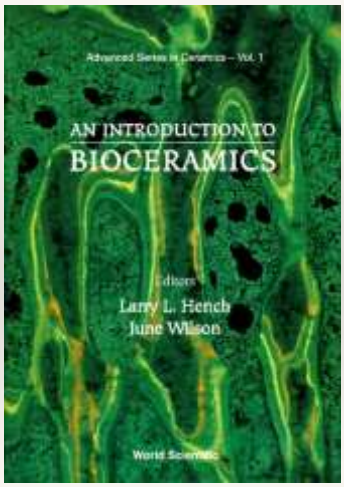
# BIOACTIVITY IS FOR YOUR PATIENTS

Working with nature to help prevent micro leakage and the future of your patients restorations

6

# The most accepted definition of Bioactivity

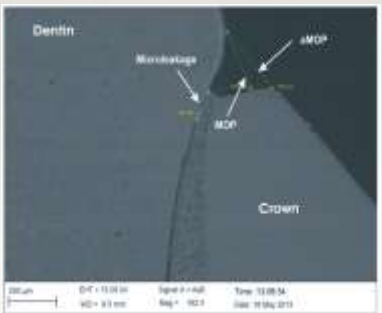
- THE CONCEPT OF BIOACTIVE MATERIALS WAS FIRST INTRODUCED IN 1969 AND LATER DEFINED AS FOLLOWS:
- "A BIOACTIVE MATERIAL IS ONE ELICITS A SPECIFIC BIOLOGICAL RESPONSE AT THE INTERFACE OF THE MATERIAL, WHICH RESULTS IN THE FORMATION OF A BOND BETWEEN THE TISSUES AND THE MATERIAL."
- HENCH L.L. 1969

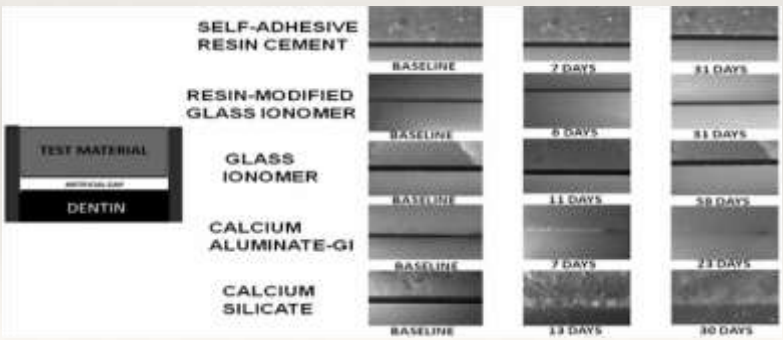



7

# THE BIOACTIVE CONTINUUM

- THE DEFINITION HAS BEEN FURTHER DEVELOPED IN RECENT YEARS
- "A BIOACTIVE MATERIAL IS ONE THAT FORMS A SURFACE LAYER OF AN APATITE-LIKE MATERIAL IN THE PRESENCE OF (SALIVA OR A SALIVA-LIKE SUBSTITUTE)."
- JEFFERIES S.R. 2014




8

WHY??

- Latest Marketing Buzzword OR True Patient Benefit?

WHERE??

WHEN??

9

# Crystal Structure Diagnostics

**The Canary System Detects Cracks & Cavities not Visible on X-rays**

+ Around & beneath intact margins of fillings & crowns
+ Under sealants (including opaque sealants)
+ On proximal surfaces
+ On smooth surfaces, pits & grooves
+ Around orthodontic brackets

**Measures tooth structure breakdown, allows for early treatment**

+ Restore conservatively
+ Remineralize back to health
+ Seal with confidence

**Research claims validated by 60+ papers**

**15+ case reports & 2 FDA CFR 21 clinical trials**

10

# The Science Behind The Canary System

- Pulses (2 Hz) of laser light hit the tooth surface.
- Tooth glows (Luminescence, LUM) and releases heat (Photo-Thermal Radiometry, PTR).
- Defective tooth crystal structure affects the retained heat and luminescence signatures.

➢**Energy Conversion Technology**

Temperature increase < 1°C ***not harmful***

- Detected signals reflect the tooth's condition.
- Detects 50 micron lesion up to 5 mm below the surface.

11

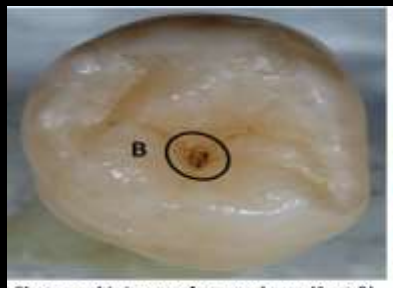
***Delegated Scanning & Whitening Assistant***

12

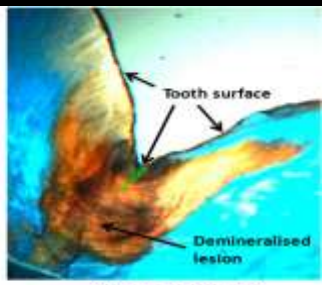
# SENSITIVITY & SPECIFICITY STUDY: UNIVERSITY OF TEXAS OCTOBER 2012

Study Design

- 20 tooth surfaces selected with range of clinical conditions from healthy to early caries
- Visual ranking by 2 dentists
- Canary Scan
- DIAGNODent
- Polarized Light Microscopy used as the gold standard to confirm presence of lesion & depth in that section




Photographic image of scanned area (Spot B)




PLM image of Spot B

| Spot | Canary Number | DIAGNOdent Peak Value | PLM Lesion Depth (µm) |
|---|---|---|---|
| B | 91 ± 14 | 2 ± 1 | 808.89 |

| Caries Detection Method | Canary System | DIAGNODent |
|---|---|---|
| Sensitivity | 100% | 18% |
| Specificity | 100% | 100% |
| Spearman Correlation with Lesion Depth | .84 | .21 |

13

# Canary is Superior to X-Rays for Proximal Caries Detection

Jan J et al. Caries Res 2014;48:384–450 DOI: 10.1159/000360836

**Objective:**

To compare the accuracy of The Canary System, ICDAS-II and bitewing radiographs in detecting proximal caries *in vitro*.

**Methods:**

**Conclusion:**

- **BW radiographs could only identify 26.7% of the lesions which questions its ability to be the gold standard**
- **The Canary System is the only method examined with both high sensitivity and high specificity.**
- **The Canary System is more sensitive than bitewing radiographs in detecting interproximal caries**

| Parameter | The Canary System | ICDAS-II | BW Radiograph |
|---|---|---|---|
| Sensitivity | 0.93 | 0.73 | 0.27 |
| Specificity | 0.83 | 0.65 | 0.88 |

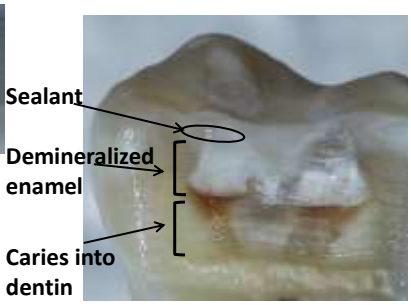
14

# Detection of Caries Beneath Sealants

- Canary Numbers >20 when scanning sealants (3M™ ESPE™ Clinpro™ Sealant) placed over pit & fissure caries.
- The caries detection ability of the Canary System was not affected by sealant & was more accurate than DIAGNOdent.

Pre-sealant

Post-sealant

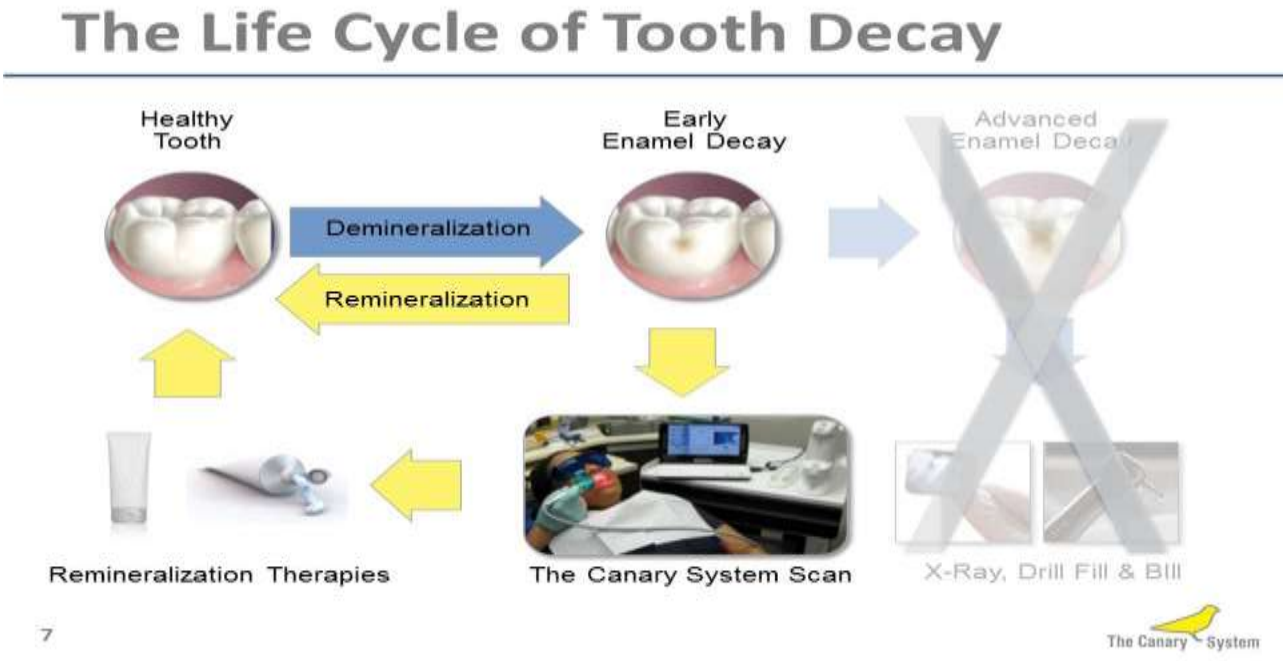



Cross-section

**Sensitivities and specificities for pit & fissure caries detection after sealant placement.**

| Caries Detection Method | The Canary System | DIAGNOdent |
|---|---|---|
| Sensitivity | 83% | 64% |
| Specificity | 79% | 46% |

15




16

## *After using diagnostic technology, what if you find something?*

17

## TOPICAL THERAPIES

- More caries resistant
- Remineralization

18

# Minimally Invasive

- Apply MIPaste Plus for 3 minutes
- Patient applies at home 2x/day

19

MINIMUM INTERVENTION

The first Professional product containing RECALDENT™ (CPP–ACP) Technology

- Prevent disease & maintain dental health
- Identify caries (cavities) risk
- Heal carious lesions (cavities) in their earliest stage
- Demineralized tooth structure can be **REMINERALIZED**

CPP-ACP

CPP-ACP
900 ppm
Sodium Fluoride

20

# MI VARNISH™ WITH RECALDENT™ (CPP-ACP)

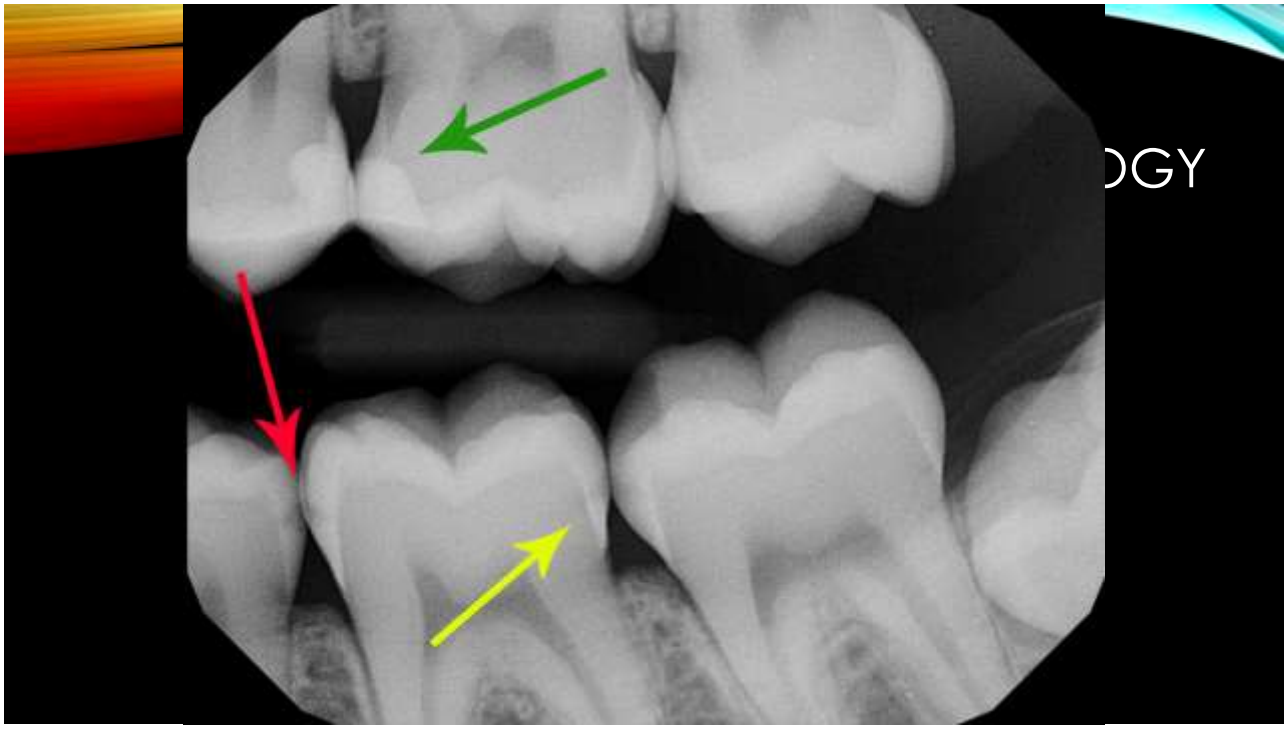
*Bioavailable **calcium, phosphate & fluoride** for an **enhanced** varnish treatment*

21

# OTHER MATERIALS

- Xylitol toothpaste, rinses and gums
- Clinpro 5000 with TCP (3M)
- Enamelon with fluoride and ACP (Premier)
- Remin Pro (Voco)
- Sensodyne ProNamel
- Arm & Hammer's Enamel Care
- Arm & Hammer Complete Care w/ Enamel Strengthening
- Colgate Sensitive pro relief
- Fluoride Varnishes
- Glass Ionomers

22

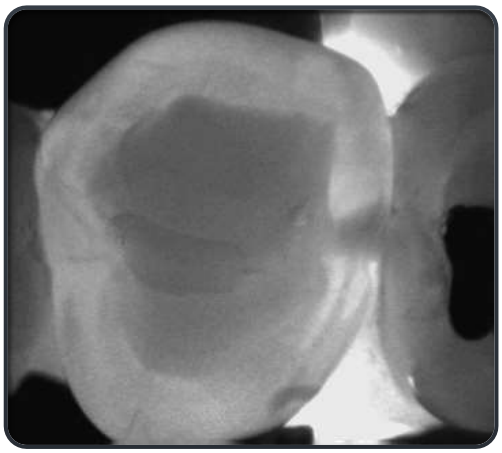



23

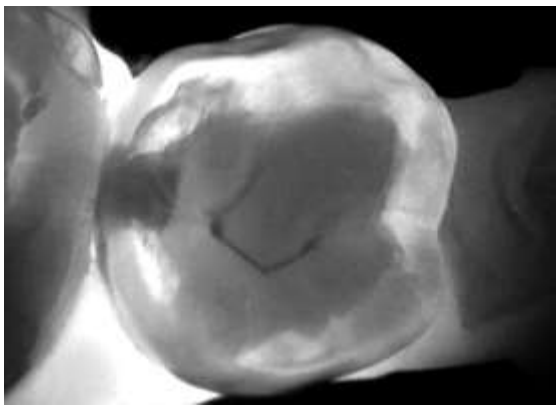
## CariVu Fiber Optic Transillumination

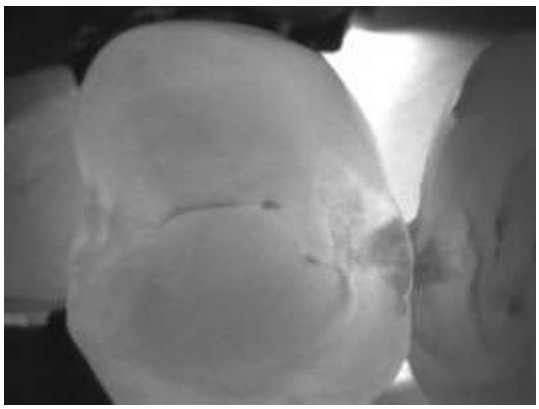
24

# WHERE IS THE CAVITY



25





Early Diagnosis that can be Visualized

26

## MINIMALLY INVASIVE DENTAL CARE

- Find Cavities & Demineralization Earlier
- Smaller, Easier to Place Fillings
- Saves Patients Tooth Structure
- Same CDT Fees Just Done Faster

**EASILY DIAGNOSING 5X MORE DECAY**

27

## NEW CDT FOR 2017 CODE: D0600

D0600* Non-ionizing diagnostic procedure capable of quantifying, monitoring and recording changes in structure of enamel, dentin and cementum

28

# FIND MORE, DO MORE, MAKE MORE…….

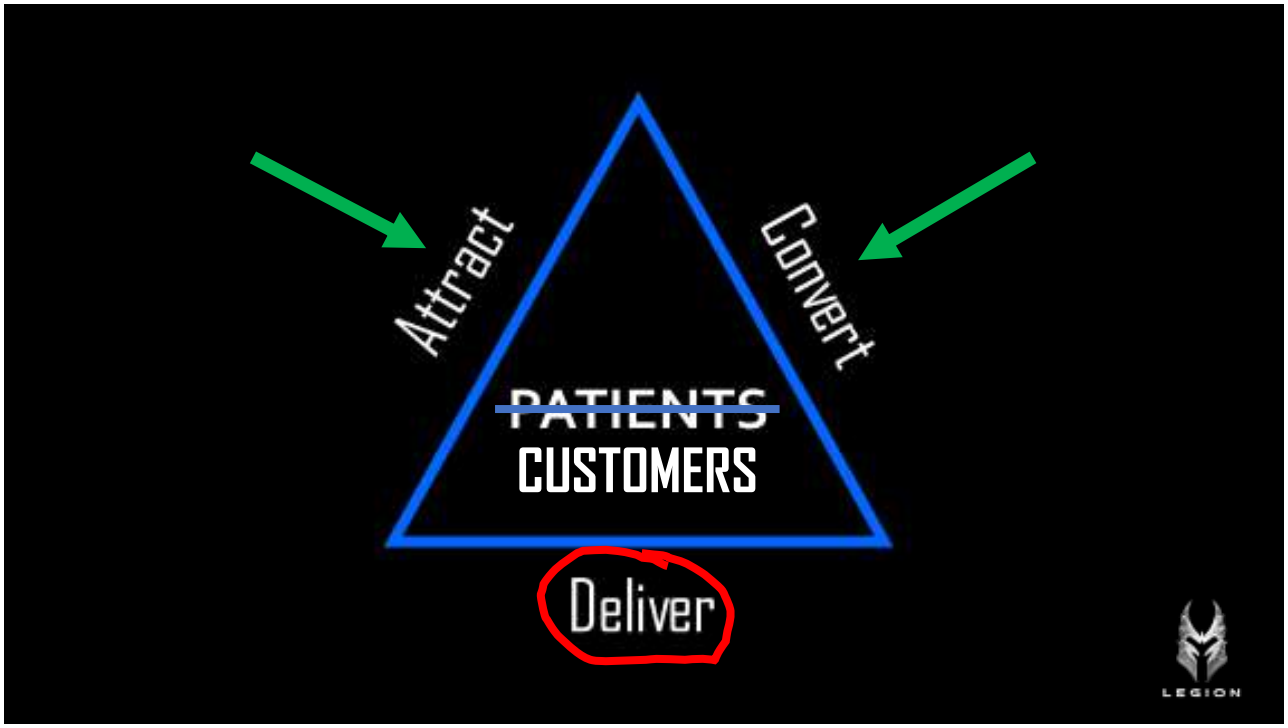
**MSRP $5335**
**Your price $4500**

29

# Huge Marketing Opportunity

- Remineralizing teeth
- Non Ionizing Diagnostic Tools (Canary/CariVu)
- Minimally Invasive Dentistry
- Health Product Sales
- Community Educational Programs
- Internet and Local Media Advertising

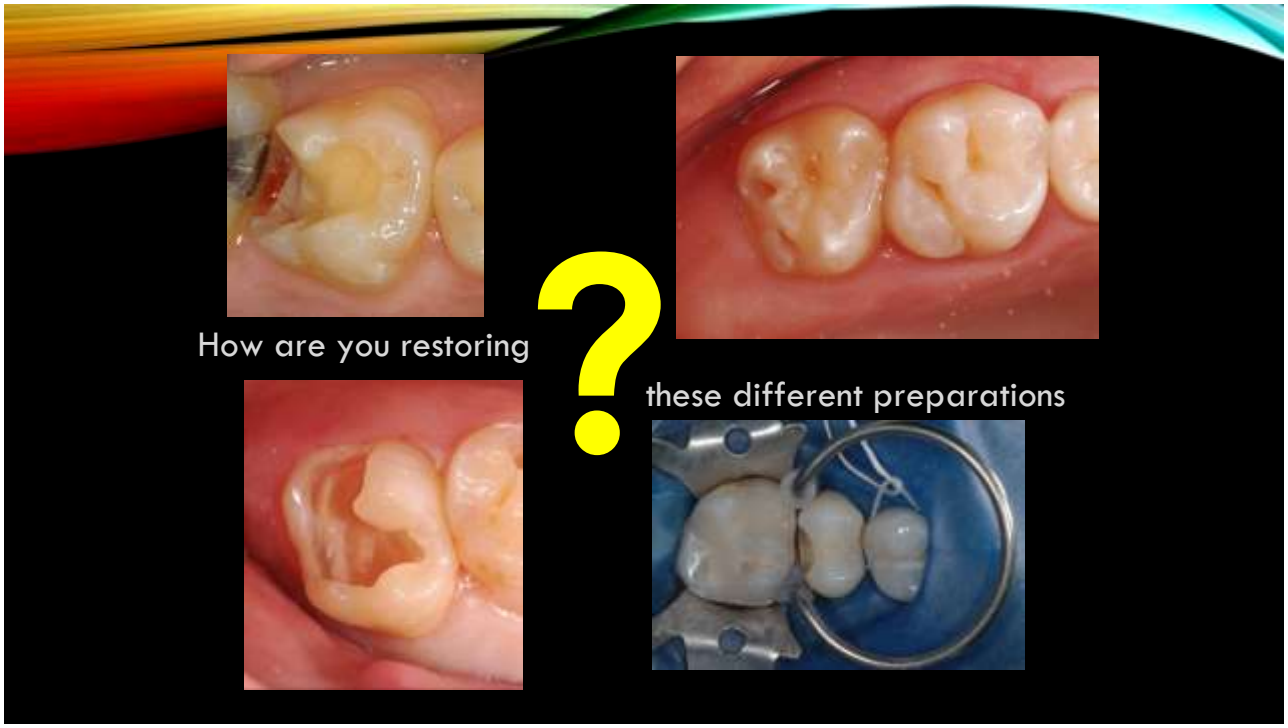
30


Attract
Convert
PATIENTS
CUSTOMERS
Deliver
LEGION

31

How will you diagnose this?
How will you prepare and treat this?

32


How are you restoring
?
these different preparations

33

Small Defects

34

MICROCOPY

0710C 1300F 0512C 0116C

35

## *Flowables* *(if you have good moisture control)*

- *Access, viscosity, small areas*
- *Deep, narrow, preparations*
- *Lots of enamel*

***…if not use a conventional glass ionomer***

36

| Cavity Depth | Product Recommendation |
|---|---|
| Up to 2 mm | G-ænial™ Flo X or |
| | G-ænial™ Universal Injectable |
| Up to 4 mm | G-ænial™ BULK Injectable |
| 4-6+ mm | G-ænial™ BULK Injectable & G-ænial Sculpt® |

37

# G-AENIAL BULK INJECTABLE – AVAILABLE SHADES

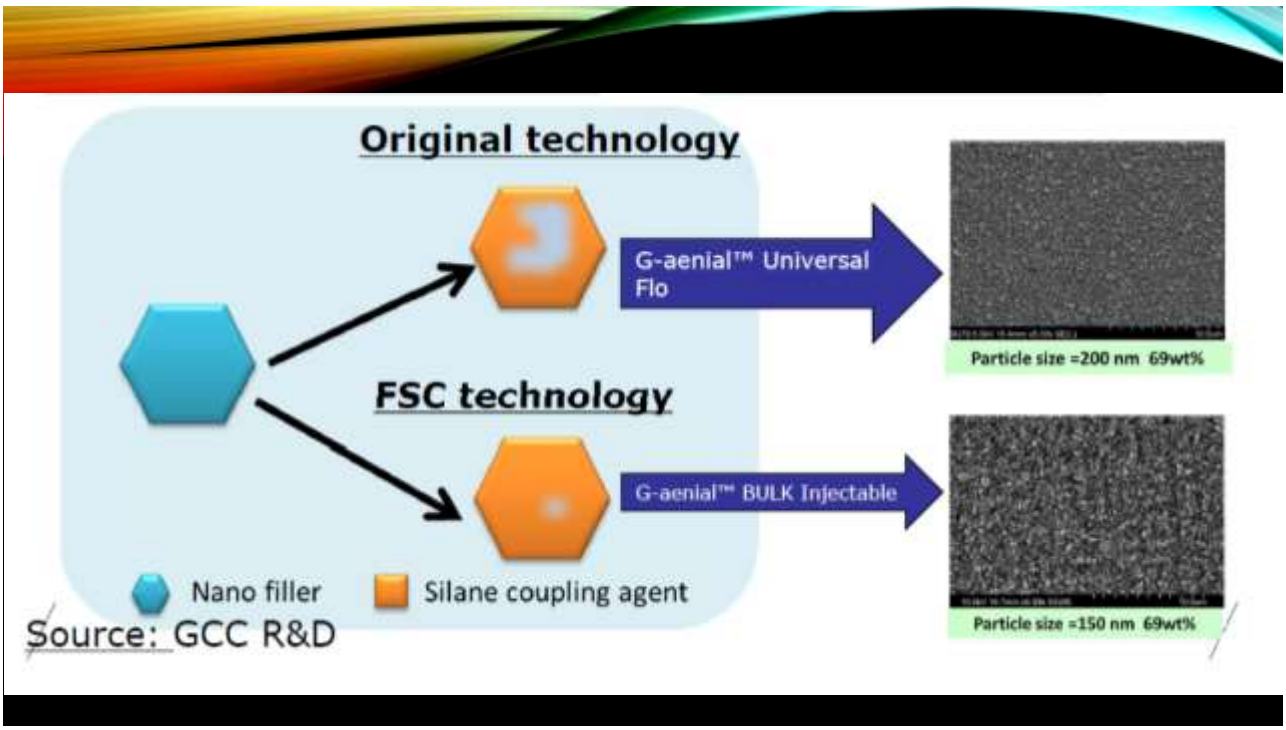
A1 & A2 shades available

38

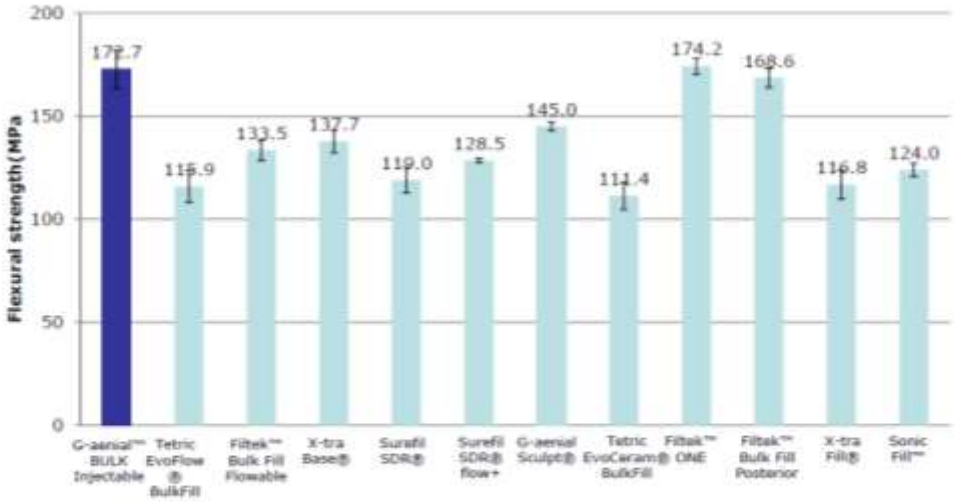
# G-AENIAL BULK INJECTABLE

- Injectable high strength nanoparticle composite with ideal viscosity handling and adaption characteristics that may be used as a one step application for bulk filling up to the occlusal surface without the need for capping or veneering with another composite

39



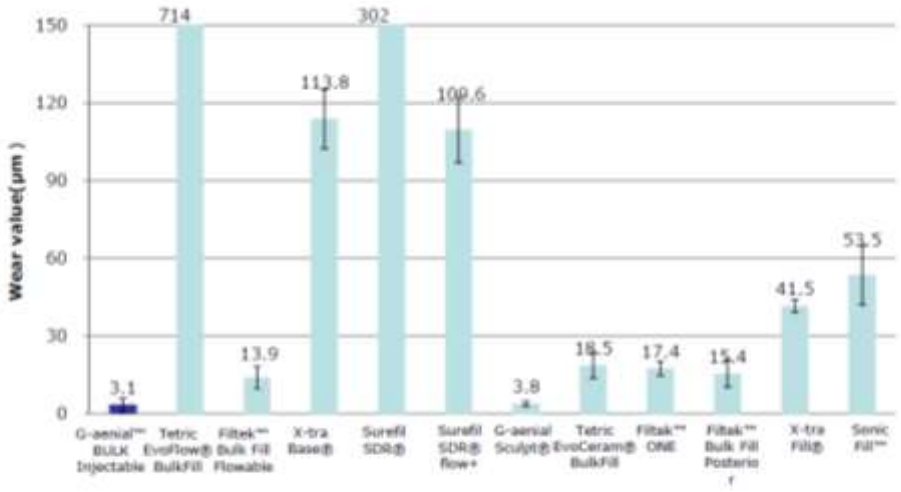

40




G-aenial™ BULK Injectable exhibits very high Flexural Strength, which translates to a **lower risk of chipping or fracture.**

Source: GCC R&D

41



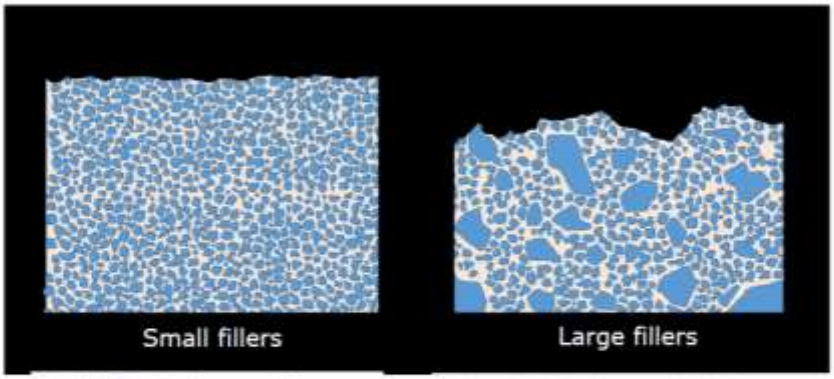

G-aenial™ BULK Injectable shows the highest wear resistance compared to the competitive set. This measure indicates that **the material will provide a highly durable and long-lasting restoration.**

Source: GCC R&D

42

# WEAR RESISTANCE

GBI features **nano-particle filler technology.** When combined with Full-Coverage Silane Coating (FSC) technology, the result is a homogeneous, uniformly dispersed layer. Some competitive products feature larger particles which may be "plucked" from the surface when subjected to opposing forces within the mouth, leading to the deterioration of the restoration over time.



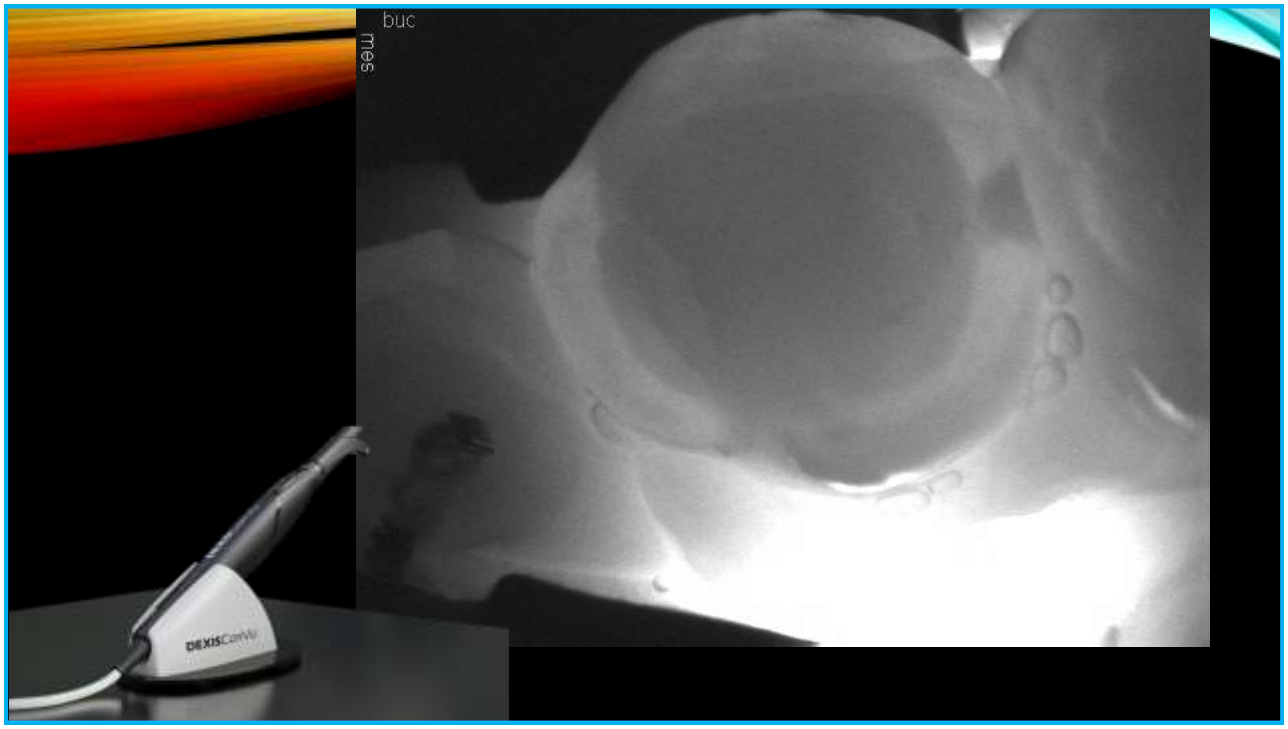

Small filler is dispersed uniformly, occlusal load is distributed equally and sustains less damage to the surface of material.

When high load is applied, large filler particles come off easily, causing an uneven surface which leads to a higher degree of wear.

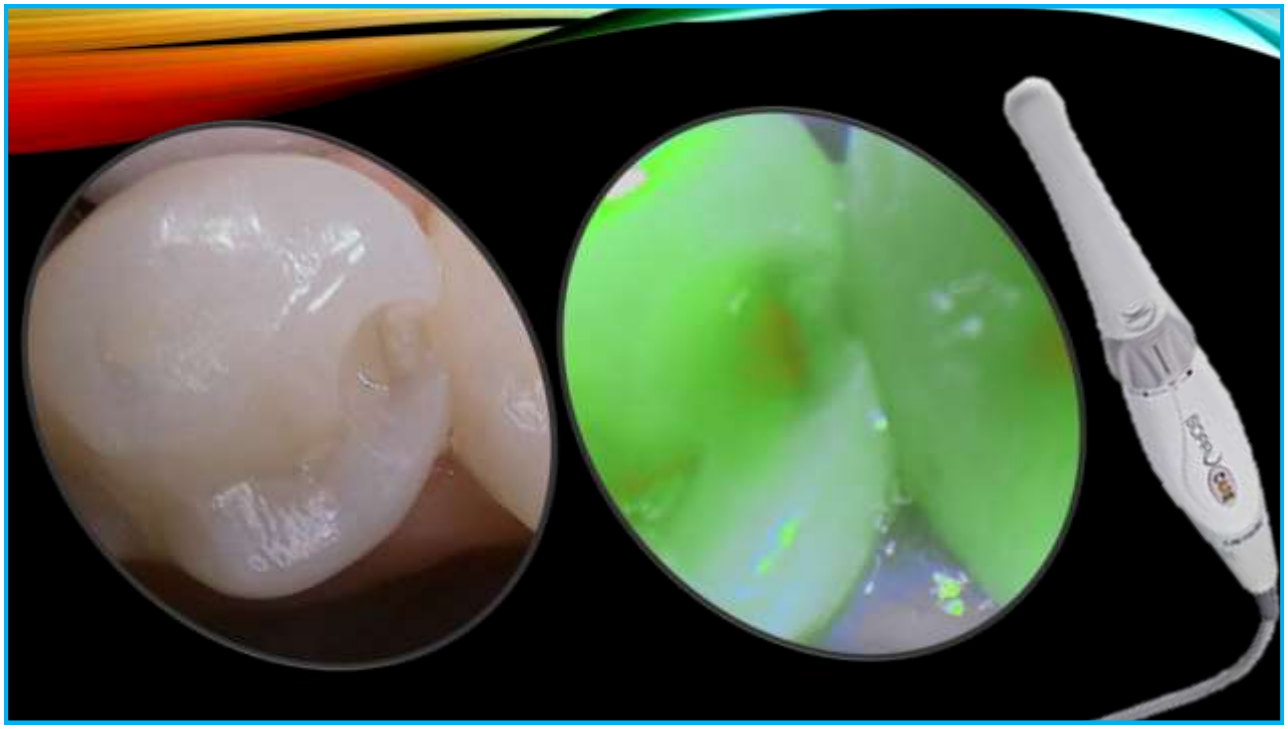
Source: GCC R&D

43

44

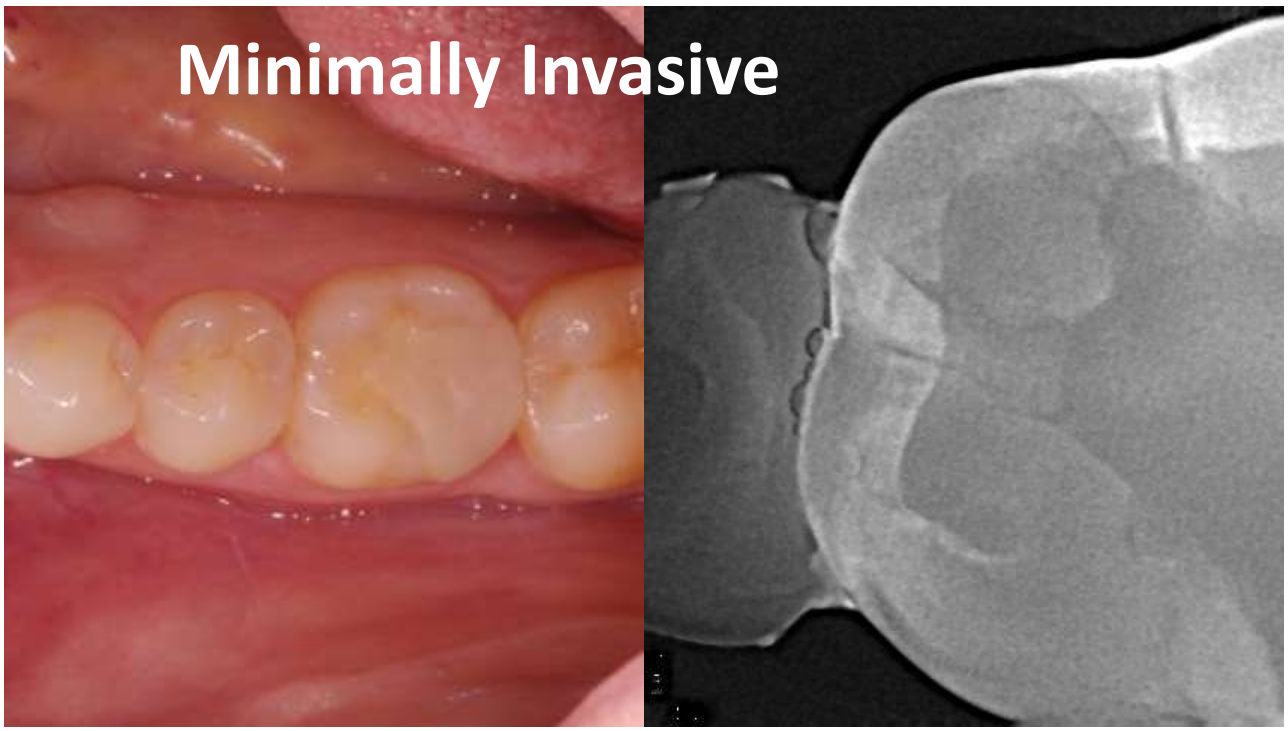



45



46

47




48

49

50

51

52

53

# Wedge Guards (TrioDent /Ultradent)

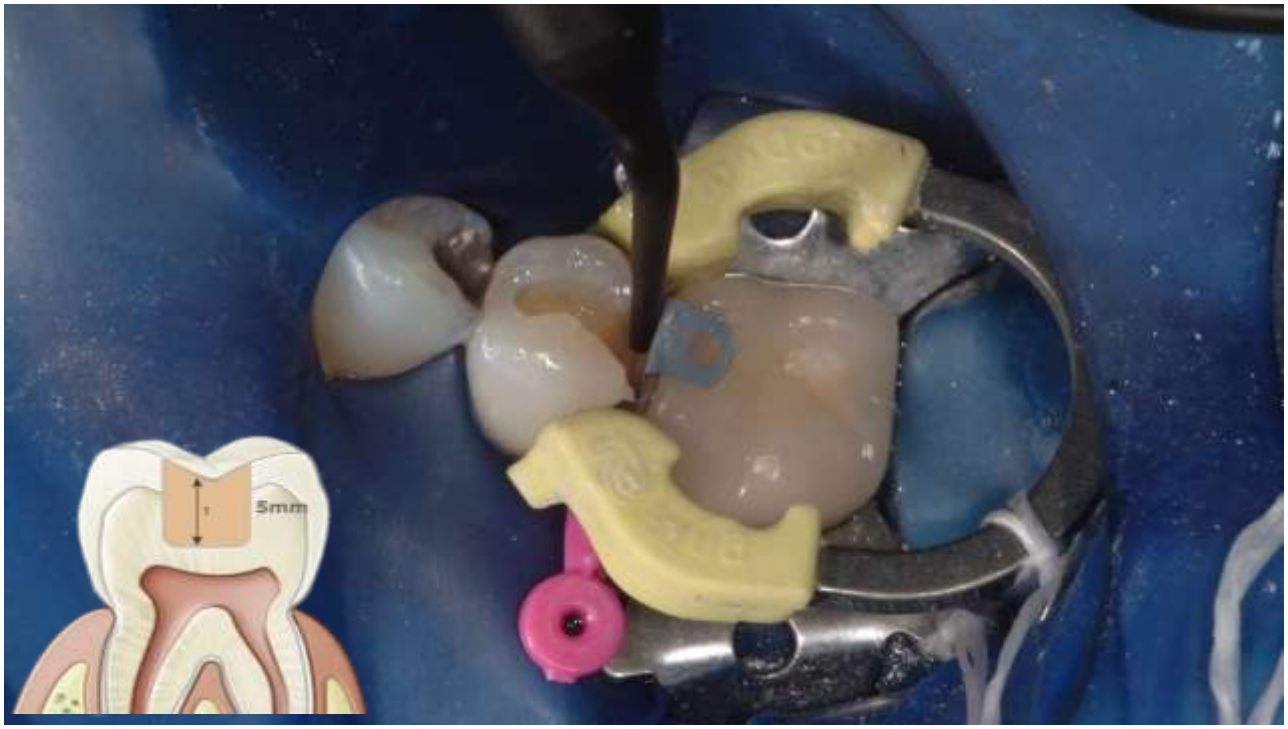
54

55

56

57

58




59

## G-aenial BULK Injectable

"operates like a flowable but performs like a restorative"

- Bis-GMA free / Radiopaque
- High Strength & Wear Resistance
- High density uniform dispersion nanofiller technology
- Sculptable

60

61

62

63

# EVERX FLOW

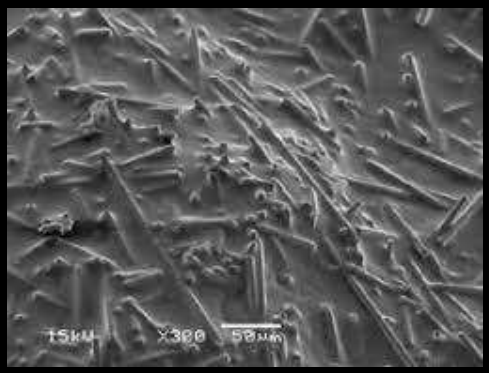
GC America

64

# EVERX FLOW

GC America

- Short fiber reinforced injectable composite
- Reduces crack propagation
- Perfect thixotropy for easy placement and adaptation
- No slumping
- Indicated for dentin replacement in bulk-filling and core build-up applications or in cases of weakened/cracked tooth structure, together with conventional composite as an enamel layer




65

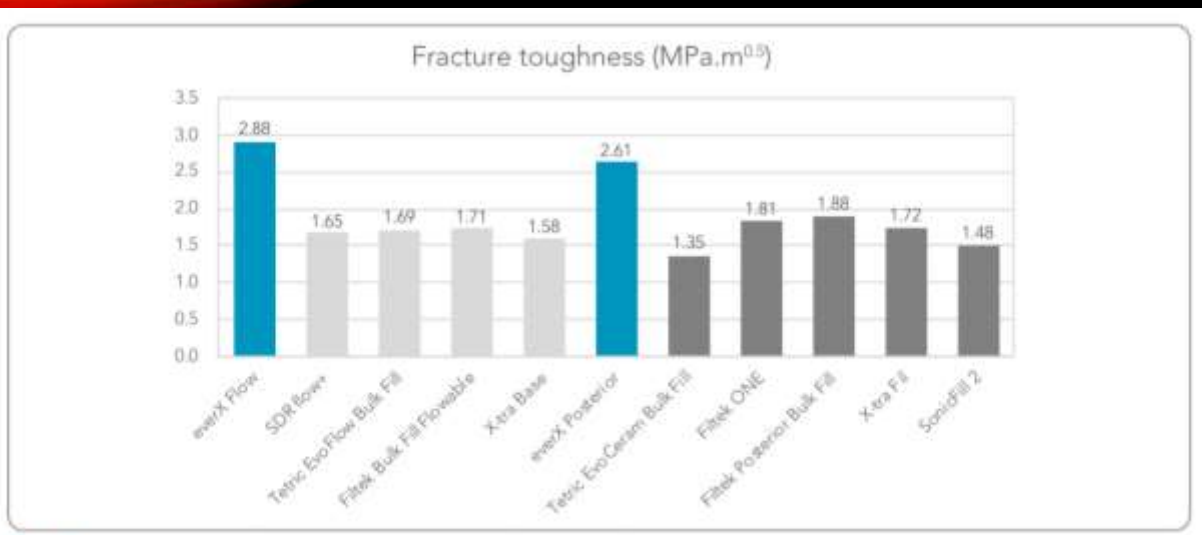



Figure 8: Fracture toughness of everX Flow and other paste & flowable bulk-fill composites.
*Source: GCC R&D, Japan, 2018. Test method: as per ASTM E399-90 (1997). Data on file.*

66

These superior results were confirmed by the University of Turku when testing the fracture toughness of everX Flow against other flowable bulk materials. **everX Flow achieved a fracture toughness about double that of all other products tested.**

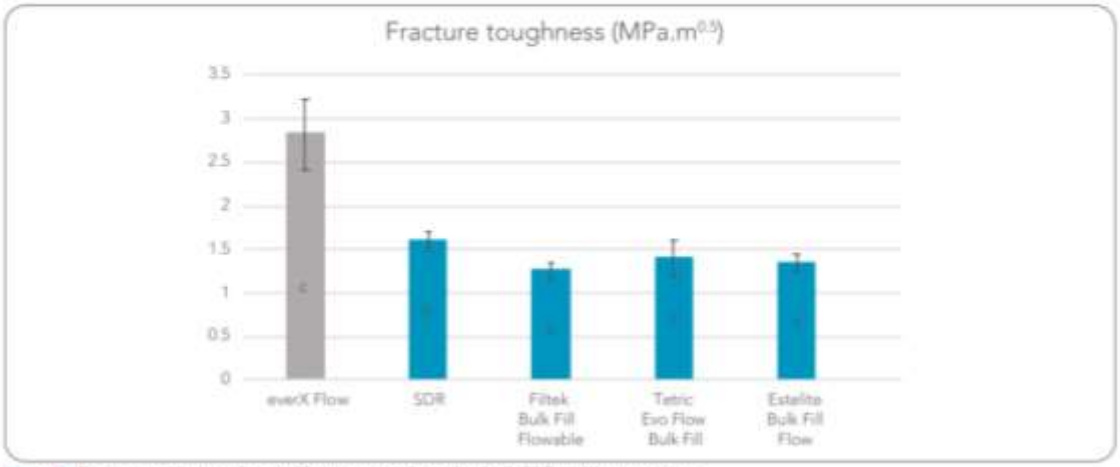



Figure 9: Fracture toughness of everX Flow compared to other bulk-fill flowable composites
*Source: Characterization of a new fibre-reinforced flowable composite, Lassila et al, Odontology, 2018*
*The same letters inside the bars represent non-statistically significant differences (p>0.05) among the groups.*

67

The same behaviour was also observed by GC R&D when performing fracture toughness tests:

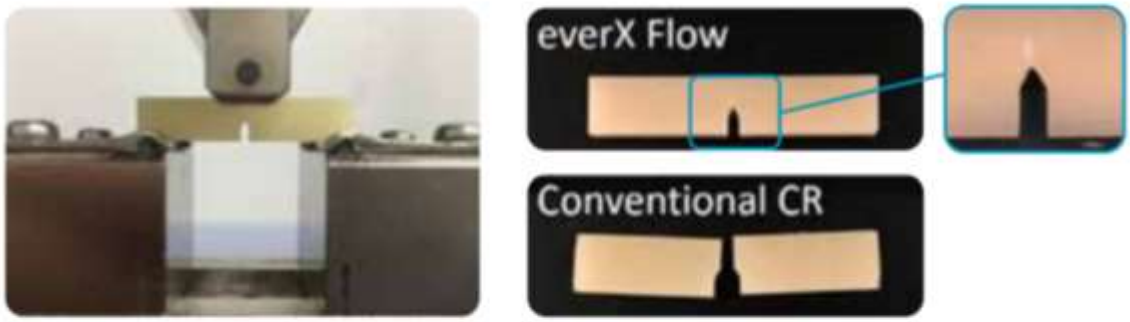



Figure 12: everX Flow sample arresting crack propagation
*Source: GC R&D, Japan, 2019. Data on file.*

68

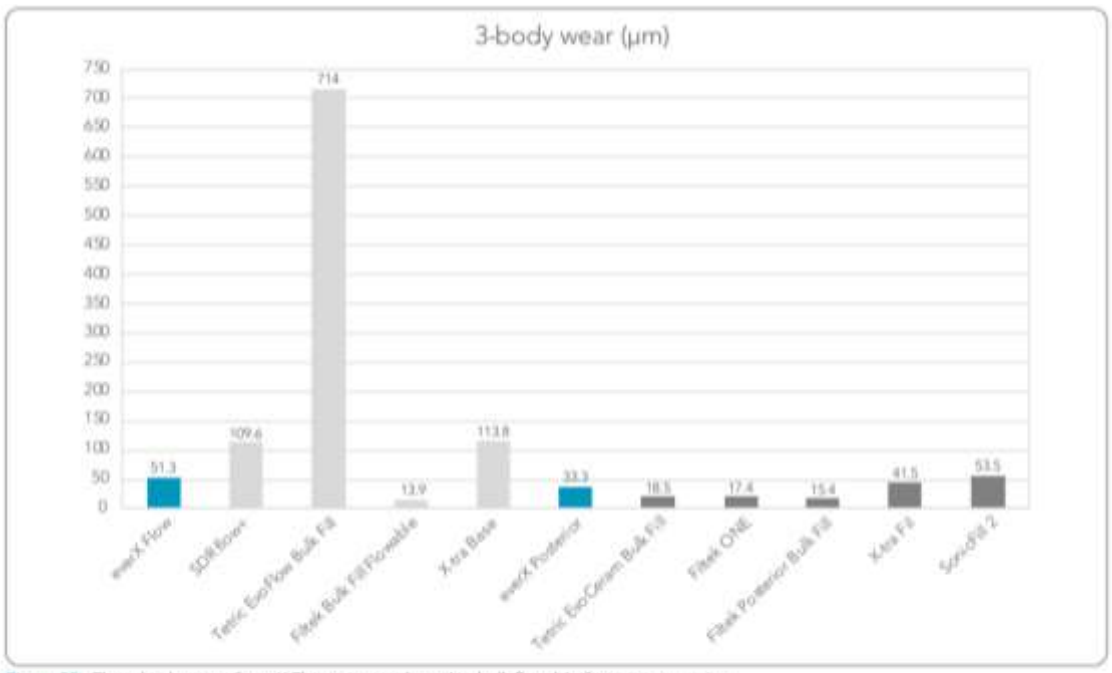
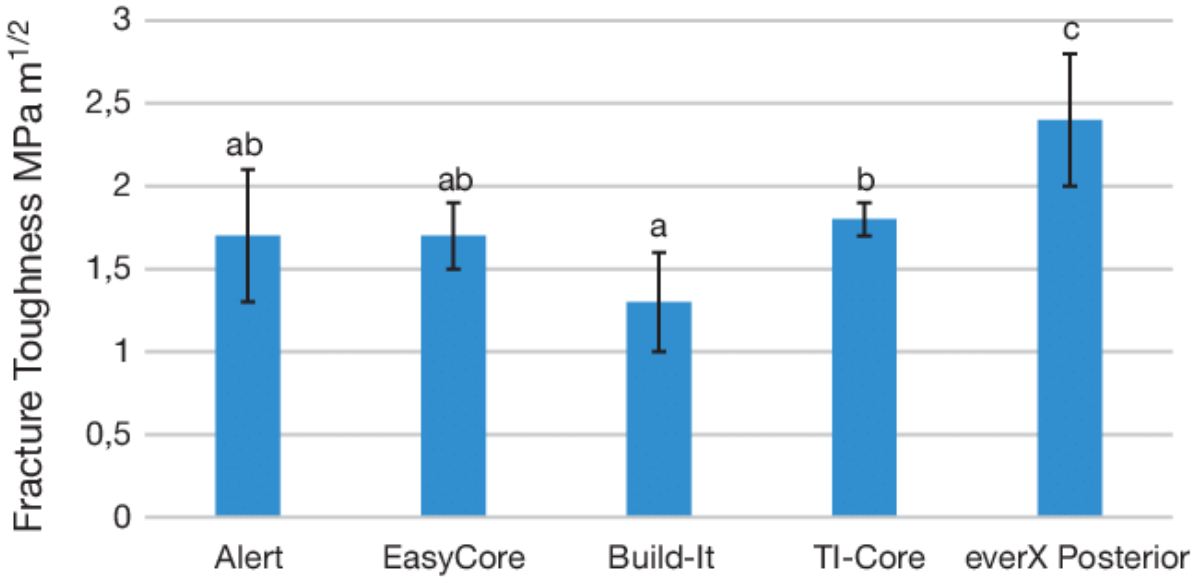



Figure 23 : Three-body wear of everX Flow compared to other bulk flowable & paste composites.
*Source: GCC R&D, 2018. Data on file.*

69




70

# FSC TECHNOLOGY

- Full coverage Silane Coating
- Improves coupling between each fiber and the resin matrix
- Increases strength and toughness

71

# Problem

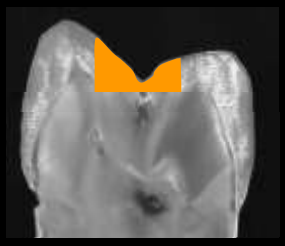
**Varying tooth substrates**

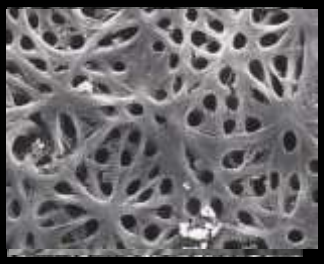
***Enamel & Variable Dentin Bonding***

72

# What substrate are we treating?

:Composite Preparation





Class I or II

3x Tubule Density Equals Higher Fluid & Increased Difficulty for Bonding
30% Decrease in Bond Strengths with most bonding systems.

73

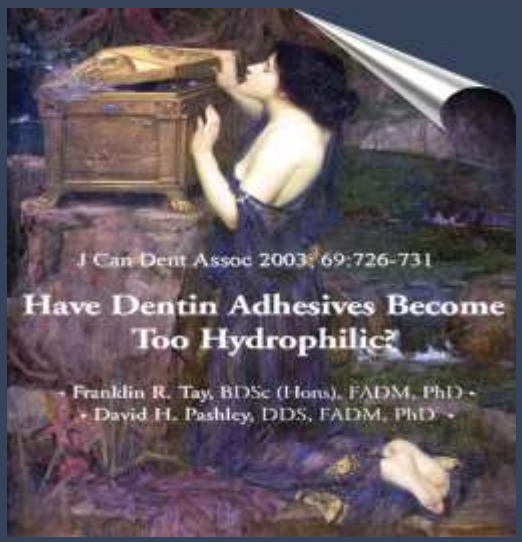
*(RFA-DE-10-004)*
*"Tooth-colored resin restorations have an average replacement time of 5.7 years due to secondary caries precipitated by bond failure."*

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148178/

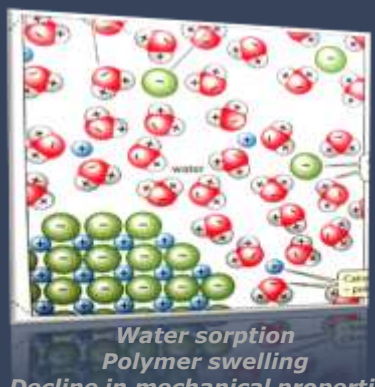
74

## Factors that compromise bond durability in restorative dentistry

### Hydrophilic dentin bonding




***We challenged that current dentin adhesive designs that incorporate increasing concentrations of hydrophilic monomers are going in the wrong direction***

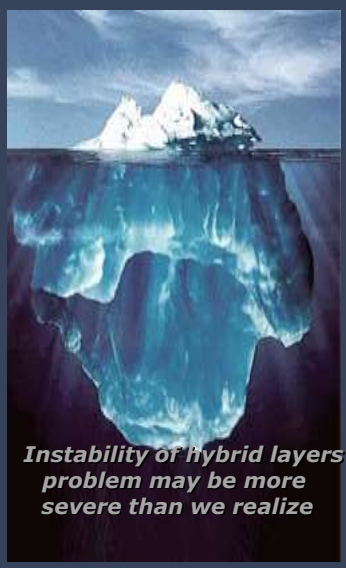


***Water sorption***
***Polymer swelling***
***Decline in mechanical properties***
***Leaching of hydrolyzed resin components***

75

## Factors that compromise bond durability in restorative dentistry

### Hydrophilic dentin bonding

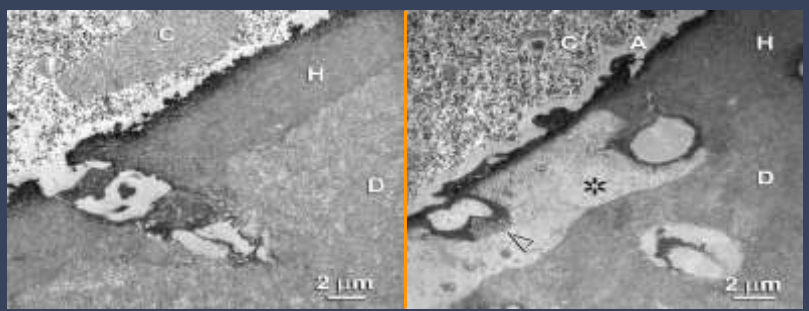


***Instability of hybrid layers problem may be more severe than we realize***

RESEARCH REPORTS
J Dent Res 2005; 4:741-746

J. Hebling[1], D.H. Pashley[2], L. Tjäderhane[3], and F.R. Tay[2,4]*

**Chlorhexidine Arrests Subclinical Degradation of Dentin Hybrid Layers *in vivo***




*Intact hybrid layers created by a simplified etch-and-rinse adhesive in caries-affected primary dentin partially disappeared after 6 months of intraoral function*

76

ⓘ *Factors that compromise bond durability*

***Hydrophilic dentin bonding***

RESEARCH REPORTS
J Dent Res 2004; 83:216-221

D.H. Pashley[1]*, F.R. Tay[2], C. Yiu[3], M. Hashimoto[4], L. Breschi[5], R.M. Carvalho[6], and S. Ito[4]

Collagen Degradation by Host-derived Enzymes during Aging

***Demineralizing dentin is like opening the Pandora's box, releasing endogenous enzymes (Matrix Metalloproteinases - MMPs) that were trapped within the mineralized dentin matrix.***

***In the presence of water (such as that derived from water sorption or from adhesives, MMPs (2,8 & 9) can breakdown collagen fibrils that are not protected by intrafibrillar minerals***

*Sukala et al. (2007)*
*Mazzoni et al. (2007)*

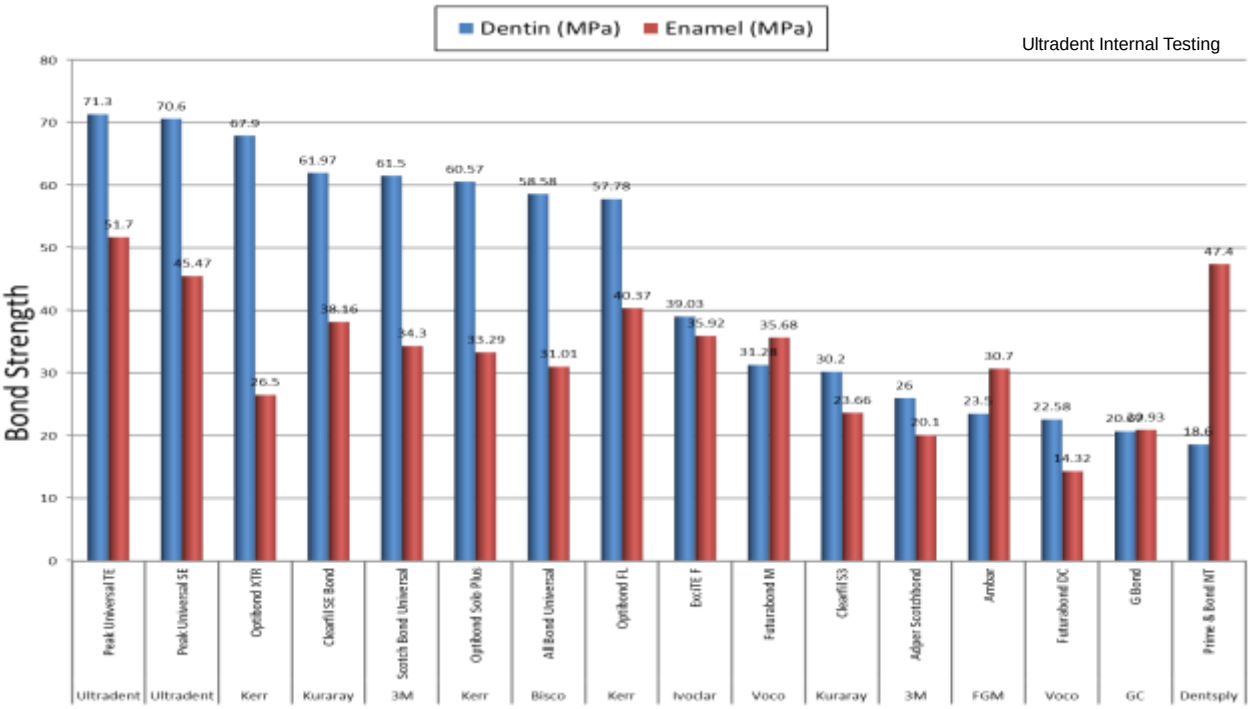
77

# BOND DEGREDATION

- Pashley DH, Tay FR, Imazato S. How to increase the durability of resin-dentin bonds. Compend Contin Educ Dent. 2011 Sep;32(7):60-4, 66.

Resin-dentin bonds are not as durable as was previously thought. Microtensile bond strengths often fall 30% to 40% in 6 to 12 months.

78


Dentin (MPa)
Enamel (MPa)
Bond Strength
Ultradent Internal Testing
Peak Universal TE
Peak Universal SE
Optibond XTR
Clearfil SE Bond
Scotch Bond Universal
Optibond Solo Plus
All Bond Universal
Optibond FL
ExciTE F
Futurabond M
Clearfil S3
Adper Scotchbond
Ambar
Futurabond DC
G Bond
Prime & Bond NT
Ultradent
Ultradent
Kerr
Kuraray
3M
Kerr
Bisco
Kerr
Ivoclar
Voco
Kuraray
3M
FGM
Voco
GC
Dentsply

79

Adhesives
Prelude
ALL-BOND UNIVERSAL
OptiBond XTR
CLEARFIL Universal Bond Quick

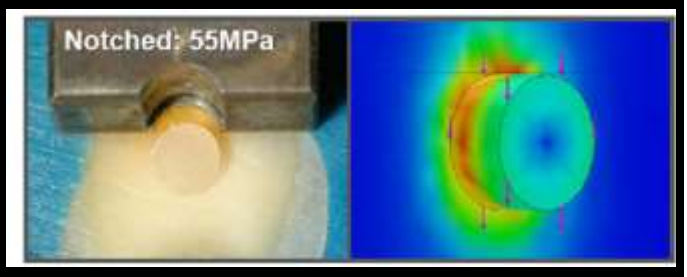
80

•Courtesy Pacific University (Dr Marc Guisberger)

81

# INSTRON

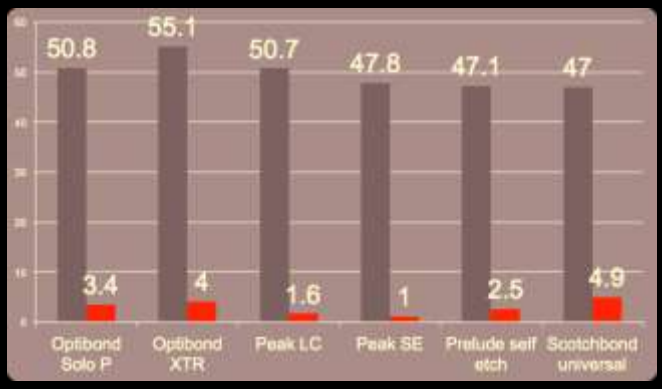
- Ultra Tester (Ultradent)
- Ultra Jig (Ultadent)



82

Courtesy Pacific University (Dr Marc Guisberger)

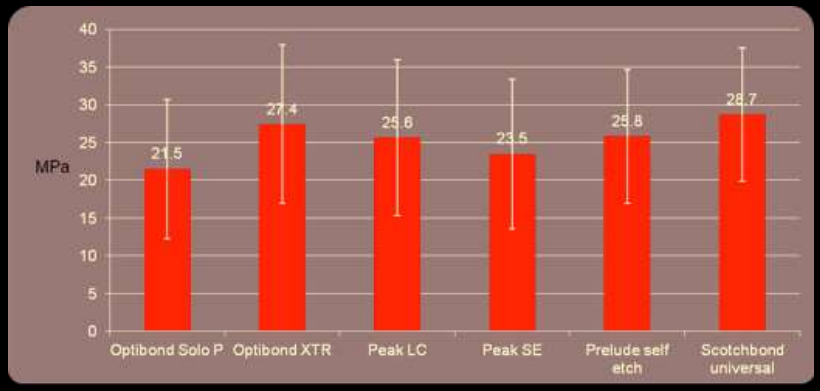
# SHEAR BOND TEST RESULTS - 2012




83

Courtesy Pacific University (Dr Marc Guisberger)

# SHEAR BOND TEST RESULTS - 2012




84

Van Meerbeek B, et al. Relationship between bond-strength tests and clinical outcomes. Dent Mater (2009), doi:10.1016/j.dental.2009.11.148

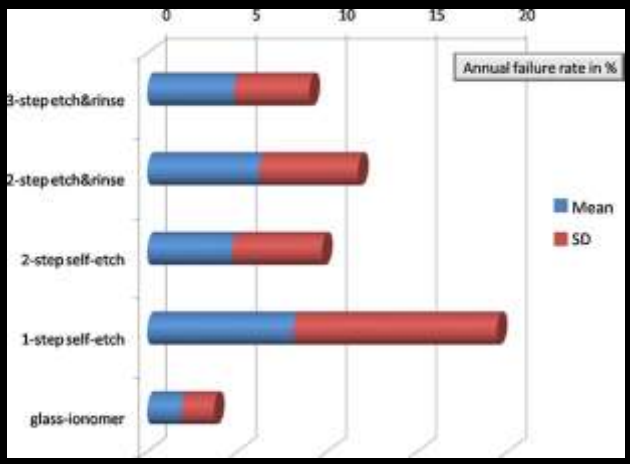



**Fig. 15 – Graph representing the mean annual failure rates per adhesive class, determined according to a systematic review of Class-V clinical trials of adhesives during the period 1998–2004 [2].**

85

## *CLINICAL TIPS WITH UNIVERSAL ADHESIVES*

1. Air Dry The Water Based Adhesive or Primer Fully To Evaporate Water. The Universal, Single-Bottle Adhesives Have Higher Concentration of Water & Alcohol, So Make Sure To Air Dry About 10's Until Water Is Evaporated.

2. Inadequate Drying Will Result in Lower Bond Strengths Water, Alcohol & Acetone Prevent The Resin From Curing So They Must Be Evaporated.

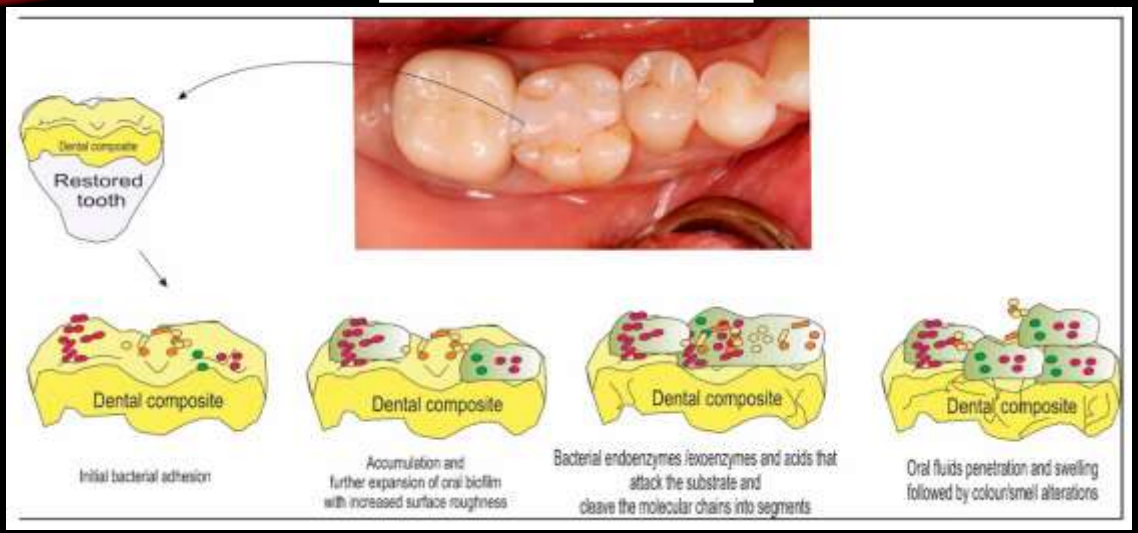
86

## DRAWBACKS OF ANY COMPOSITE RESIN

- Material placement techniques
- Variable substrate
- Polymerization stress & shrinkage
- Water absorption
- Hydrophobic bonding agents
- Decreased adhesive bond strength over time
- MMPs and Cathepsins
- Microleakage

87

## ORAL BACTERIA DEGRADATION OF RESIN RESTORATIONS




88

# MORE RESEARCH

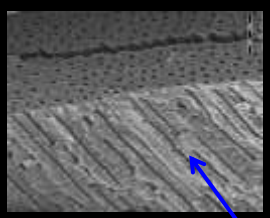
American Journal of Dentistry Oct 2017

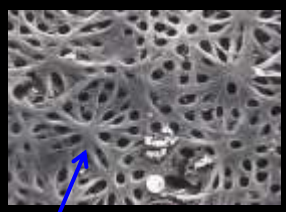
- https://www.researchgate.net/publication/321184952_The_role_of_adhesive_materials_and_oral_biofilm_in_the_failure_of_adhesive_resin_restorations

89

# Deep Preparations

- Bonding Agent, Flowable & a Layered NanoHybrid Composite
- Conventional Glass Ionomer, Bonding Agent & then Composite





- Fluoride Release
- High compressive strength
- Hydrophillic
- Insoluble
- True chemical adhesion
- Minimizes microleakage
- No sensitivity
- Acid Base Resistant Zone
- Decreased gap formation & C Factor
- Coefficient thermal expansion similar to dentin

90

# Why Glass Ionomers?

- Bioactive material
  - affinity to tooth structure. when placing a glass ionomer a weak acid or conditioner is used to aid in releasing calcium and phosphate ions from the tooth structure. These calcium and phosphate ions combine into the surface layer of the glass ionomer and form an intermediate layer called the interdiffusion zone. This bond layer can be very strong and significantly reduce the microleakage that would occur at the margins of the restoration.
- Very good fluoride and ion release helps remineralize tooth structure in the remineralization–demineralization process that naturally occurs in the oral cavity.
- They chemically bond to enamel and dentin.

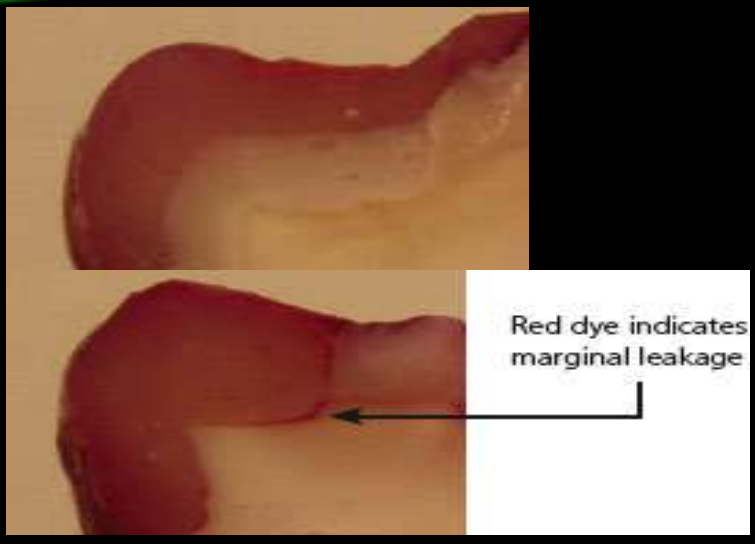
91

# Why Glass Ionomers?

- They produce good marginal integrity.
- They shrink only one ninth the amount of composite material.
- They are fluoride-rechargeable.
- There are no free monomers in the material.
- The cavity preparation can be bulk-filled, making the materials easy to place.
- They exhibit excellent biocompatibility.

92

# GLASS IONOMER SANDWICH




- Class I, II, III & V posterior restorations
- Open & Closed Sandwich techniques
- Composite replacement
- Amalgam replacement
- High caries risk patients
- Pediatric patients
- Geriatric patients
- Special needs patients
- Long term resistance to microleakage

93

# microleakage testing in vitro using three different bases under composites

*T. DUONG, L. TRAN, R. PERRY , G. KUGEL, Special Issues of the Journal of Dental Research.* ABSTRACT #0366
*> Tufts University School of Dental Medicine, Boston, MA, USA.*

## abstract:

**Objective:** To compare Class II microleakage in vitro of three different bases placed under composite restorations.

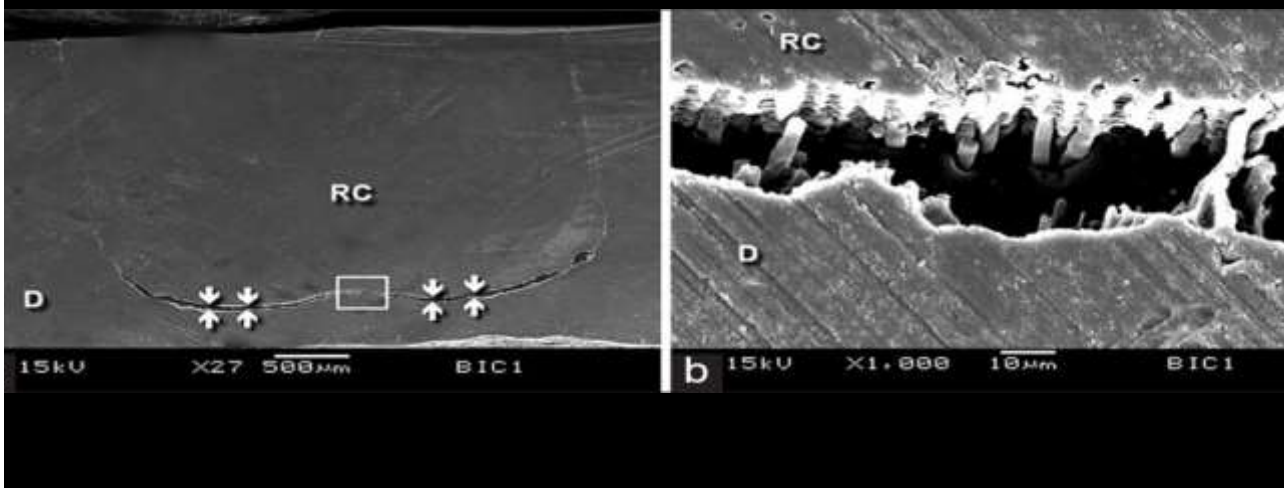
**Methods:** Thirty-six extracted molars were prepared as Class II MO/DO: 2mm occlusal depth, 2mm axial box depth, 3-5mm gingival box width, and 1mm gingival margin below CEJ. Teeth were randomly divided into three groups of twelve (groups 1-2 = glass ionomer; group 3 = flowable resin): Group 1-Riva Light Cure GI (SDI), Group 2-Riva Self Cure GI (SDI), Group 3-Esthet-X Flow (DENTSPLY Caulk). All groups were primed with Clearfil SE Bond Primer and Bond (Kuraray). All samples were then restored using ICE nano-hybrid Composite (SDI), finished and polished. Restorations were thermocycled for 300 cycles between 5°C and 55°C with a dwell of 30 seconds and then placed in 0.5% aqueous basic fuchsin dye for 24 hours at 37°C. Samples were sectioned mesiodistally and scored independently by two evaluators for microleakage at the occlusal-cavo and proximal-cavo surfaces under a 40x stereomicroscope.
Dye penetration was evaluated using a scoring system:
0 = no penetration, 1 = penetration in enamel/cementum, 2 = penetration at the axial wall, 3 = penetration beyond the axial wall.

**Results:** A Kruskal-Wallis test revealed no statistically significant difference in microleakage between the three groups at the occlusal-cavo surface ($p>0.05$). Group 3 was found statistically different at the proximal-cavo surface. Group 3 yielded the most microleakage at both interfaces while Group 2 showed no axial wall penetration at either interface.

**Conclusion:** Both light-cured and self-cured glass ionomers were more resistant to microleakage than a flowable resin on both occlusal-cavo and proximal-cavo surfaces.

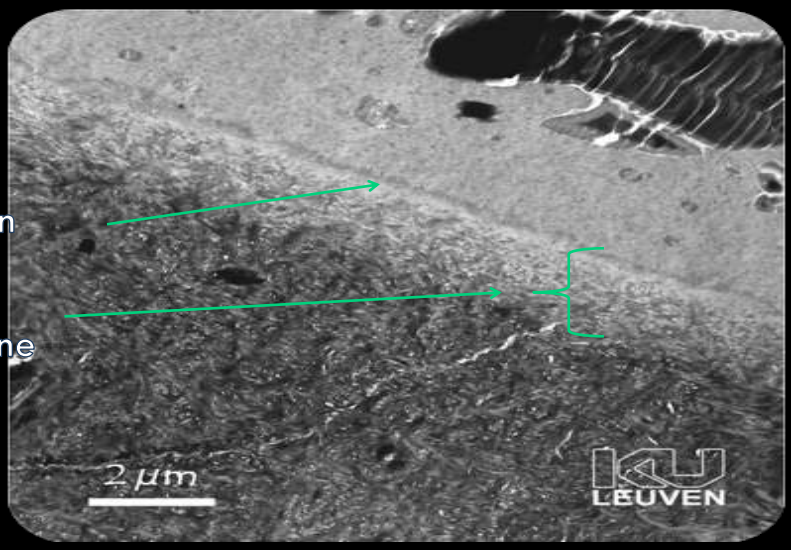
94

# RESIN TO DENTIN HYBRID ZONE




95

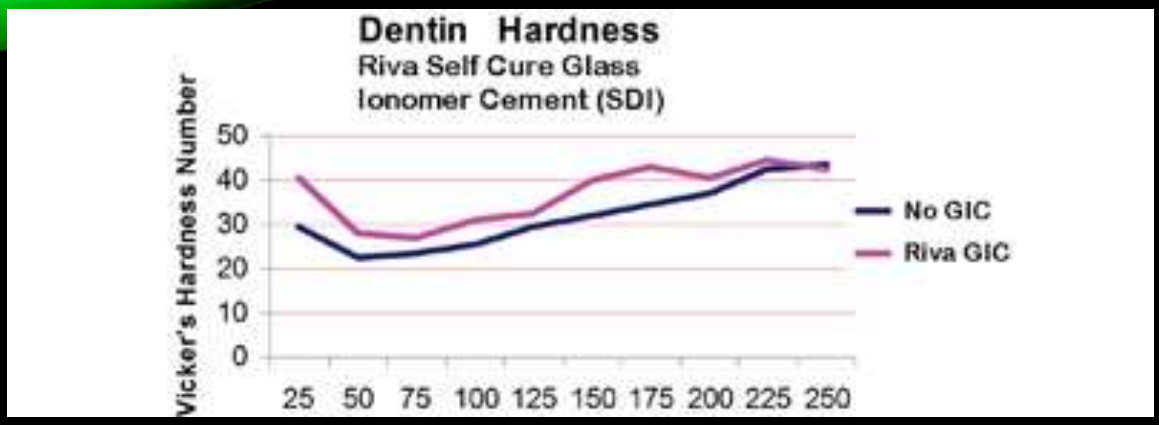
# GLASS IONOMER INTERFACE




Interface Analysis (TEM)

*CARDOSO et al. J Dent 2010*

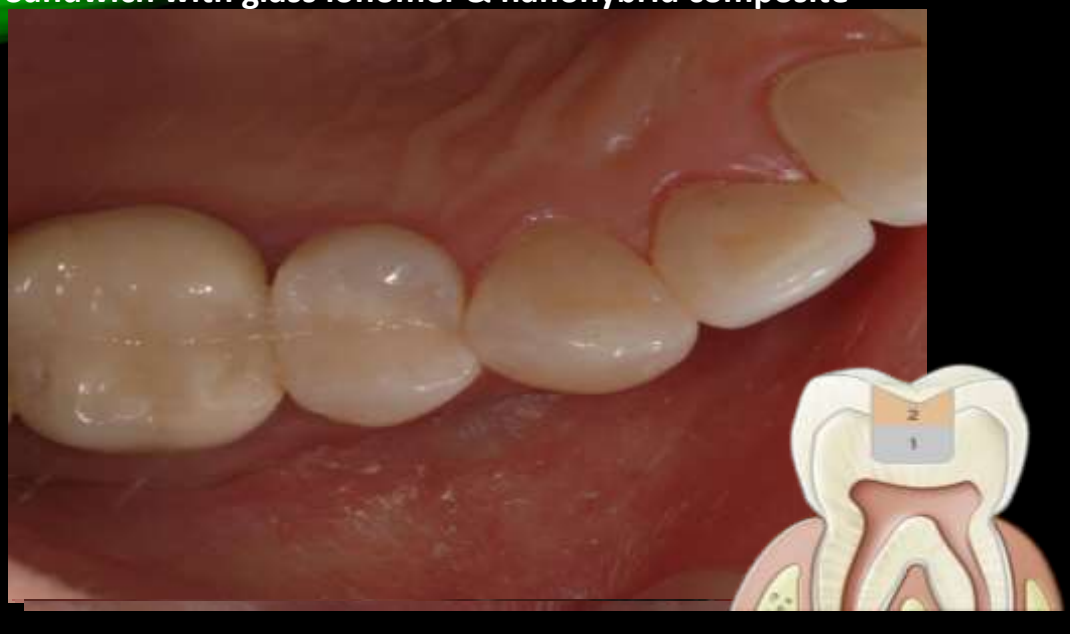
96




# BENEFITS OF A BIOACTIVE MATERIAL CONTACTING THE DENTIN

97

**Open Sandwich with glass ionomer & nanohybrid composite**



98

When dentin is missing, use conventional glass ionomers to replace it. It is the best dental material available today that virtually mimics dentin. No adhesive is required, and sensitivity is non-existent. Like dentin, conventional glass ionomers have a very high compressive strength, ensuring it will withstand long term mastication forces.

99

Gordon J. Christensen

Clinicians Report Reprint

Reprinted July 2020, with permission, from Volume 13 Issue 7, July 2020, Pages 1, 4 & 5

CR is the original and only independent dental product testing organization with funding only from dentists!

## A New Look at an Old Idea

**Gordon's Clinical Observations:** The glass ionomers *(GIs)* of today are not like the ones of yesterday. Clinicians have been laminating GIs and composite resins for over 20 years, and why not? GIs are self-etching; maintain a sealed, consistent bond interface on dentin over time; and provide a direct source of fluoride to at-risk areas of the oral cavity. They have improved properties, like thicker consistency, faster set times, and greater strength. They deserve strong consideration for future use.

Even though 91% of the dentists CR surveyed said that they used glass ionomers *(GIs)* and RMGIs (up 25% from 2015), most of the time they limited their application to geriatrics, pediatrics, the cervical third, and patients who had active caries.

Common complaints about GIs were weak bond strength, low wear resistance, difficult handling, and limited shade options. However, if the idea is to create a restoration *with clean margins that stay sealed and intact for the long term*, the glass-ionomer laminate or "sandwich technique" offers some of the best chances for success.

**In the following report, we review this often overlooked technique and provide yet one more *critical* reason as to why you should re-evaluate the way you look at glass ionomers.**

### The Sandwich Technique



100

## Dispelling Common Misconceptions about Glass Ionomers

**1. GIs don't bond well to tooth substrate or composite resin.**

***To Dentin:*** TRUE. Values are only one third as strong as we see with most resin bonding systems. However, GIs maintain the dentin bond much better over time than do resin adhesives. *(See: Matrix Metalloproteinases—The Margin Killers)*

***To Composite Resin Systems:*** There is a plethora of bond data demonstrating composite resin can be bonded to fully polymerized GI and RMGI substrates samples which were at least 24 hours old. This is significant because GI materials set within minutes, but over the first 24 hours may gain up to 800% in compressive strength. There is a direct correlation between bond strength and compressive strength.

**FIRST LOOK DATA: Only in *Clinicians Report***

CR researchers designed a novel test method to demonstrate bond strength of composite resin to FRESH glass ionomers, as would be experienced clinically. Results showed adequate bond to freshly cured GI and RMGI materials.

**2. Glass Ionomers are weak and brittle and should not be used in stress-bearing areas.**

As a bulk-fill stand-alone restorative material, yes, GIs should used judiciously *(non-stress-bearing restorations)* as they may break down or wear at much higher rates when compared to resin composites. However, ***as a dentin replacement material under composite resin***, it acts as a therapeutic restorative material that maintains long-term sealed margins with the esthetics, physical strength, and wear characteristics expected from a traditional composite resin restoration.

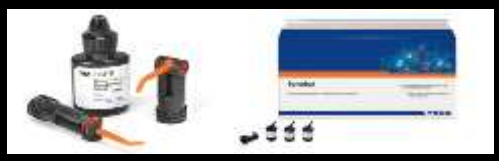
**3. Glass Ionomers take too long to set up.**

*GC Fuji IX GP (GC America) takes 2 minutes and 30 seconds from the time it is expressed to the time it hardens.* Many of the other GIs tested were under 3:30 minutes. Even with the additional time for hardening, it does not add much time to the total procedure and is well worth the additional benefits gained.

101

## GLASS IONOMER MATERIALS

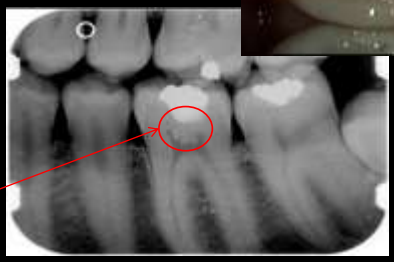
- Dentsply-ChemFil Rock Restorative
- SDI-Riva LC, light cure HV, Riva SC, self cure HV
- G.C. America-Fuji II LC, Equia Fil (Fuji IX)
- VOCO-Ionolux, Ionofil Molar AC
- 3M/ESPE-Ketac Nano, Photac Fil Quick, Vitremer, Ketac Molar Quick, Ketac Fil Plus
- Shofu- FX II



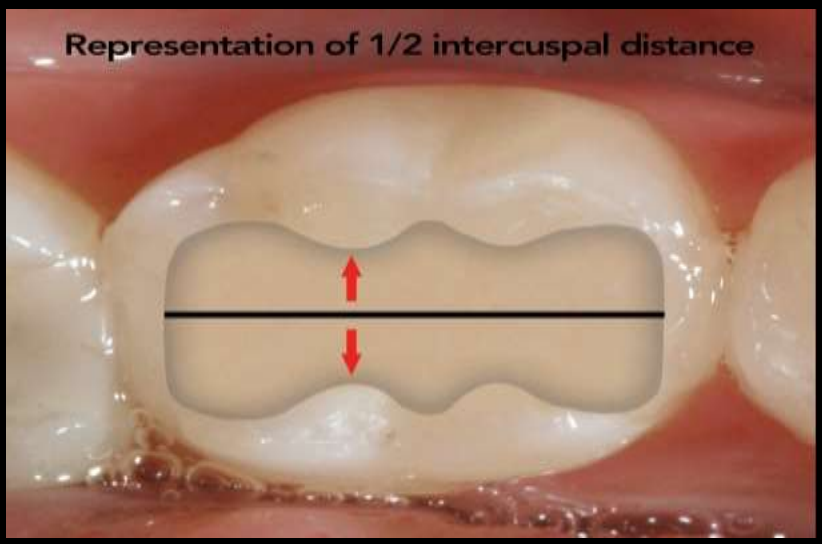
102

# LARGE SIZED LESIONS (>2MM)

- Mostly dentin
- Dentin has more moisture and less substanc
- Open and Closed defects
- Complications & Risks are higher
- Porous, Wet, Dentin Available
- Interproximal concerns
- Increased Occlusal Loading
- Remaining Tooth Structure




103




104

# EQUIA FORTE HT

*EQUIA FORTE™HT is a complete system that is an ideal solution for posterior restorations:*

- *Class I, II, III and V posterior restorations*
- *Composite replacement*
- *Amalgam replacement*
- *High caries risk patients*
- *Pediatric patients*
- *Geriatric patients*
- *Special needs patients*
- *Buildups*
- *Long term provisionals/Emergencies***

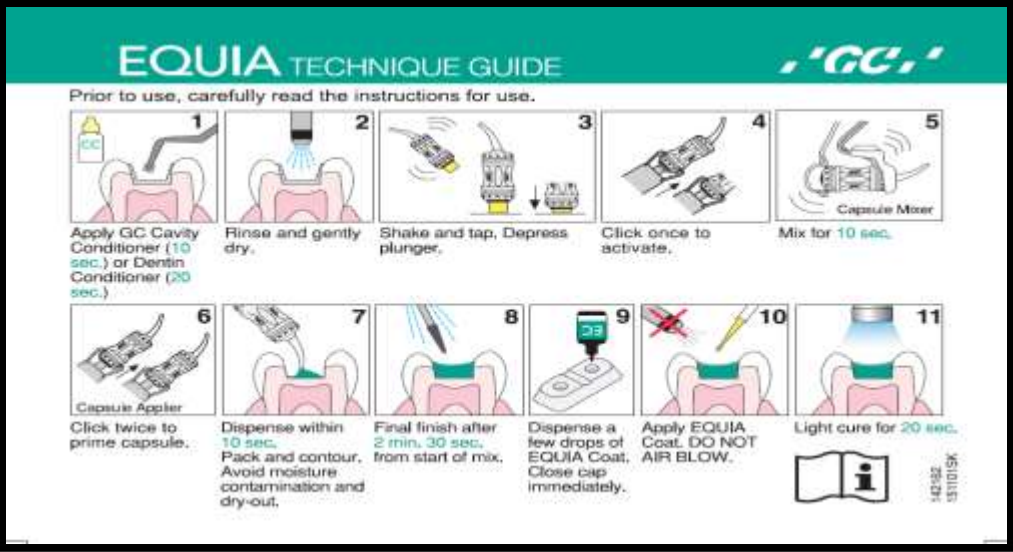
105

# EQUIA FORTE HT

Caries control/quadrant dentistry

(Class II, III, V & core buildup)

106



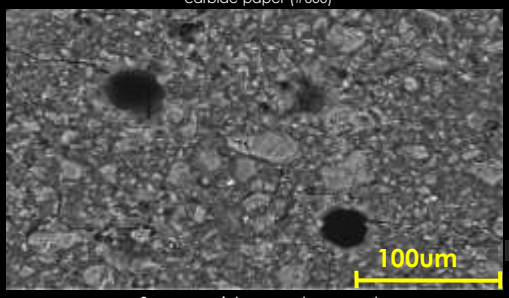

107

107

# WHAT DOES EQUIA COAT DO?

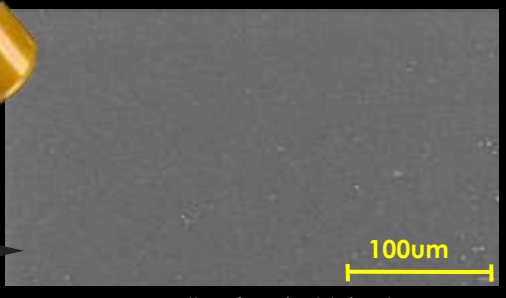
*Fill porosities to increase physical properties of the restoration and offers a much smoother surface…*

**EQUIA FORTE HT**
Polished by using silicon carbide paper (#600)




*Some voids are observed*

**EQUIA FORTE HT**
After coating




*A smooth surface is obtained*

108

# GLASS IONOMER VS. OPEN SANDWICH

109

# GLASS IONOMER VS. OPEN SANDWICH

- 10 years later.

110

## ENDODONTIC SANDWICH TECHNIQUE

111

## ENDODONTIC SANDWICH TECHNIQUE

112

## ENDODONTIC SANDWICH TECHNIQUE

113

## ENDODONTIC SANDWICH TECHNIQUE

114

## ENDODONTIC SANDWICH TECHNIQUE

115

## ENDODONTIC SANDWICH TECHNIQUE

116

## ENDODONTIC SANDWICH TECHNIQUE

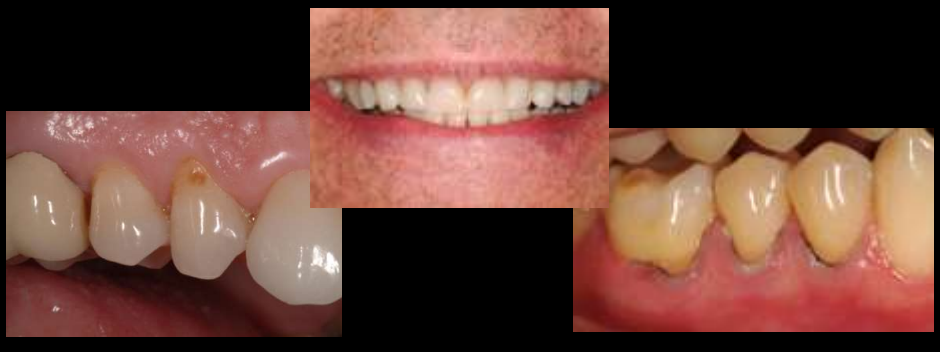
117

## ENDODONTIC SANDWICH TECHNIQUE

118

# ABFRACTION LESIONS

- Sometimes it presents as single teeth due to excursive interferences or as a pivot, fulcrum or "teeter totter" tooth.
- Other times there are more in a quadrant and there is severe wear to the occlusion.
- Other times it maybe on the facials of anterior teeth, where there is wear on the incisal edges or wear facets on the linguals, however little to no wear on posteriors.
- Occlusal guards should be fabricated along with an occlusal analysis in CR on models.



119

# Flowables?

120

## TYPICAL COMPOSITE BREAKDOWN

Microleakage and missing fillings from high occlusal loads on teeth can cause large cervical stress concentrations resulting in disruption of the bonds between the hydroxyapatite crystals and the eventual loss of cervical enamel and dentin.

121

## ABFRACTION LESIONS & CLASS V RESTORATIONS

LATIN WORDS, AB – "AWAY", FRACTION – "BREAKING"

- Pathological loss of tooth structure caused by biomechanical loading forces.
- Static and cyclic flexural overloading of tooth structure ultimately leading to fatigue and failure of tooth structure away from the point of loading.

122

Van Meerbeek B, et al. Relationship between bond-strength tests and clinical outcomes. Dent Mater (2009), doi:10.1016/j.dental.2009.11.148

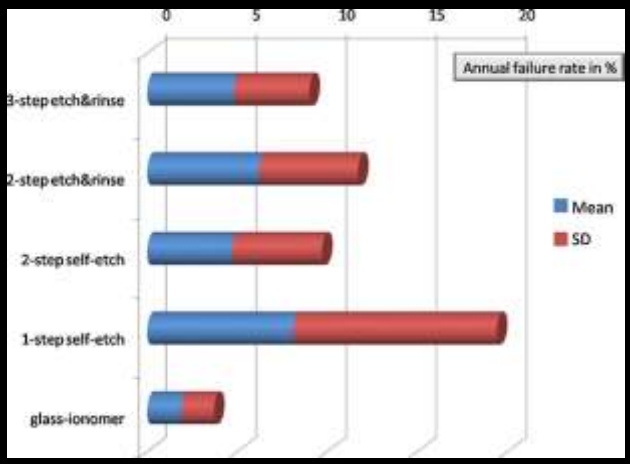



**Fig. 15 – Graph representing the mean annual failure rates per adhesive class, determined according to a systematic review of Class-V clinical trials of adhesives during the period 1998–2004 [2].**

123

# RESIN MODIFIED GLASS IONOMERS (RMGI)

- Light cured
- Dual cured
- High flexural strength
- Lower compressive strength than conventional G.I.
- Good polishability
- Excellent wear
- Hydrophillic
- Fluoride release
- No microleakage
- No adhesives
- Acid resistant layer
- Reduces sensitivity
- True chemical adhesion

124

# GC FUJI AUTOMIX LC

125

## Replacing Existing Restorations & Decay

- Resin bonding is mostly due to the intertubular dentin.
  - Deep preparations have less intertubular dentin.
  - More moisture present due to odontoblastic tissues and fluid
  - Higher risk of post-op sensitivity
  - *Use a New Advanced Adhesive and Flowable*

- Glass Ionomer (GI)
  - True adhesion to tooth structure
  - Bonds to moist dentin
  - Less technique sensitive
  - Fluoride release
  - Decreased gap formation and cusp deformation
  - Coefficient of thermal expansion is similar to dentin
- No post operative sensitivity
  - Use on dentin & cementum
  - Base out deep areas
  - Place resin/composite on top of GI

Dentin Bond Strengths of Simplified Adhesives: Effect of Dentin Depth. Compendium June 2006, p.340-345
Using Cavity Liners with Direct Posterior Composite Restorations. Compendium June 2006, p.347-351

126

# RESIN MODIFIED GLASS IONOMER RESTORATION

Post-Op Photo – notice unlike typical class V composite RMGI restorative material.

127

TIP

## Restorative Therapy- Case

**Typical treatment involves the placement of a #00 retraction cord on each tooth followed by a shade selection. Roughen tooth structure with air abrasion. Place cavity conditioner on all areas to be restored for 10 seconds, then wash and dry.**

128

## Restorative Therapy- Case

Mix RMGI and syringe into place. Utilize hand instruments to shape and remove gross excess. Cure each tooth for 20 seconds. Remove excess and contour using a handpiece with fine diamond burs. Teeth should be isolated from saliva.

129

## Restorative Therapy- Case

After contouring the restorations can be coated with a self etch adhesive coating, and cure for 10 seconds.

130

## Restorative Therapy- Case

**Ten year post-op photos show the integrity of the material is still excellent. Note the lack of marginal microleakage stain often present with composite restorations.**

131

## RESIN MODIFIED GLASS IONOMER

132

# RESIN MODIFIED GLASS IONOMERS (RMGI)

- Light cured
- Dual cured
- High flexural strength
- Lower compressive strength than conventional G.I.
- Good polishability
- Excellent wear
- Hydrophillic
- Fluoride release
- No microleakage
- No adhesives
- Acid resistant layer
- Reduces sensitivity
- True chemical adhesion

133

# RESIN MODIFIED GLASS IONOMER RESTORATION

Post-Op Photo – notice unlike typical class V composite RMGI restorative material.

134

# RESIN MODIFIED GLASS IONOMER

135

# The tooth is the gold standard

| Attributes | Tooth Structure | Bioactive Restoratives | Composites | Glass Ionomers | RMGIs |
|---|---|---|---|---|---|
| Esthetic | Yes | Yes | Yes | No | Yes |
| Hydrophilic | Yes | Yes | No | Yes | Yes |
| pH adjusting | Yes | Yes | No | NO | NO |
| High Strength | Yes | Yes | Yes | No | No |
| Releases Calcium, Phosphate & Fluoride | Yes | Yes | No | No | No |
| Stimulates Apatite Formation | Yes | Yes | No | No | No |
| Shock-Absorbent /Flexible | Yes | Yes | No | No | No |
| Resists chipping and cracking | Yes | Yes | No | No | No |

LARRY CLARK

136

ACTIVA kids
ACTIVA BioACTIVE RESTORATIVE
ACTIVA BioACTIVE BASE/LINER
ACTIVA BioACTIVE CEMENT
riva light cure
BEAUTIFIL Flow Plus X
Biodentine
septodont
ceramir
https://www.oralhealthgroup.com/features/bioactivity-restorative-dentistry-users-guide/

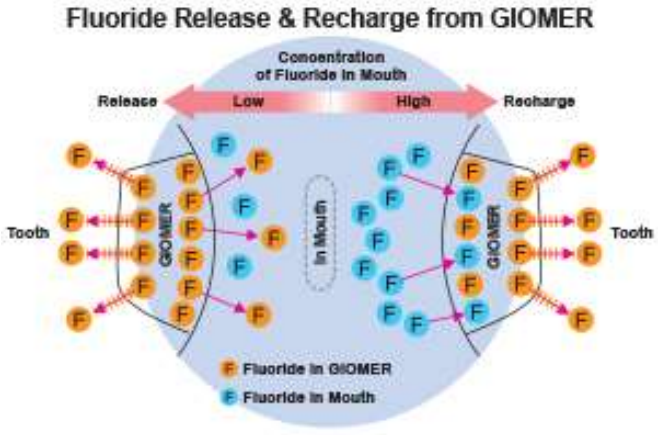
137

since 1922
2022
SHOFU
Bright smiles for another 100 years
BEAUTIFIL Flow Plus X
SHOFU INC.
PRG Technology
Giomer

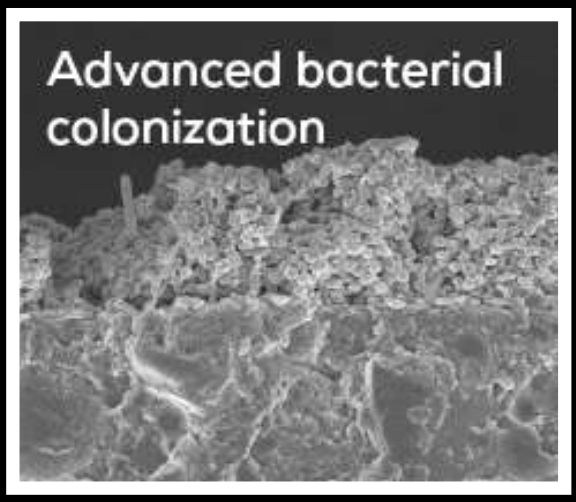
138

- Giomers represent the hybridization of glass ionomer and composite resin properties: the fluoride release and recharge of glass ionomers and the esthetics, physical properties, and handling of composite resins.
- The Giomer concept in based on PRG (Pre-Reacted Glass) technology: a glass core, surrounded by a glass ionomer phase enclosed within a polyacid matrix. Studies show dentin remineralization occurs at the preparation surface adjacent to the giomer.
- Giomers, through the creation of fluoride reservoirs, release and recharge fluoride efficiently, significantly better than compomers and composite resins, although not as well as glass ionomers.

139



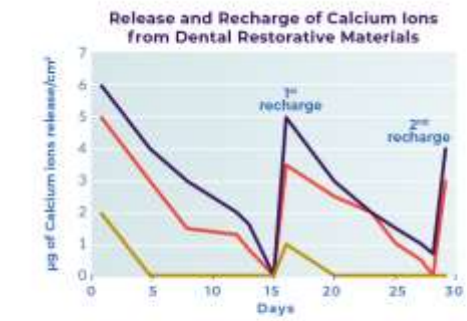

140

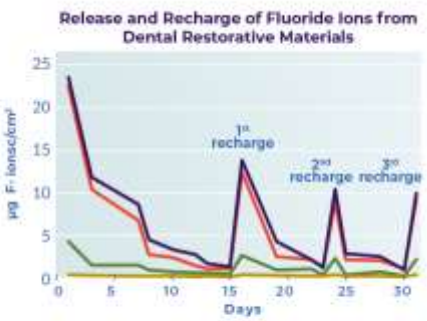


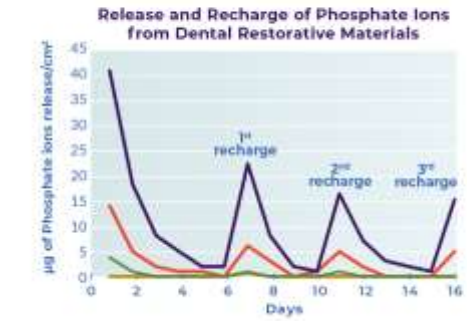

Conventional Composite

Bioactive Giomer Composite

141



142

PULPDENT
ACTIVA
IONIC-RESTORATIVE™

*Releases/recharges calcium, phosphate and fluoride*

143

# DO Restoration Tooth #29

144

# CLASS V AND CLASS II TOOTH #31

145

## Biofilm Challenge and Gap Formation

Specimens are in a 37c Pressurized chamber for 30+ days

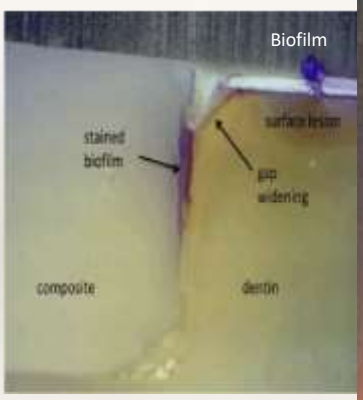
Biofilm is refreshed daily

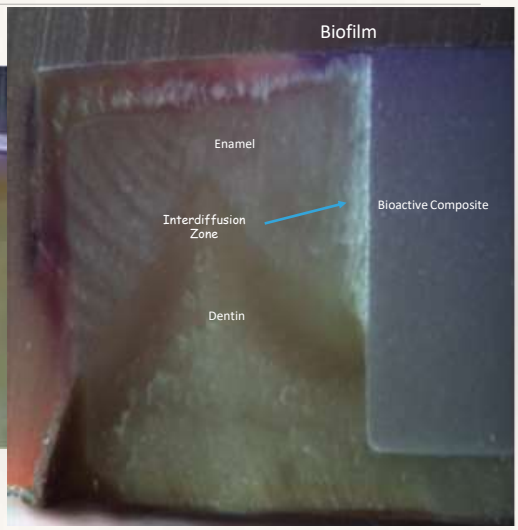
Results, biofilm can deteriorate margins and composites

Marginal leakage can occur

Demineralizaton of enamel and dentin can occur

Gap formation will follow interface of restoration

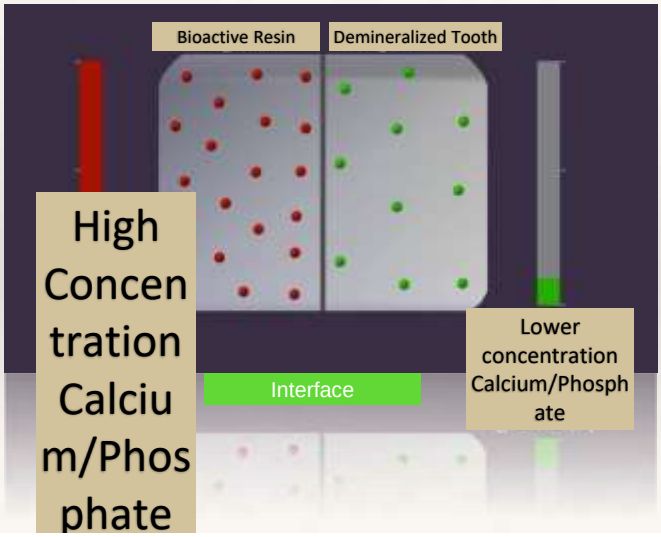



Drs. Ferracane and Hilton, Oregon Health Sciences University

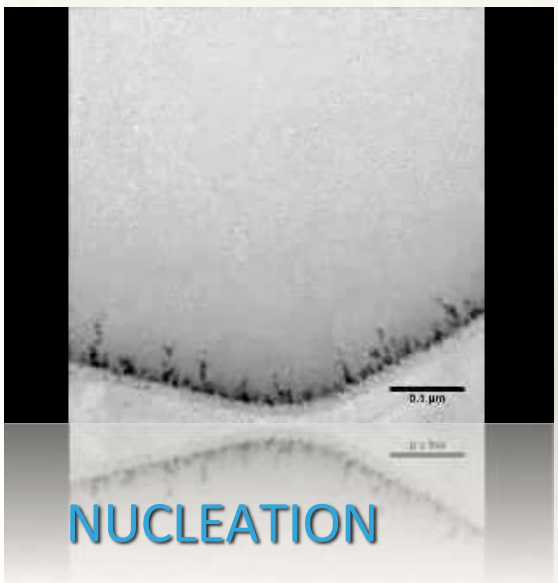
146

# Diffusion




- DIFFUSION IS UNDERSTOOD IN TERMS OF THE TRANSFER OF FREE IONS
- BIOACTIVE HYDROPHILIC RESIN ALLOWS IONS TO PASS THROUGH WITHOUT DEGRADATION
- IONS OF TOOTH AND BIOACTIVE RESIN COME INTO EQUILIBRIUM/BALANCE
- POLYANIONS ENVIRONMENT
- (-C00H/ HPO4-2) WE CREATE A POLYANIONIC ENVIRONMENT TO THE CALCIUM PHOSPHATE

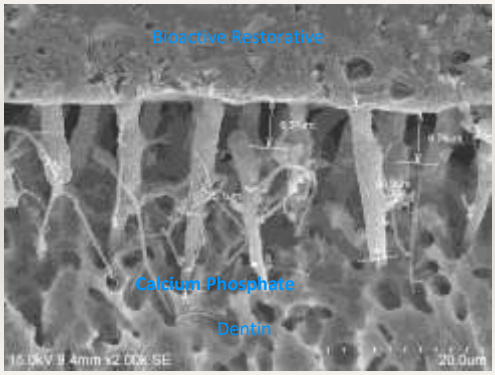
148




- POLYANIONS, POLYANIONIC SURFACES SERVE AS AN ORGANIZING MATRIX WHERE PROTEIN-PROTEIN INTERACTIONS OCCUR.
- NUCLEATION IS THE INITIAL PROCESS OF CRYSTALLINE FORMATION
- THE CALCIUM/PHOSPHATE COMPLEX IN BIOACTIVE RESIN SERVES AS NUCLEATION SITES
- THE CONTINUOUS GROWTH OF CRYSTALLINE STRUCTURES CONSTITUTES BIOMINERALIZATION

149

# Resin tags acting as nucleation sites




**Bioactive Restorative Material to Dentin**

B. Harper, H. Hamama, P. Neelekantan: Hong Kong University

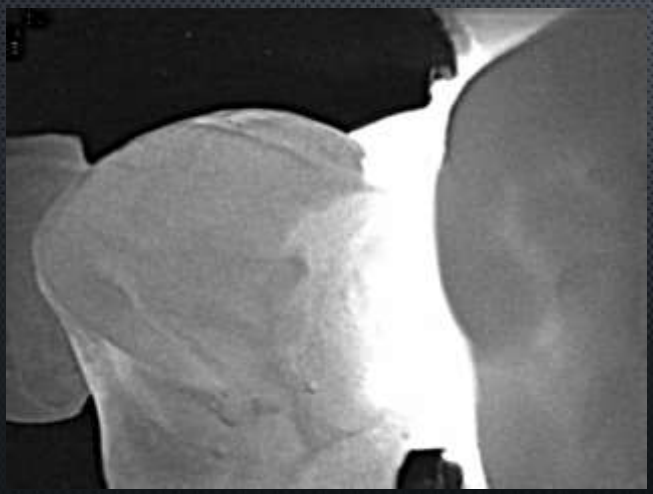
150

# Cavities, Old Composite Replacements, Undercut Block Out

- Bioactive flowable
- Releases Calcium, Fluoride, Phosphate ions
- Highly fracture and wear resistant
- BPA & Bis-GMA free
- Highly radiopaque
- 8 Shades A1-3.5, A4, A6, B1, BW

151

# FIND THE LESION?



152

# DO YOU SEE THE PROBLEM?

153

## HOW MANY OF THESE DO WE MISS AS DENTISTS?

154

## MORE CONSERVATIVE RESTORATIONS

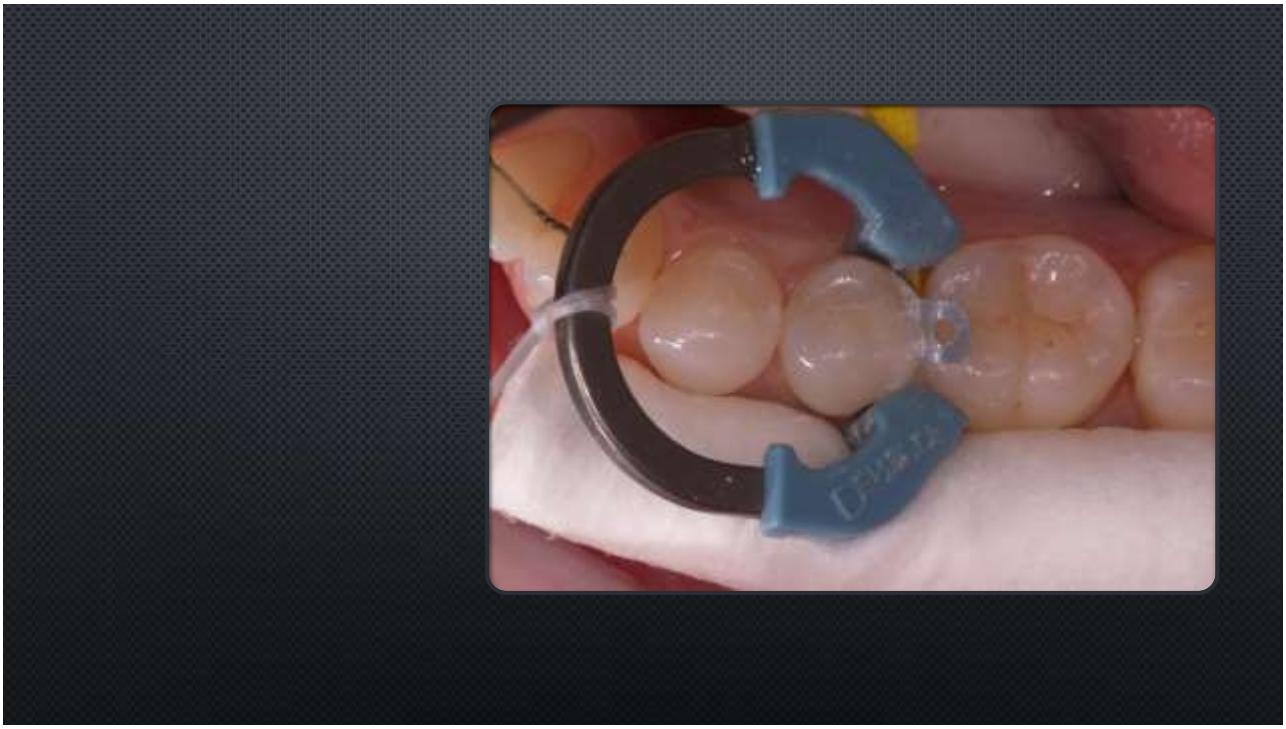
155

156

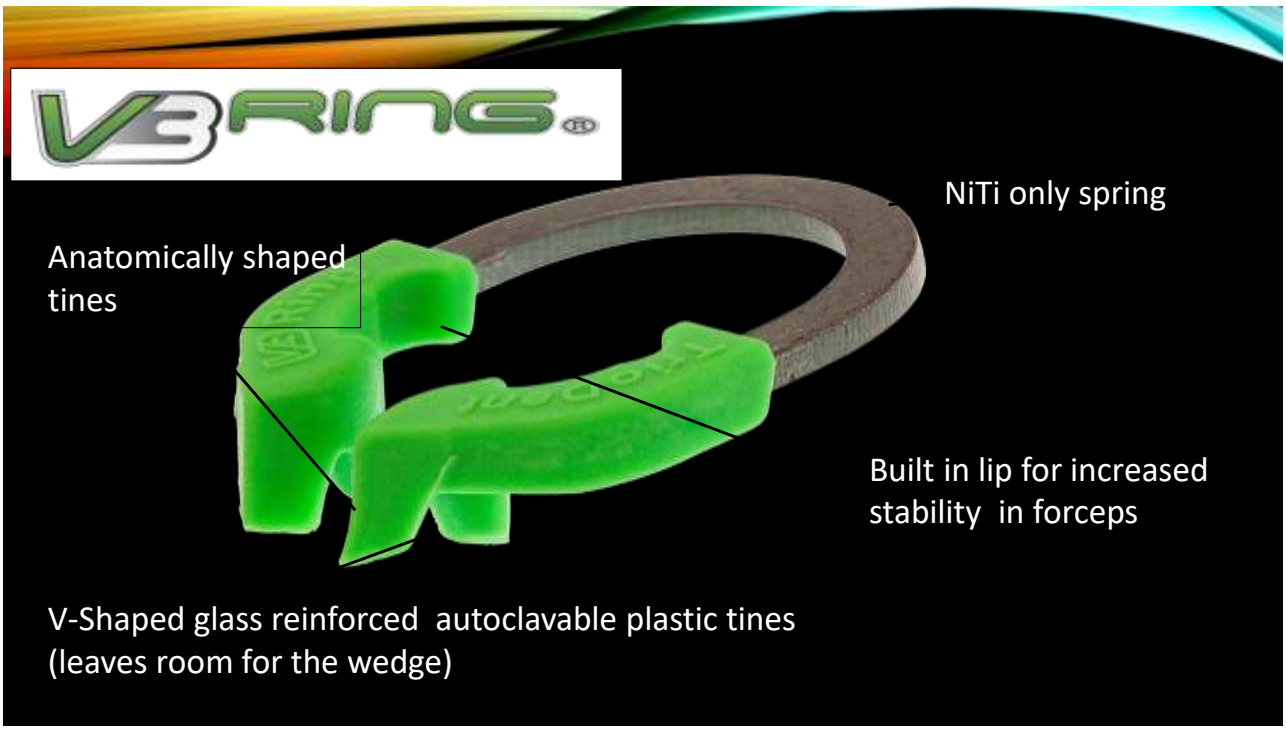
157

158

159



160


V3 RING
NiTi only spring
Anatomically shaped tines
Built in lip for increased stability in forceps
V-Shaped glass reinforced autoclavable plastic tines (leaves room for the wedge)

161

**PALODENT PLUS-DENTSPLY**

*Identical except for color*

162

163

164

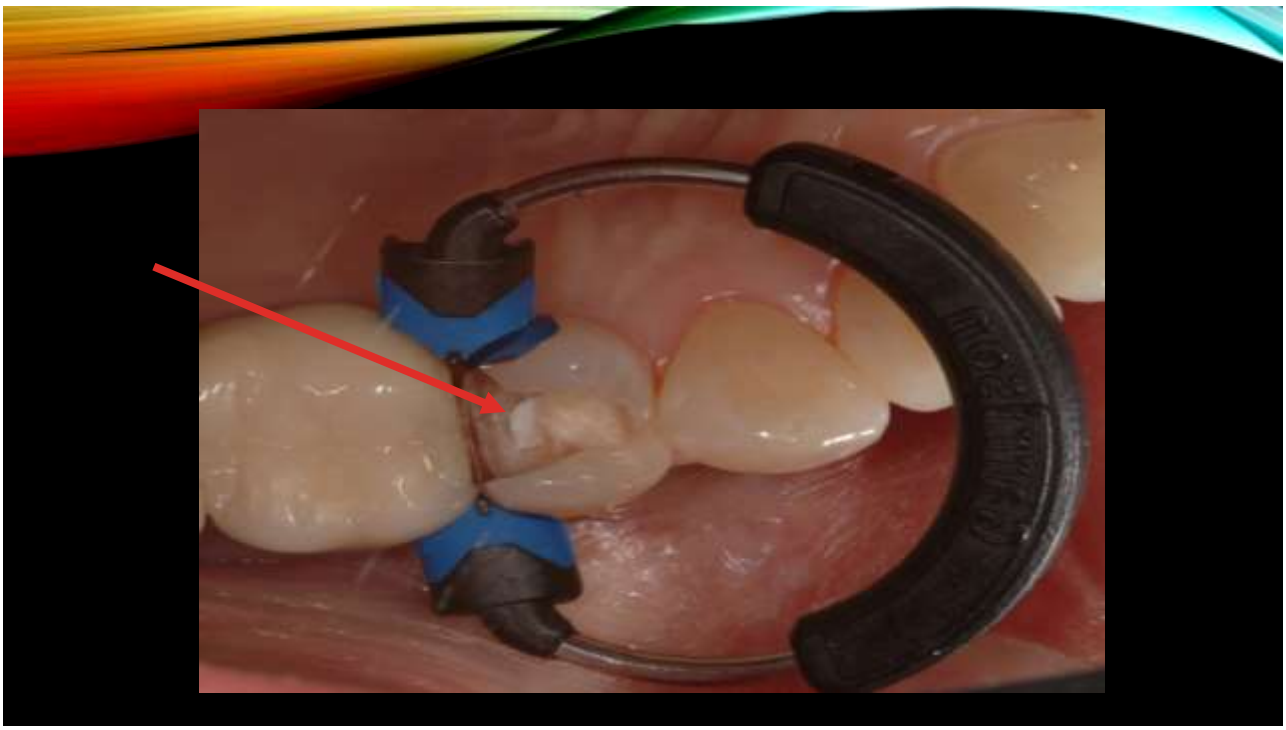
THE MOST BIOACTIVE COMPOSITE ON THE MARKET

165

# THERACAL LC (BISCO)

TheraCal LC®
TheraCal LC is a light-cured, resin-modified calcium silicate. Its unique apatite stimulating ability makes it ideal for direct and indirect pulp capping and as a protective liner.

168



169

# THERACAL LC (BISCO)

- Calcium release stimulates[1*] hydroxyapatite and secondary dentin bridge formation[2,3]
- Alkaline pH promotes healing and apatite formation[2,4]
- Significant calcium release[1] leads to protective seal[5,7,8]
- Protects and insulates the pulp[5,6]
- Moisture tolerant[1] and radiopaque – can be placed under restorative materials and cements

170

- Alkaline pH 8.5
- Moisture Tolerant
- Self Sealing
- Apatite Formation
- Insoluble/No Degredation
- Stronger with time
- Semi / Translucent
- Biocompatibility-Excellent
- Bioactivity-Apatite formation
- No silane, conditioning, bonding

**Calcium Aluminate/Glass Ionomer Hybrid Cement****

171

ceramir® CROWN & BRIDGE

- Ceramir Crown & Bridge is indicated for permanent cementation of:
  - Porcelain fused to metal crowns and bridges
  - Metal (gold, etc.) crowns and bridges
  - Gold inlays and onlays
  - Cast or prefabricated metal posts
  - Strengthened core all-zirconia or all-alumina ceramic crowns and bridges
  - Lithium Disilicate (eMax)
  - Stainless steel crowns
  - Ortho bands and appliances

172

## Bioactivity

A reactive bioactive system that contributes to hydroxyapatite mineralization of hard tissue through ion release and alkaline pH.**

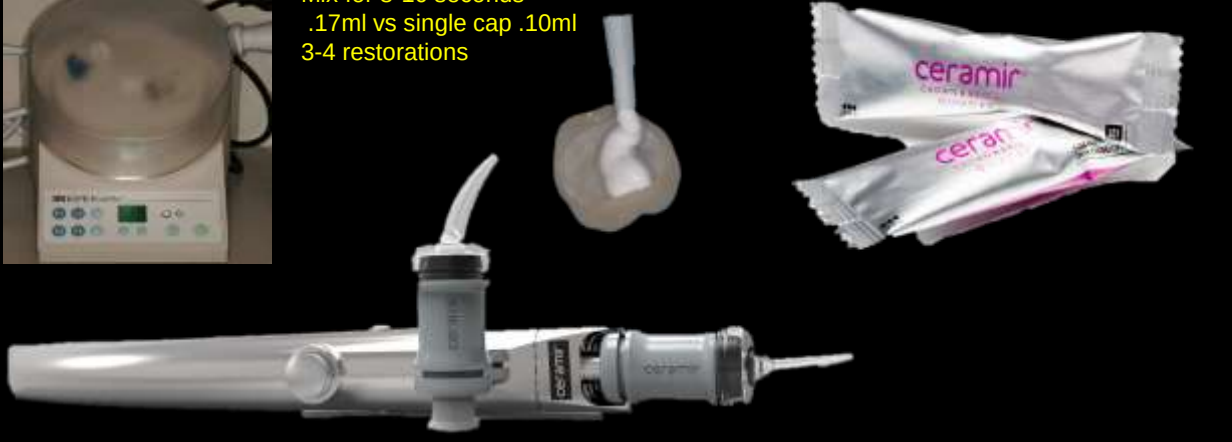
**Calcium Aluminate/Glass Ionomer Hybrid Cement****

173

# Cementation Technique

**Calcium Aluminate/Glass Ionomer Hybrid Cement****

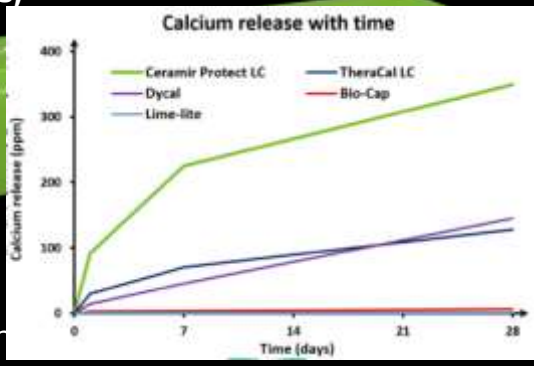
Mix for 8-10 seconds
.17ml vs single cap .10ml
3-4 restorations




174

# CERAMIR PROTECT LC (DOXA)

•**Direct pulp capping for any pulpal exposures, including:**
•Carious pulp exposure
•Mechanical pulp exposure
•Pulp exposure due to trauma



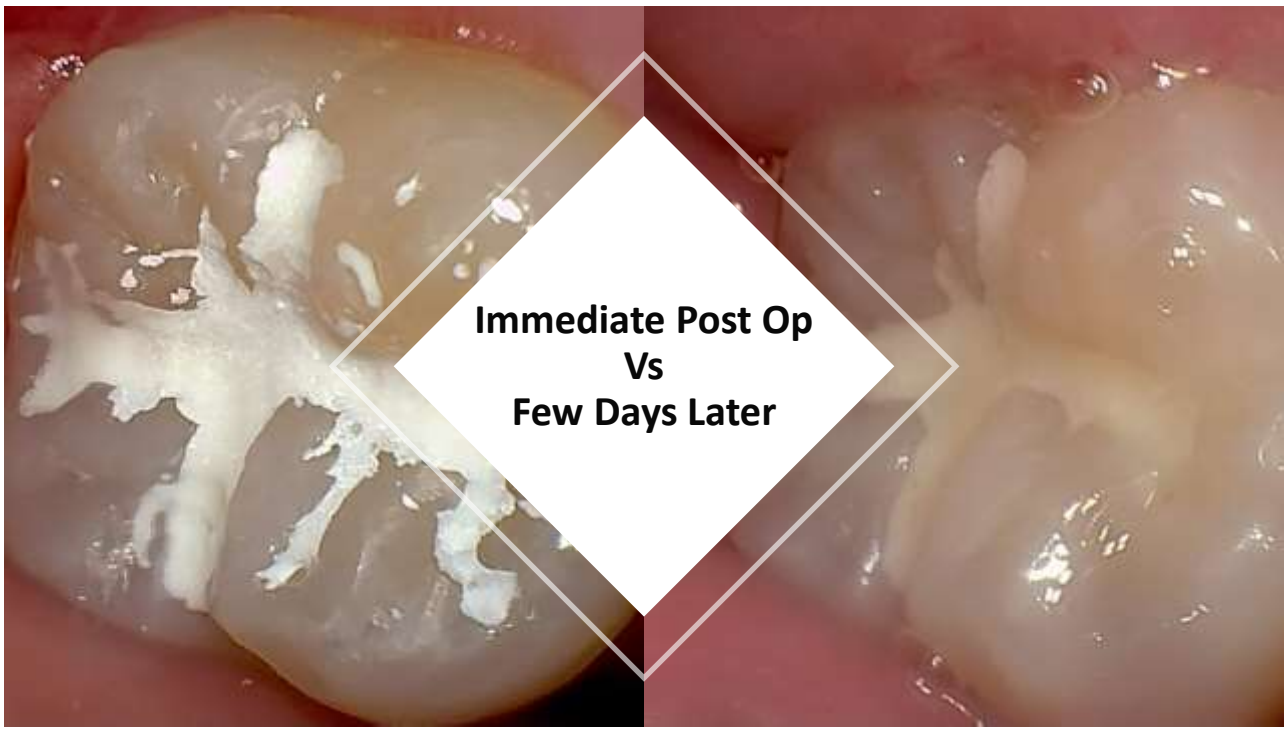

**Indirect pulp capping in deep preparations:**
- Under amalgam restorations
•Under Class I and Class II composite restoration
•Under cements
•As an alternative to calcium hydroxide

**https://www.ceramirdental.com/ceramir-protect-lc-syringe.html**

175

Bioactive
Biocompatible
Restorative
Material
ceramir
RESTORE
QUIXCAP
capsule
innovation

176


Immediate Post Op
Vs
Few Days Later

177

178

## CLASS V - RESTORATIONS

179

## Class V Restorations
-subgingival
-deep restoration
-moisture control

Doxa

180

## CLASS V - RESTORATIONS

Doxa

181

## Class I, II & III: Non-Load Bearing Restorations

Doxa

182

## Class I, II & III Non-Load Bearing Restorations

Doxa

183

# Wedge Guards (TrioDent /Ultradent)

Doxa

184

# FenderWedges (Garrison Dental)

Doxa

185

# Fendermate (Directa Dental)

Doxa

186

# Class I, II & III Non-Load Bearing Restorations

Doxa

187

## Class I, II & III Non-Load Bearing Restorations

Doxa

188

## Class I, II & III Non-Load Bearing Restorations

Doxa

189

# Ceramir Restore Review

- Easy (No etchants or adhesives)
- Fast & Consistent
- Hydrophilic
- No post op sensitivity
- Biocompatible
- Bioactive
- Natural Integration and REPAIR of the Tooth

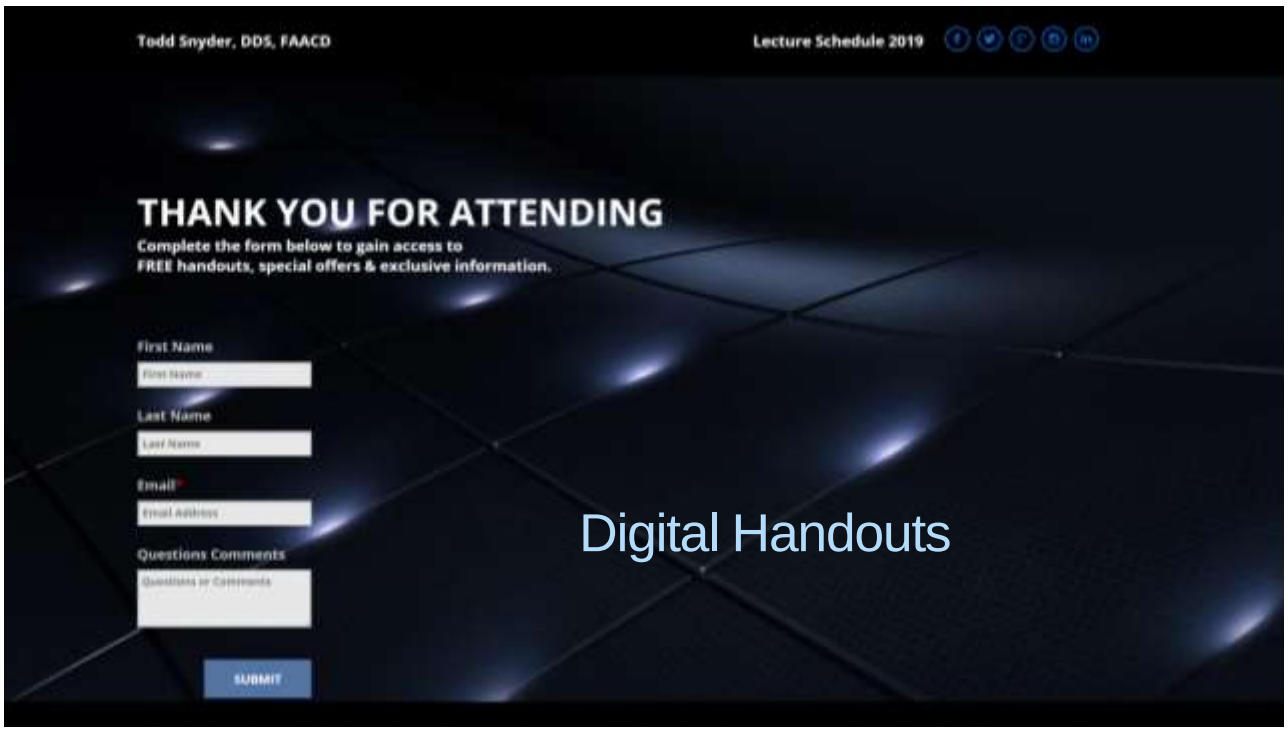
Doxa

190

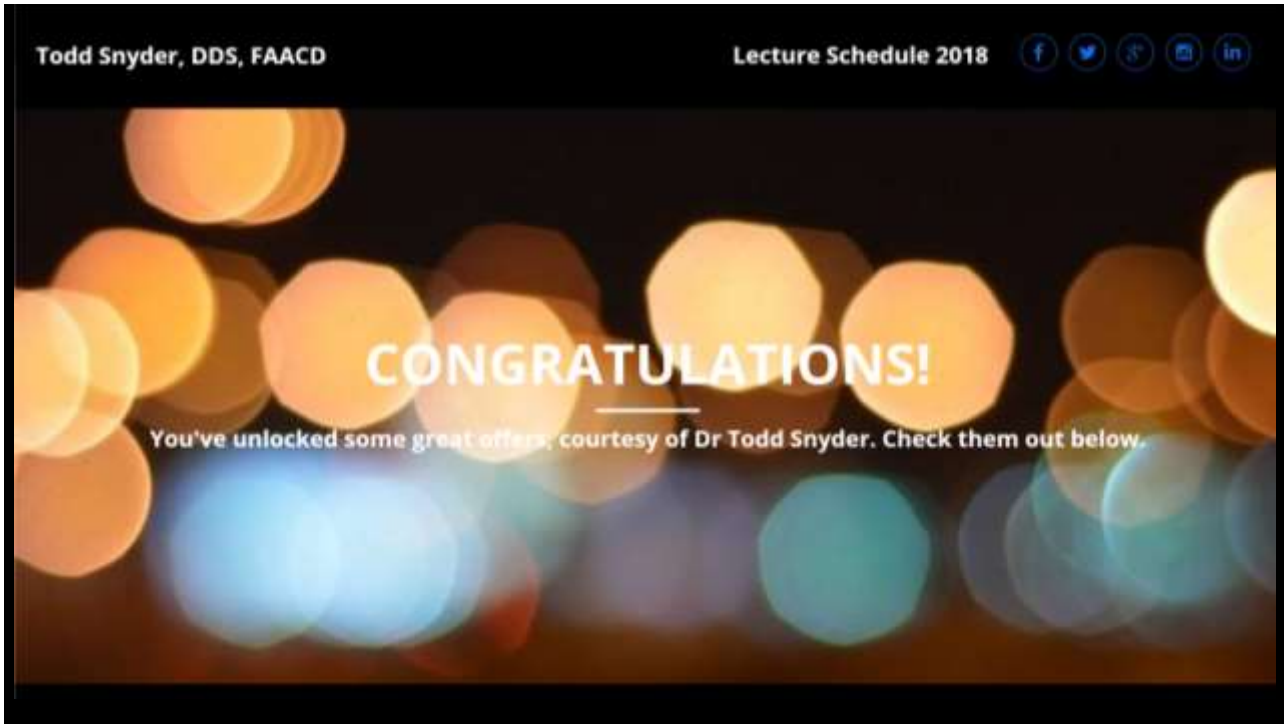
195

Lecture Handout with additional free content
www.DENTOOLZ.com
Digital Handouts, Products I Use & Special Offers
Link will be emailed to you, check your spam/junk folder.

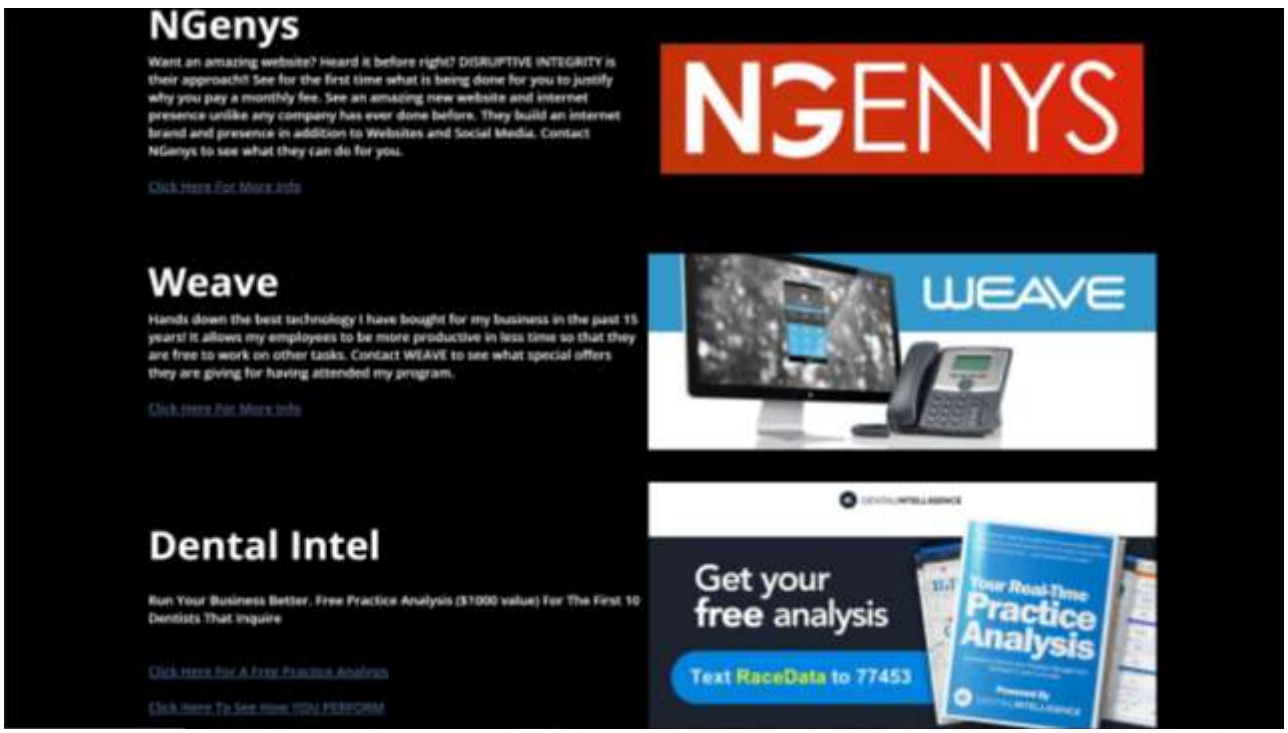
196


Todd Snyder, DDS, FAACD
Lecture Schedule 2019
THANK YOU FOR ATTENDING
Complete the form below to gain access to
FREE handouts, special offers & exclusive information.
First Name
Last Name
Email
Questions Comments
SUBMIT
Digital Handouts

197


Todd Snyder, DDS, FAACD
Lecture Schedule 2018
CONGRATULATIONS!
You've unlocked some great offers, courtesy of Dr Todd Snyder. Check them out below.

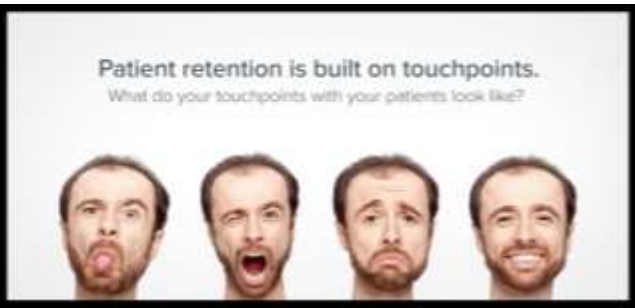
198


NGenys
Want an amazing website? Heard it before right? DISRUPTIVE INTEGRITY is their approach! See for the first time what is being done for you to justify why you pay a monthly fee. See an amazing new website and internet presence unlike any company has ever done before. They build an internet brand and presence in addition to Websites and Social Media. Contact NGenys to see what they can do for you.
Click Here For More Info
NGENYS
Weave
Hands down the best technology I have bought for my business in the past 15 years! It allows my employees to be more productive in less time so that they are free to work on other tasks. Contact WEAVE to see what special offers they are giving for having attended my program.
Click Here For More Info
WEAVE
Dental Intel
Run Your Business Better. Free Practice Analysis ($1000 value) For The First 10 Dentists That Inquire
Click Here For A Free Practice Analysis
Click Here To See How YOU PERFORM
Get your free analysis
Text RaceData to 77453
Your Real-Time Practice Analysis

199

# 34 Ways To Increase Patient Retention

Click Here To Learn How




# More Elective Cosmetic Dentistry

Click Here For Handout

Porcelain Veneers, Smile Makeovers: The Business of More Elective Cosmetic Dentistry | TODD C. SNYDER, DDS, FAACD

200

# YOUR FUTURE BEGINS NOW!

LEGION

TSNYDER@LEGIONPRIDE.COM

WWW.LEGION.DENTIST

TODD C. SNYDER, DDS, FAACD

201

Dr. Todd Snyder
Webinar Attendees Receive:
20% OFF*
All BISCO Products
Promo code: 22SNY
Expiration date: 12/31/2022
BISCO
* U.S. customers only. Cannot be combined with any other offer. One purchase only. Rx only.

202