The Evolution of Pediatric Dentistry: Changing Concepts in Clinical Practice

Texas Dental Association,
May 2018

Mark Cannon DDS MS
FAAPD, FADM, FICD, FAAOSH, etc.

- Professor
- Division of Dentistry
- Department of Otolaryngology
- Feinberg School of Medicine
- Research Director- Lurie Children's Hospital of Chicago
- Chicago, IL USA
- Full time practice

Agenda- Pediatric Updates

- **Bioactive**- enhance the formation of apatite in simulated body fluid
- **Biointeractive**- release of ions that enhance re-mineralization
- **Bulk Fill-**
  - Dual cure materials- can be Bioactive or Biointeractive
  - Self cure- biointeractive
  - Light cured- low refraction of light, currently not bioactive nor biointeractive

Biologic Materials for Pulpal Vitality

- Indirect Pulpal Therapy
- Direct Pulpal Therapy
- Pulpotomy
- Pulpectomy
- Trauma

Mark Cannon
Professor- Northwestern University
Research Director-
Ann and Robert Lurie Children's Hospital

New Biologic Materials for Pulpal Vitality

Research and Clinical Protocols




Where does calcium silicate

- Cal m lime den roa n cem st nota
- It is an a WH proc

Biologic Materials

- MTA
- Biodentine
- Lime Lite
- NeoMTA
- TheraCal LC and DC




Biologic Materials

- MTA- the original, Portland cement type ASTM I from the California Portland Cement company.
- Slow set, grey color, mixed with water, very expensive and difficult to place or control.
- Replaced by white MTA- Type III?

s

ir and restorative

age for excellent sealing
ation.

d mechanical behavior as

easy short and long term

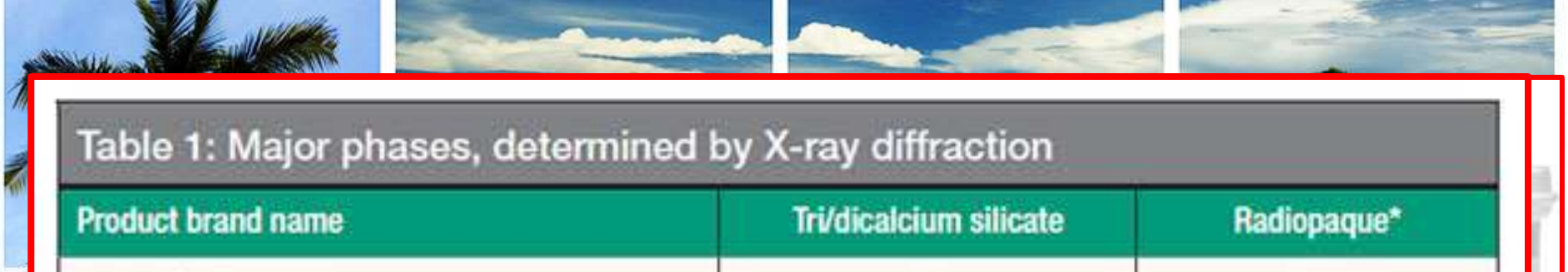


Table 1: Major phases, determined by X-ray diffraction		
Product brand name	**Tri/dicalcium silicate**	**Radiopaque***
ProRoot® MTA (white)	76	20
Biodentine®	83	4
BioRoot™	63	37
MedCem MTA®	70	23
TheraCal®	78	17
EndoSequence® Sealer	41	59
EndoSequence® Root Repair	59	33
EndoSequence® BP Root Repair	55	37
EndoSequence® RRM	63	34
NeoMTA Plus®	72	25
Grey MTA Plus®	72	25

* Bismuth oxide, barium zirconate, zirconia, and/or tantalite

TheraCal

the innovative light-curable Calcium Silicate-based pulp-capping material

190 A1
, 2008

433/228.1

INDIANAPOLIS, IN 46282-0200 (US)

itions and
sed, nearly
exposed, or breached pulp chamber are disclosed herein. Embodiments include dental pulp healing lining or capping

J Dent. 1999 Nov;27(8):557-64.

Human pulp response after an adhesive system application in deep cavities.

Hebling J[1], Giro EM, Costa CA.

Author information

ALLBOND 2- acceptable biocompatibility

Quintessence Int. 20(

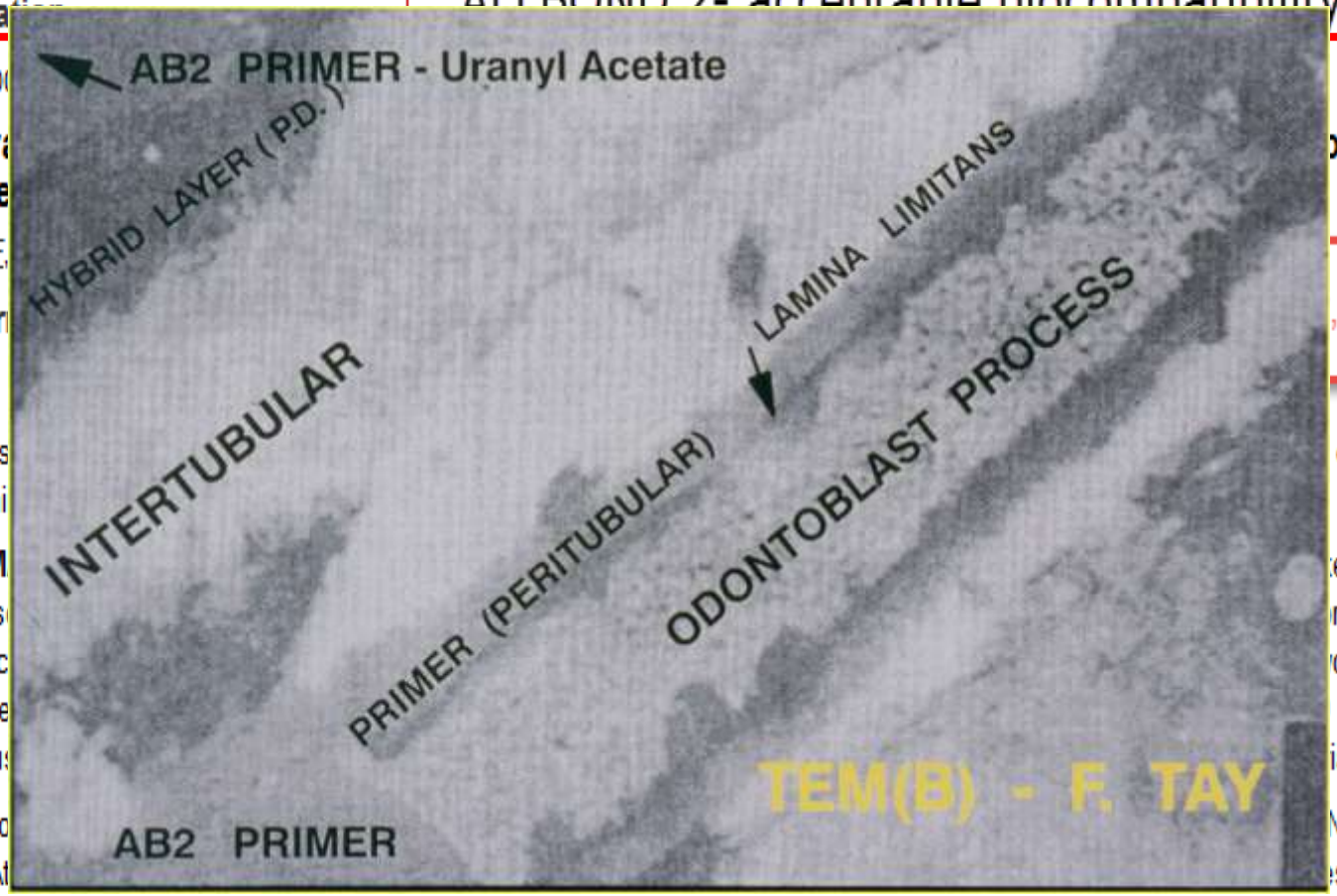
An in vivo eva… two-compone…

Hafez AA[1], Cox CF,

Author infor…

…one- or

…, One Step



Abstract

OBJECTIVE: This… remove dentin chi…

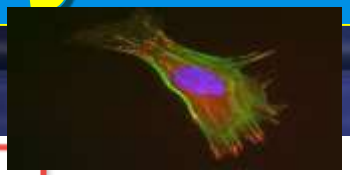
METHOD AND M… histologically obs… exposures were c… excluded from the… obtained by perfus…

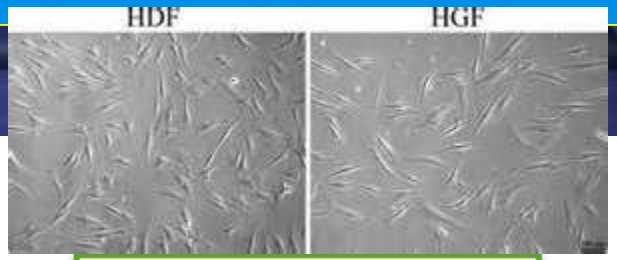
…coagulum, to …eys and …rite. Twenty-two …o pulps were … days, tissues were …ia.

RESULTS: For bo… were observed. At… No necrotic pulps …esent in 28 pulps. Four 97-day pulps exhibited necrosis associated with stained bacteria. One 97-day pulp contained dentin chips throughout the pulp and demonstrated no healing, no reparative dentin, and no stained bacterial profiles.

CONCLUSION: Normal soft tissue reorganization and dentinal bridge formation were observed in 86% of pulps treated with sodium hypochlorite and either adhesive system.

Cytotoxicity- HEMA- Bond





Killing cells

J Oral Rehabil. 2001 Oct;28(10):971-5.

In vitro cytotoxicity of six dentin bonding agents.

Koliniotou-Koubia E[1], Dionysopoulos P, Koulaouzidou EA, Kortsaris AH, Papadogiannis Y.

Author information

Scotchbond- HEMA

Abstract

The cytotoxicity of six dentin bonding agents (Syntac, Solobond, Bond 1, Scotchbond 1, Heliobond and F-2000) was tested against an established cell line, L929. Under aseptic conditions 3, 5 and 10 microL dentin bonding agents were placed in the centre of Petri dishes. Each dish was covered with a 5-mL suspension of fibroblasts at a concentration of 40 000 cells mL(-1). The cultures were incubated at 37 degrees C and cytotoxicity was assessed by a quantitative technique at 24 and 72 h. All the dentin bonding agents were found to be cytotoxic. Scotchbond 1 and F-2000 showed the highest cytotoxicity followed by Solobond and Bond 1. Heliobond and Syntac were the least toxic materials.

J Biomed Mater Res. 2002;63(1):53-60.

Cytotoxicity of modern dentin adhesives--in vitro testing on gingival fibroblasts.

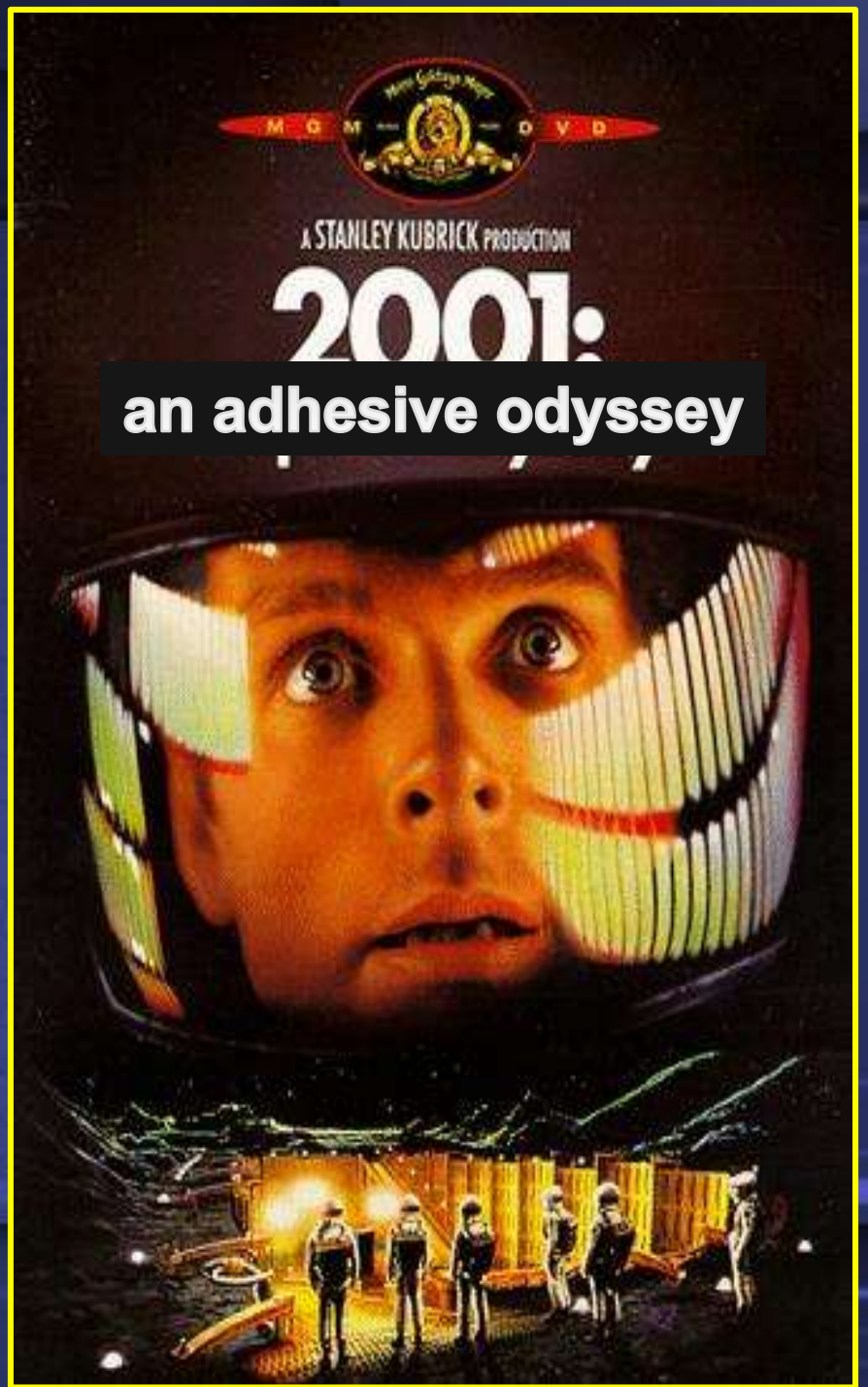
Szep S[1], Kunkel A, Ronge K, Heidemann D.

Author information

Scotchbond and Ariston Liner least recommended

Abstract

The present investigation was designed to test cellular toxicity of modern dentin adhesives. With the use of the products Ariston Liner, Etch & Prime 3.0, Optibond Solo, Prime & Bond NT, Scotchbond 1, and Syntac Sprint, test specimens were prepared according to the manufacturers' instructions and transferred into a culture medium. Eluates were obtained and pipetted onto fibroblast cultures, incubated, and subsequently stained. The respective cell densities and the numbers of normal, altered, and dead cells were determined and compared with control cell cultures. Statistical analysis of the data showed that all materials caused cytotoxic effects. Scotchbond 1 displayed the highest number of dead cells. The difference was statistically significant compared to Etch" 3.0, Optibond Solo, Prime&Bond NT, and the control. The lowest cell density was found for Scotchbond 1 and Ariston Liner. The difference was also statistically significant in comparison with Etch" 3.0, Optibond Solo, Prime&Bond NT, and the control. To conclude, all tested dentin adhesives caused cytotoxic reactions. Taking the limitations of an in vitro experiment into consideration, Prime&Bond NT, Optibond Solo, and Etch" 3.0 appear to be the most recommendable products, and Scotchbond 1 and Ariston Liner the least.



Confused?

Ability to maintain alkalinity

Material Safety Data Sheet

Issued: 08/16/2012 Revision Number: 3

1. Identification of S

Product Name: T
Manufacturer:
Telephone:

Emergency
Telephone Numbe

EC Representativ

ccepted

2. Composition/Inform

Ingredient	Concentration Range (%)	CAS Number	Symbol/Risk Classificaton	OSHA PEL (mg/m3)	ACGIH (mg/m3)	LD50 (mg/kg, rat/oral)
Portland Cement Type III	<60.	65997-15-1.	Xi,R36/38/43.	5.	10.	N/D.
Polyethlene glycol dimethacrylate.	<50.	25852-47-5.	Xi,R36/38/43.	N/D.	N/D.	N/D.
Barium zirconate	<10.	12009-21-1	Xn; R20/22.	5.	5.	420.

Bases and Liners- Dycal and Vitrebond

SEM Evaluation of Internal Adaptation of Bases and Liners under Composite Restorations

Dimitrios Dionysopoulos * and Eugenia Koliniotou-Koumpia

Department of Operative Dentistry, School of Dentistry, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece; E-Mail: jeny@dent.auth.gr

Table 1. The materials tested in the present study.

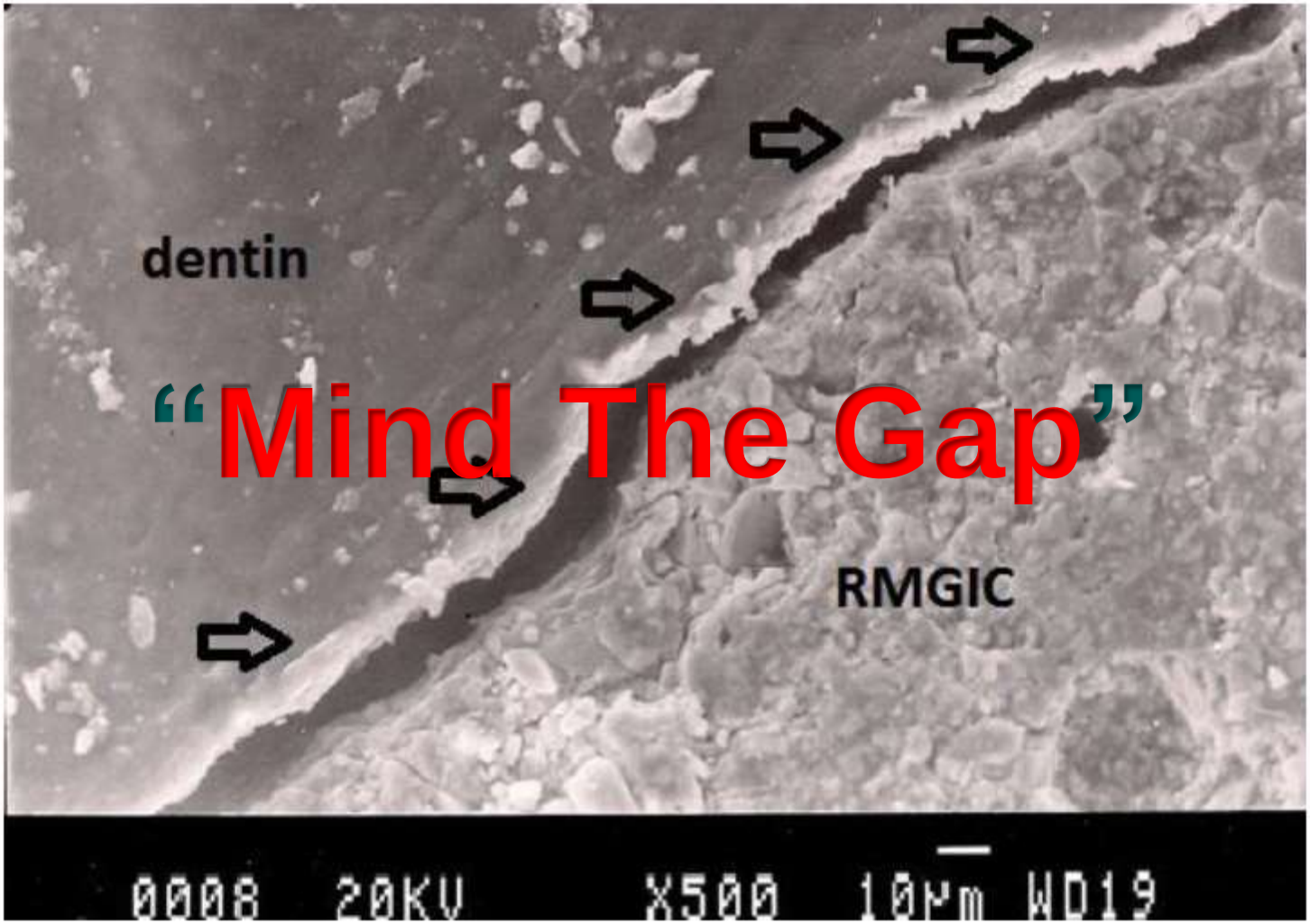
Material	Manufacturer	Type
Dycal	Dentsply, Culk, USA	Calcium hydroxide liner
Vitrebond	3M ESPE, St. Paul, MN, USA	Resin-modified glass ionomer cement
Clearfil Tri-S Bond	Kuraray, Japan	One-step self-etch adhesive system
Clearfil Majesty	Kuraray, Japan	Nanohybrid composite resin

Bases and Liners- Dycal and Vitrebond

Group	Materials
1	Dentin- Clearfil Tri-S Bond + Clearfil Majesty
2	Dentin- Dycal + Clearfil Tri-S Bond + Clearfil Majesty
3	Dentin- Dycal + Vitrebond + Clearfil Tri-S Bond + Clearfil Majesty
4	Dentin- Vitrebond + Clearfil Tri-S Bond + Clearfil Majesty
5	Dentin- Clearfil Tri-S Bond + Vitrebond + Clearfil Majesty
6	Dentin- Clearfil Tri-S Bond + Vitrebond + Clearfil Tri-S Bond + Clearfil Majesty

Materials	Mean gap width (µm)
Dycal–Clearfil Tri-S Bond + Clearfil Majesty	3.6 ± 2.1^{A}
Dycal–Vitrebond + Clearfil Tri-S Bond + Clearfil Majesty	26.2 ± 11.4^{B}
Vitrebond–Clearfil Tri-S Bond + Clearfil Majesty	3.8 ± 1.8^{A}
Clearfil Tri-S Bond + Vitrebond– Clearfil Majesty	21.6 ± 8.6^{B}
Clearfil Tri-S Bond + Vitrebond– Clearfil Tri-S Bond + Clearfil Majesty	5.3 ± 2.4^{A}

Figure 5. Representative SEM photomicrograph of a Group 4 specimen. The arrows indicate microgap between resin-modified glass ionomer cement (Vitremer) and dentin.



Configuration Factor, C-Factor

100 µm
Mag = 100 X

TheraCal LC

IADR
International Association for Dental Research

IADR 2011 Abstract #2520 Gandolfi et al.
Apatite-forming ability of TheraCal pulp capping material

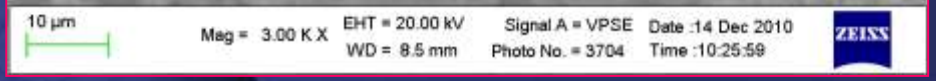
IADR 2011 Abstract #2521 Gandolfi et al.
Chemical-physical properties of TheraCal pulp capping material

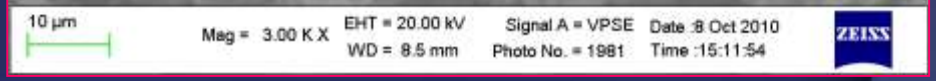
IADR 2011 Abst. #2520 Gandolfi et al. Apatite-forming ability of TheraCal pulp-capping material

24 h TheraCal

28 days TheraCal

Conclusions: TheraCal was able to induce the formation of apatite and represents a promising material in direct pulp-capping clinical procedures. The ability to form apatite may play a critical/positive role in new dentine formation.





Ca^{+2} Ion Release (ppm)

	Calcium	Released	In Soaking	Water	(ppm)	(n=10)
	3 hrs	1 day	3 days	7 days	14 days	28 days
TheraCal	74.7 (9.2)	37.4 (4.5)	25.2 (6.5)	24.6 (2.0)	24.1 (1.1)	19.6 (3.1)
Control	1.2 (0.3)	0.5 (0.4)	0.6 (0.4)	0.6 (0.4)	0.6 (0.4)	0.6 (0.4)
ProRoot	32.2 (4.5)	29.8 (3.5)	35.4 (2.3)	24.5 (3.9)	14.3 (2.7)	16.1 (2.9)

IADR 2011 Abst. #2521 Gandolfi et al.

		pH of	Soaking	Water	(n=10)	
	3 hrs	1 day	3 days	7 days	14 days	28 days
TheraCal	10.96 (0.03)	10.19 (0.24)	9.28 (0.41)	8.32 (0.06)	8.63 (0.15)	8.04 (0.18)
Control	6.96 (0.19)	7.23 (0.25)	7.24 (0.13)	7.25 (0.25)	7.27 (0.25)	7.20 (0.12)
ProRoot	11.52 (0.75)	10.91 (0.13)	11.52 (0.41)	11.25 (0.82)	7.84 (0.13)	8.25 (0.24)
Water	6.88 (0.04)	7.00 (0.02)	7.07 (0.09)	7.10 (0.1)	6.96 (0.06)	7.22 (0.12)

pH changes

International Endodontic Journal

doi:10.1111/j.1365-2591.2012.02013.x

Chemical–physical properties of TheraCal, a novel light-curable MTA-like material for pulp capping

M. G. Gandolfi, F. Siboni & C. Prati

Laboratory of Biomaterials and Oral Pathology, Department of Odontostomatological Sciences, University of Bologna, Bologna, Italy

Abstract

Gandolfi MG, Siboni F, Prati C. Chemical–physical properties of TheraCal, a novel light-curable MTA-like material for pulp capping. *International Endodontic Journal.*

Aim To evaluate the chemical–physical properties of TheraCal, a new light-curable pulp-capping material composed of resin and calcium silicate (Portla cement), compared with reference pulp-capping ma rials (ProRoot MTA and Dycal).

Methodology Calcium (Ca) and hydroxyl (OH) i release over 28 days, solubility and water upta (weight percentage variation, Δ%) at 24 h, cure dep and radiopacity of TheraCal, ProRoot MTA and Dy were evaluated. Statistical analysis ($P < 0.05$) release of ion was carried out by two-way repeat measures ANOVA with Tukey, whilst one-way ANO with Tukey test was used for the other tests.

Results TheraCal released significantly more calcium than ProRoot MTA and Dycal throughout the test period. TheraCal was able to alkalinize the surrounding fluid initially to pH 10–11 (3 h–3 days) and subsequently to pH 8–8.5 (7–14 days). TheraCal had a cure depth of 1.7 mm. The solubility of TheraCal (Δ −1.58%) was low and significantly less than that of Dycal (Δ −4.58%) and ProRoot MTA (Δ −18.34%). The amount of water absorbed by TheraCal (Δ +10.42%) was significantly higher than Dycal

Conclusions TheraCal displayed higher calcium-releasing ability and lower solubility than either ProRoot MTA or Dycal. The capability of TheraCal to be cured to a depth of 1.7 mm may avoid the risk of untimely dissolution. These properties offer major advantages in direct pulp-capping treatments.

calcium hydroxide, Dycal, ProRoot MTA, pulp capping materials, resin-modified calcium silicate, TheraCal.

Received 14 July 2011; accepted 29 December 2011

Biocompatibility of Dental Materials

Cytotoxic Effects of Resin-Based L/C Pulp Capping Materials

Applied on the Immortalized Odontoblast Cell Line MDPC-23

Prof. Dr. Carlos Alberto de Souza Costa

Araraquara School of Dentistry – UNESP

Department of Physiology and Pathology

Materials

1. TheraCal (Bisco) – MTA (“Portland” Cement) based resin
2. Ultra-Blend Plus (UltraDent) – Ca $(OH)_2$ based resin
3. Vitrebond (3M/ESPE) – Resin modified glass ionomer
4. DMEM (Dulbecco’s Modified Eagle Medium) – Control (complete culture medium)

TheraCal presented the lowest decrease in cell metabolic activity

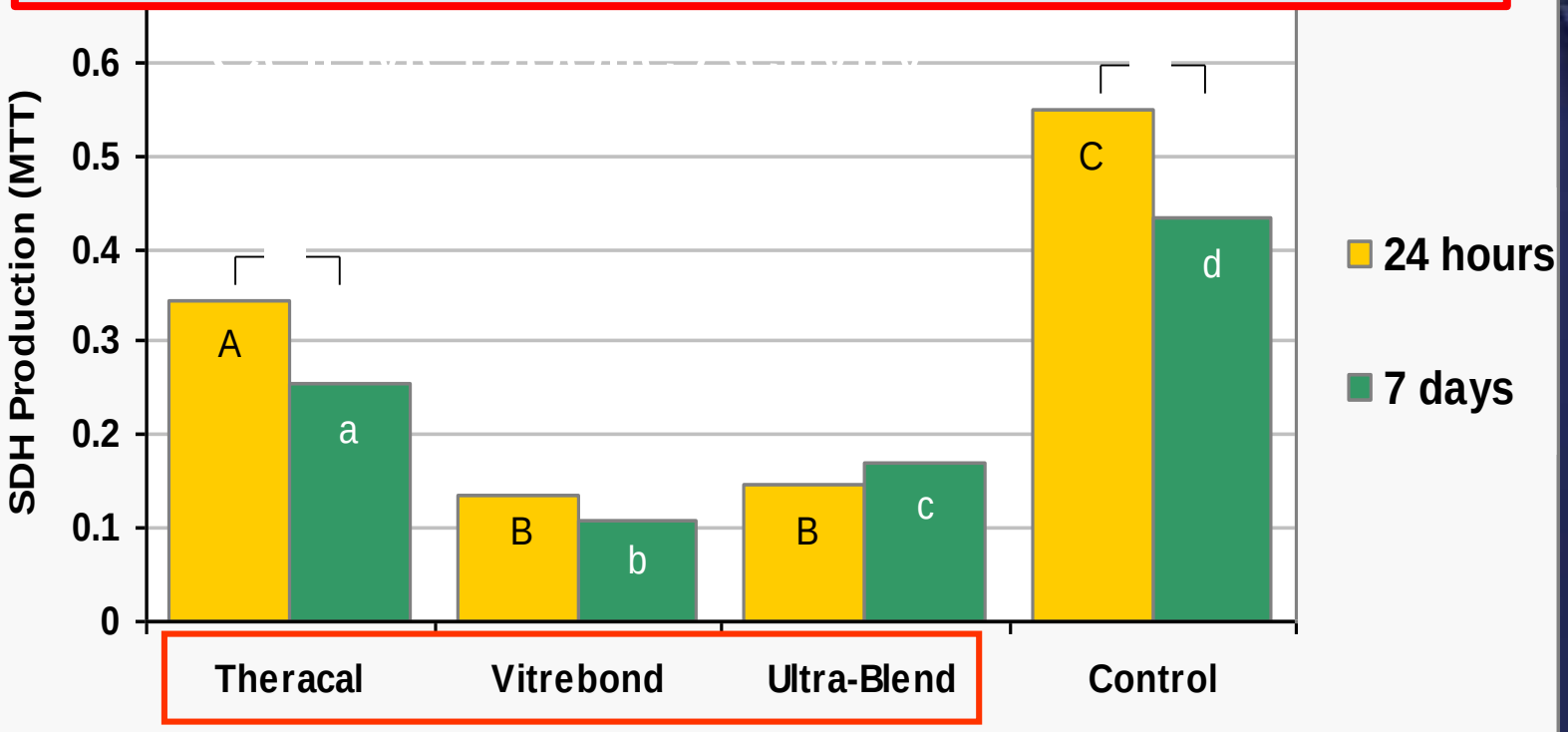


Figure 1. Succinic dehydrogenase (SDH) production detected by the MTT assay according to the groups and extract aging. Letters allow comparison among groups within the same period. Bars indicated by the same letter do not differ statistically (Mann-Whitney, $p>0.05$). Asterisks indicate statistical difference between periods within the groups (Mann-Whitney, $p<0.05$).

TheraCal presented the lowest suppression of cell protein expression

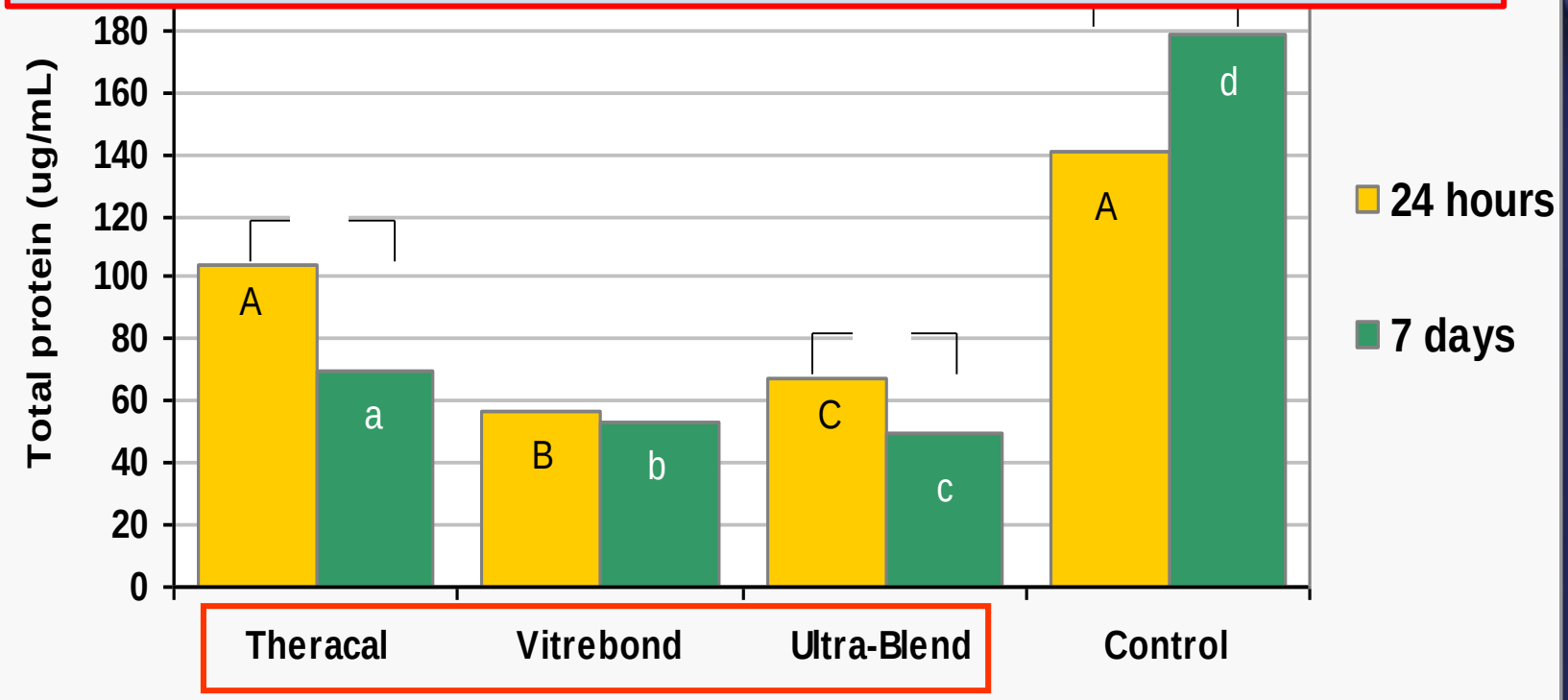


Figure 2. Total protein expression (µg/mL) according to the groups and extract aging. Letters allow comparison among groups within the same period. Bars indicated by the same letter do not differ statistically (Mann-Whitney, $p>0.05$). Asterisks indicate statistical difference between periods within the groups (Mann-Whitney, $p<0.05$).

Numero
Studies

Cal

Materials and Methods (cont.)

Each quadrant was randomly assigned to one of four treatment groups;

(Group A), TheraCal (Bisco) was applied to the pulpal tissue and light cured for 15 seconds

(Group B), pure Portland cement mixed with a 2% chlorhexidine solution and applied

(Group C), Triage, Fuji VII (GC America) mixed in capsule and injected

(Group D), VLC Dycal (Dentsply) applied and light cured

The pulp capping bases were then covered with a RMGI (Fuji II LC GC America).

Results:

- TheraCal LC

Very little if any inflammation and good **hard** tissue bridge formation

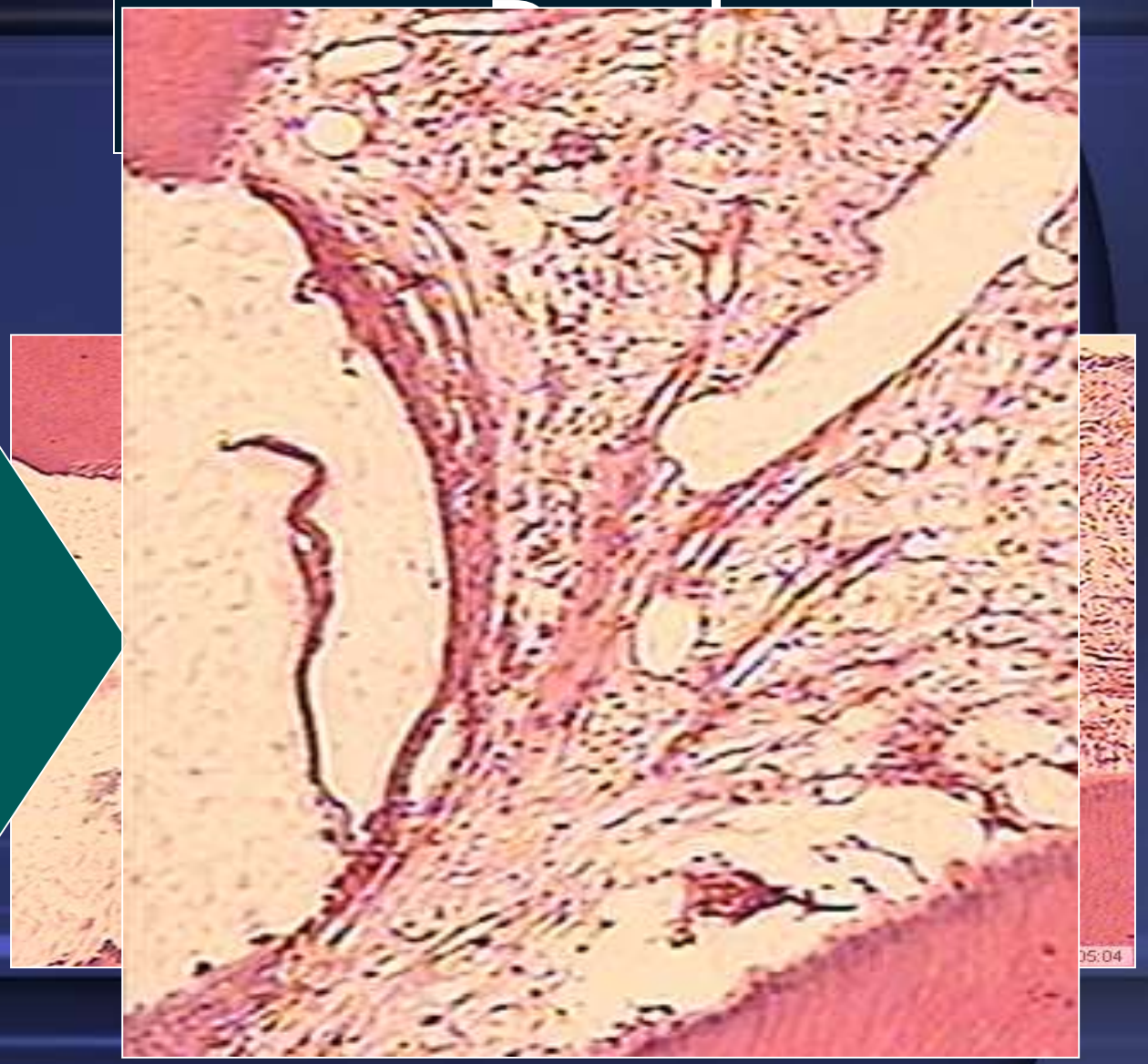
Results:

Some bridging Inflammatory cells

- Glass Ionomer Cement

Results:

- Visible Light Cured

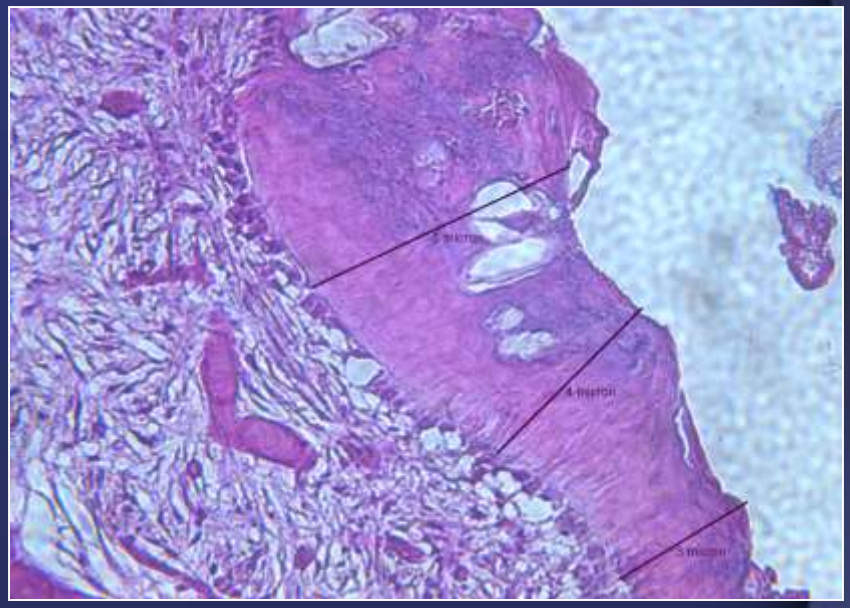


Very poor dentin bridging
Some
Inflammatory infiltrate and vacuoles

Results:

28 Days

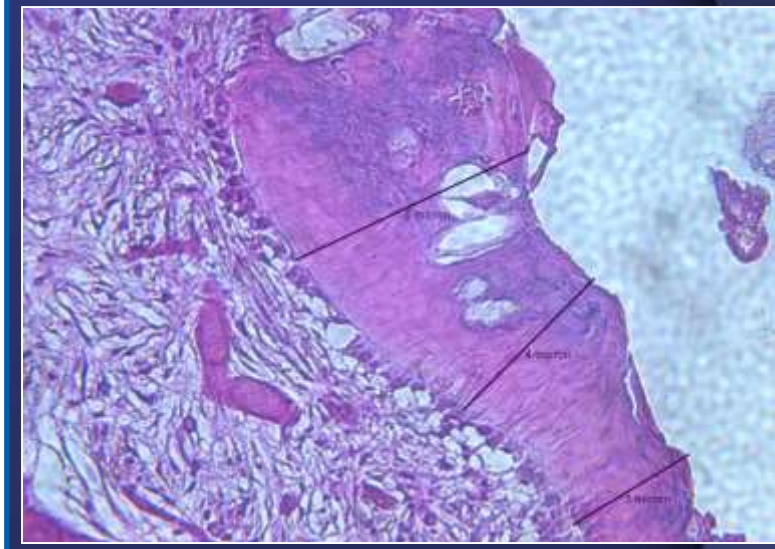
- Hard Tissue Bridge Thickness
  - TheraCal and Portland average the same thickness
  - Glass Ionomer and VLC Dycal average less than a fifth as thick as TheraCal



Material	TheraCal	GIC	PC	Dycal
Average	50.27µ	10.72µ	60.72µ	10.90µ

Statistical Analysis

Measured thickness of the hard tissue bridges with the pure Portland and TheraCal groups **statistically greater** than that of the other two groups (H= 15.849 with 3 degrees of freedom, P=0.002).



3 sections measured at 3 different areas

Results:

- MicroCT
- Light cured

Primate Pulpal Healing after Exposure and TheraCal Application

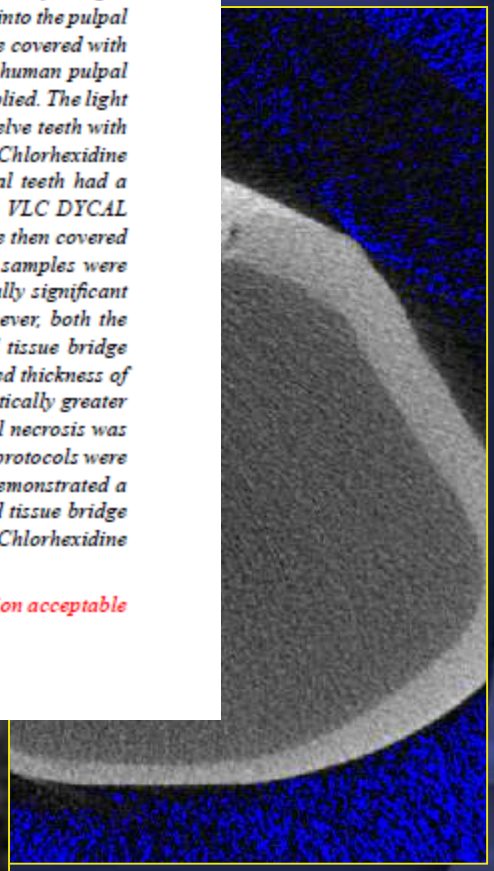
Cannon M*/ Gerodias N**/ Vieira A***/ Percinoto C****/ Jurado R*****

Aim: The purpose of this in vivo study was to compare the effectiveness of a new light cured resin based dicalcium/tricalcium silicate pulp capping material (TheraCal LC, Bisco), pure Portland cement, resin based calcium hydroxide or glass ionomer in the healing of bacterially contaminated primate pulps. Study design: The experiment required four primates each having 12 teeth prepared with buccal penetrations into the pulpal tissues with an exposure of approximately 1.0 mm. The exposed pulps of the primate teeth were covered with cotton pellets soaked in a bacterial mixture consisting of microorganisms normally found in human pulpal abscesses. After removal of the pellet, hemostasis was obtained and the pulp capping agents applied. The light cured resin based pulp capping material (TheraCal LC) was applied to the pulpal tissue of twelve teeth with a needle tip syringe and light cured for 15 seconds. Pure Portland cement mixed with a 2% Chlorhexidine solution was placed on the exposed pulpal tissues of another twelve teeth. Twelve additional teeth had a base of GIC applied (Triage, Fuji VII GC America) and another twelve had a pulp cap with VLC DYCAL (Dentsply), a light cured calcium hydroxide resin based material. The pulp capping bases were then covered with a RMGI (Fuji II LC GC America). The tissue samples were collected at 4 weeks. The samples were demineralized, sectioned, stained and histologically graded. Results: There were no statistically significant differences between the groups in regard to pulpal inflammation (H= 0.679, P=1.00). However, both the Portland cement and light cured TheraCal LC groups had significantly more frequent hard tissue bridge formation at 28 days than the GIC and VLC Dycal groups (H= 11.989, P=0.009). The measured thickness of the hard tissue bridges with the pure Portland and light cured TheraCal LC groups were statistically greater than that of the other two groups (H= 15.849, P=0.002). In addition, the occurrence of pulpal necrosis was greater with the GIC group than the others. Four premolars, one each treated according to the protocols were analyzed with a microCT machine. The premolar treated with the light cured TheraCal LC demonstrated a complete hard tissue bridge. The premolar treated with the GIC did not show a complete hard tissue bridge while the premolar treated with VLC Dycal had an incomplete bridge. The pure Portland with Chlorhexidine mixture created extensive hard tissue bridging.

Conclusion: TheraCal LC applied to primate pulps created dentin bridges and mild inflammation acceptable for pulp capping.

Key words: pulp exposures, pulp response, bacteria, primate

The Journal of Clinical Pediatric Dentistry Volume 38, Number 4/2014



Bridge

Yongsei Dog Study

Basic Research—Technology

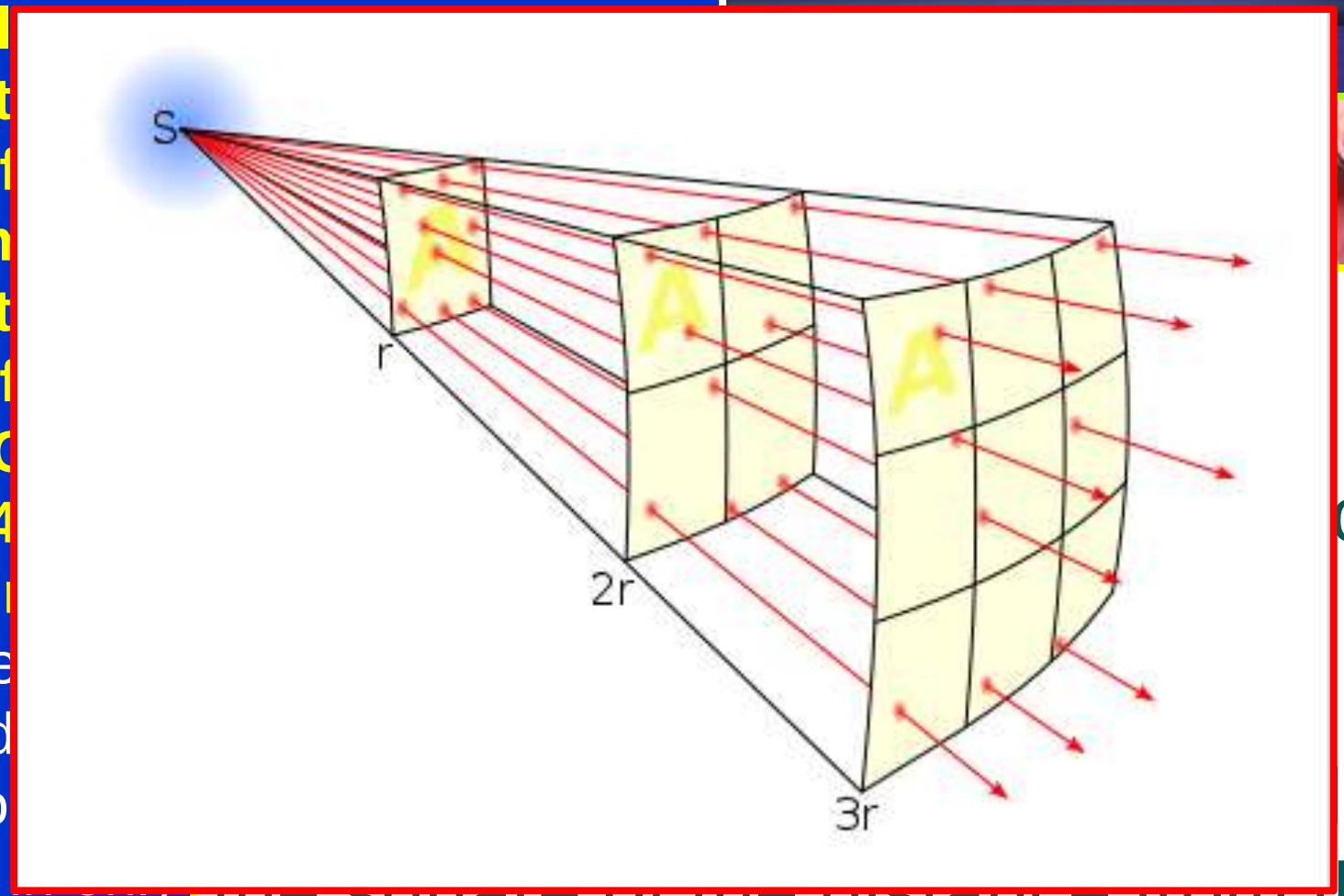
Comparative Study of Pulpal Responses to Pulpotomy with ProRoot MTA, RetroMTA, and TheraCal in Dogs' Teeth

Haewon Lee, DDS, Yooseok Shin, DDS, PhD,† Seong-Oh Kim, DDS, PhD,*‡ Hyo-Seol Lee, DDS, PhD,*‡ Hyung-Jun Choi, DDS, PhD,*‡ and Je Seon Song, PhD*‡*

This study was conducted to evaluate and compare pulpal responses to **ProRoot MTA (Dentsply Tulsa Dental, Tulsa, OK), RetroMTA (BioMTA, Seoul, Korea), and TheraCal (Bisco Inc, Schamburg, IL)** in dog partial pulpotomy models.

Yongsei Dog Study

Compl
format
33% of
specin
format
75% of
TheraC
mild (4
inflam
mild de
palisad
odonto
visible
specimens, w
odontoblasts a
cells.



cs,

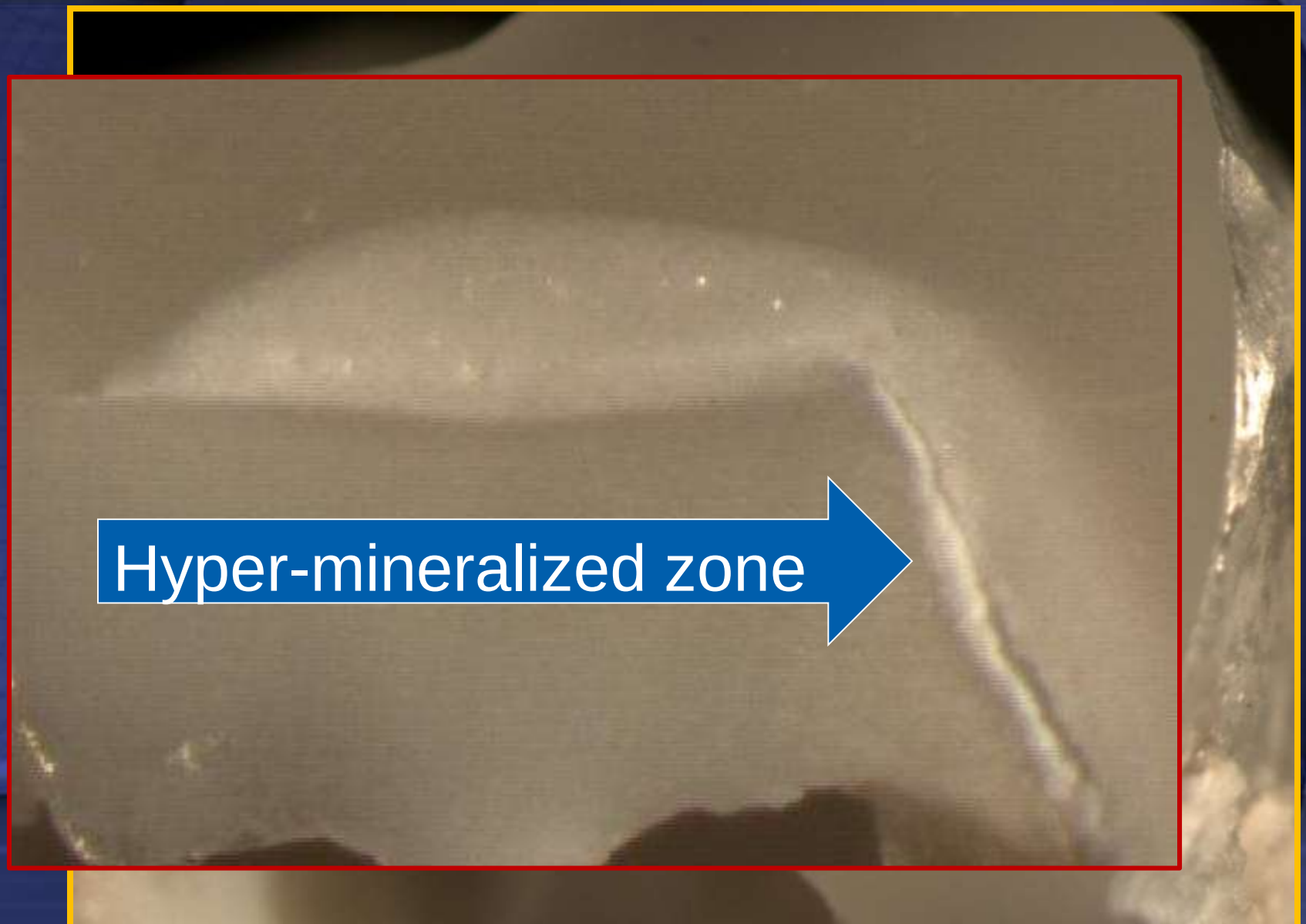
to

the square of the distance from the source of that physical quantity.

Yongsei Dog Study

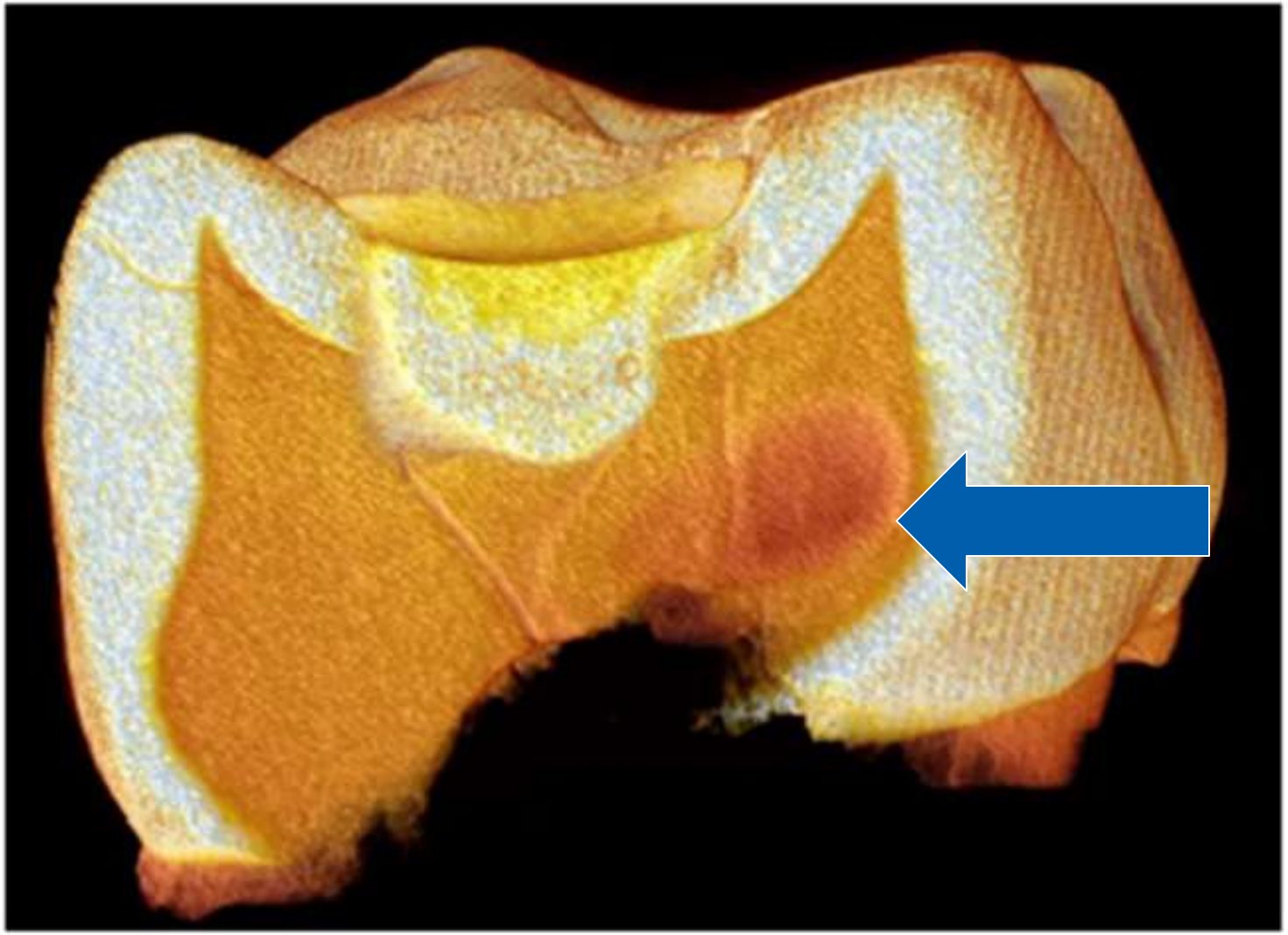
ious in
nitations
n vivo
els in
. Our
teeth,
material.
d
ells (32,
resent
with
o

Retrieval Studies! TheraCal LC



Retrieval Studies! Pulpotomy

Retrievals- 9 years old



Failed Amalgam – painful, cracked

- Constant sensitivity to cold and hot-
- Spontaneous pain
- Can’t eat

Failed Amalgam – painful, cracked

- Bleu Cheese **Dycal**- soft, recurrent caries, stained margins, amalgam flies out

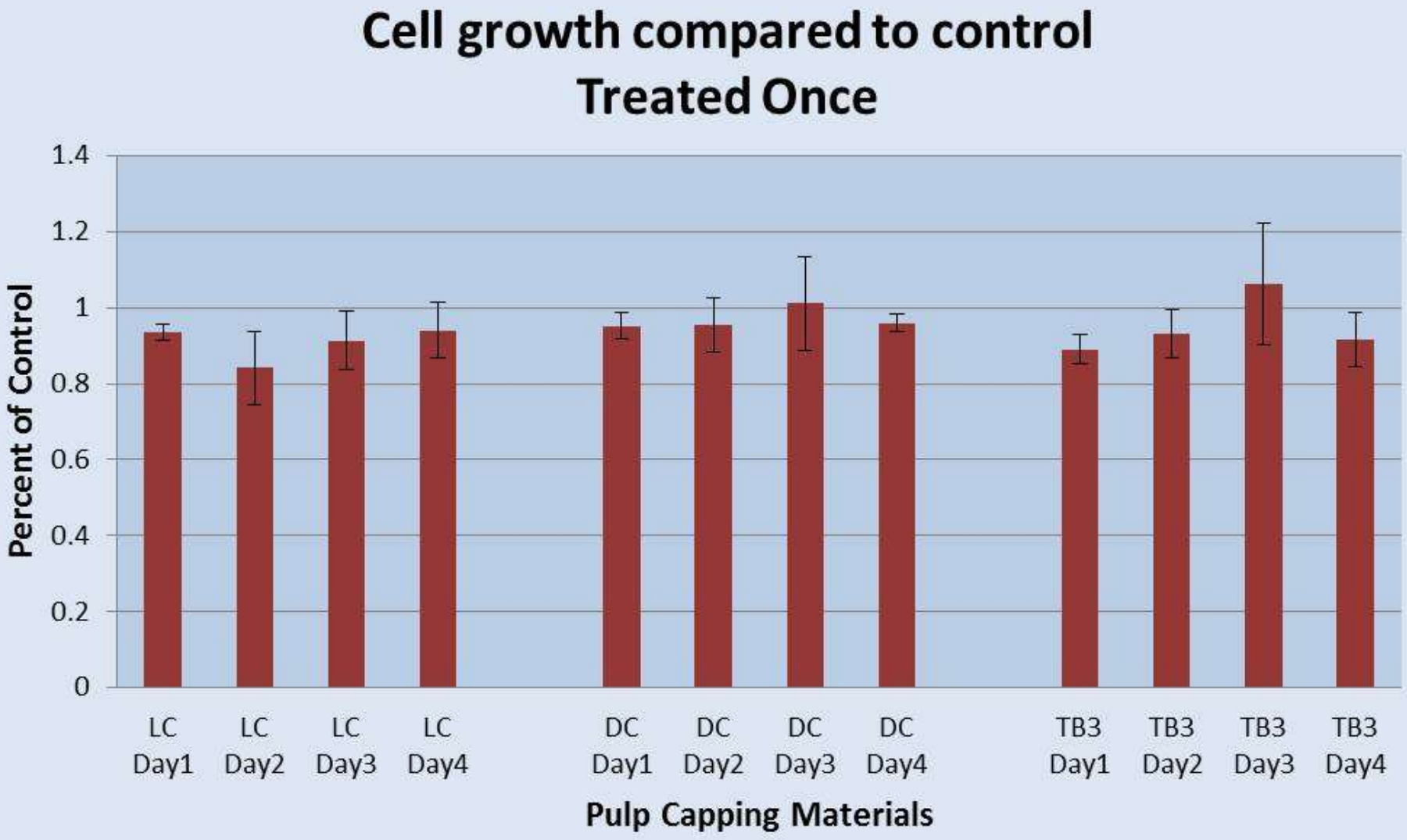
Failed Amalgam – painful, cracked

- **Dycal** and underlying carious dentin removed, microleakage stain left for photo

Failed Amalgam – painful, cracked

- TheraCal DC placed after etching, light cured for 20 seconds (but dual cure, base)

TheraCal Products



Completed Restoration

- Molar resto ALLBOND Universal a Activa Restorative
- Occlusion adjusted, slightly into cuspal contact due to **STA**

Calcium Fluoride- **insoluble**

- **FDA**- cannot have bioactive calcium and fluoride in a water based toothpaste
- **MI Paste Plus-** from GC- has virtually NO water

Calcium Fluoride- **insoluble**

- **Objectives:** The aim of this in vitro study was to evaluate the effects of overlaying **RMGI (Vitrebond Plus, 3M Oral)** on the calcium release of **resin-modified calcium silicate (TheraCal LC)** and bond strength between TheraCal LC (Bisco) and resin composite **(Reveal Bulk, Bisco).**

Calcium Fluoride- **insoluble**

Material and Methods: For calcium release study, fully cured TheraCal LC disks were prepared ***(2-cm-diameter and 0.1-cm-high).*** One side of TheraCal LC disk was covered by other materials (as shown in Table 1). Disks were then stored in 20ml of deionized water at 37ºC. **Release of ions was measured on Orion Model 710A+ after 1 day, 3 days and 7 days** with new deionized water being replenished after each test. **For shear bond strength study, fully cured TheraCal disks (6mm-diameter, 3mm-height) was bonded with resin composite as shown in Table 1 (group 1 and 2), by using notched-edge shear bond strength test method (ISO 29022:2013).** The specimens were then stored in 37ºC-water/24-hours before breaking by Instron tester (crosshead-speed 1mm/min). The data were analyzed statistically by one-way ANOVA and Student-t Tests.

Calcium Fluoride- **insoluble**

Conclusion: The overlaying RMGI reduced the calcium r

Cal
Cal
Cal

And why do Dental Schools teach everything wrong??

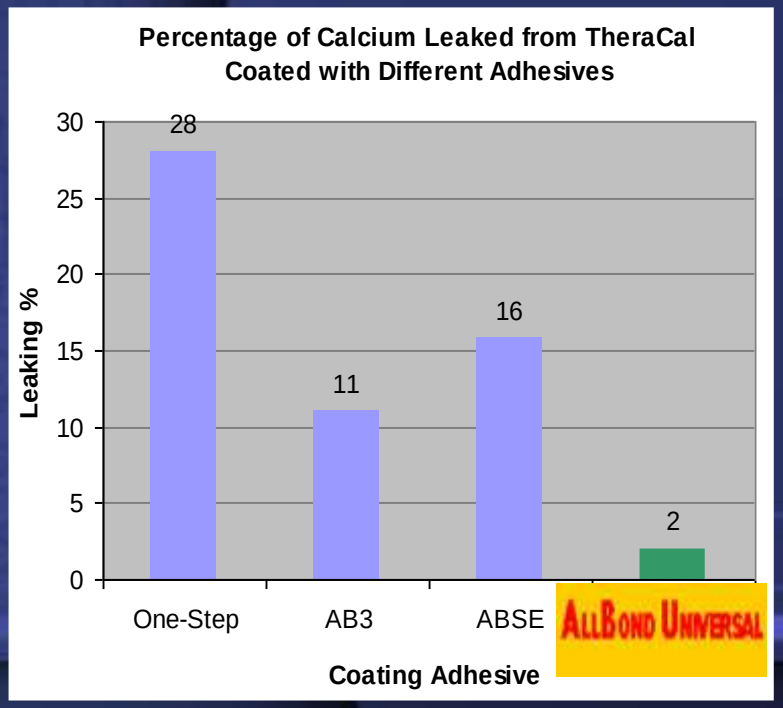
T

for Dycal!!!!

same row ($p<0.05$).

ALLBOND UNIVERSAL:
Non-permeable Hydrophobic Adhesive

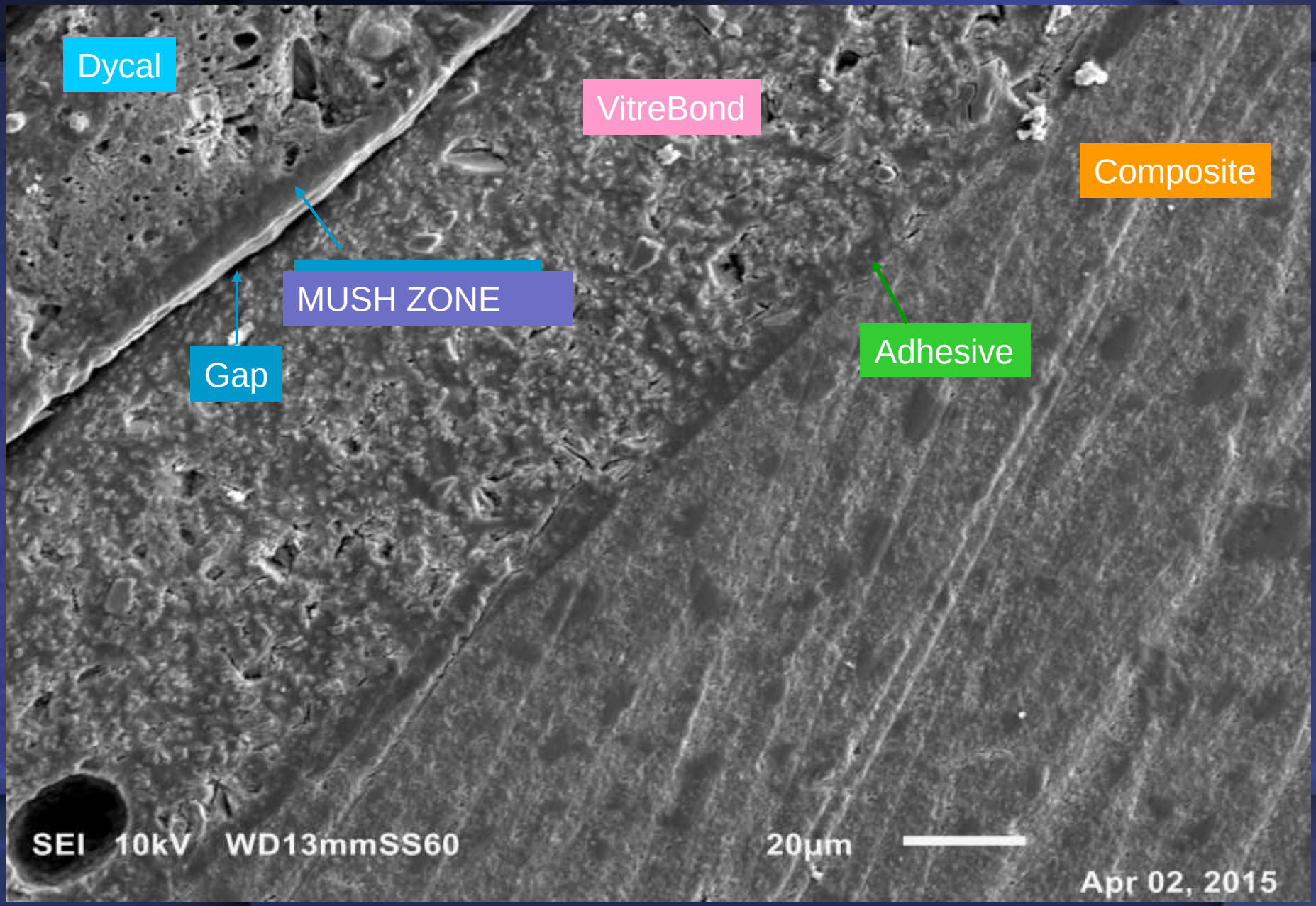
Calcium Release of TheraCal Discs with and without Adhesive Coating



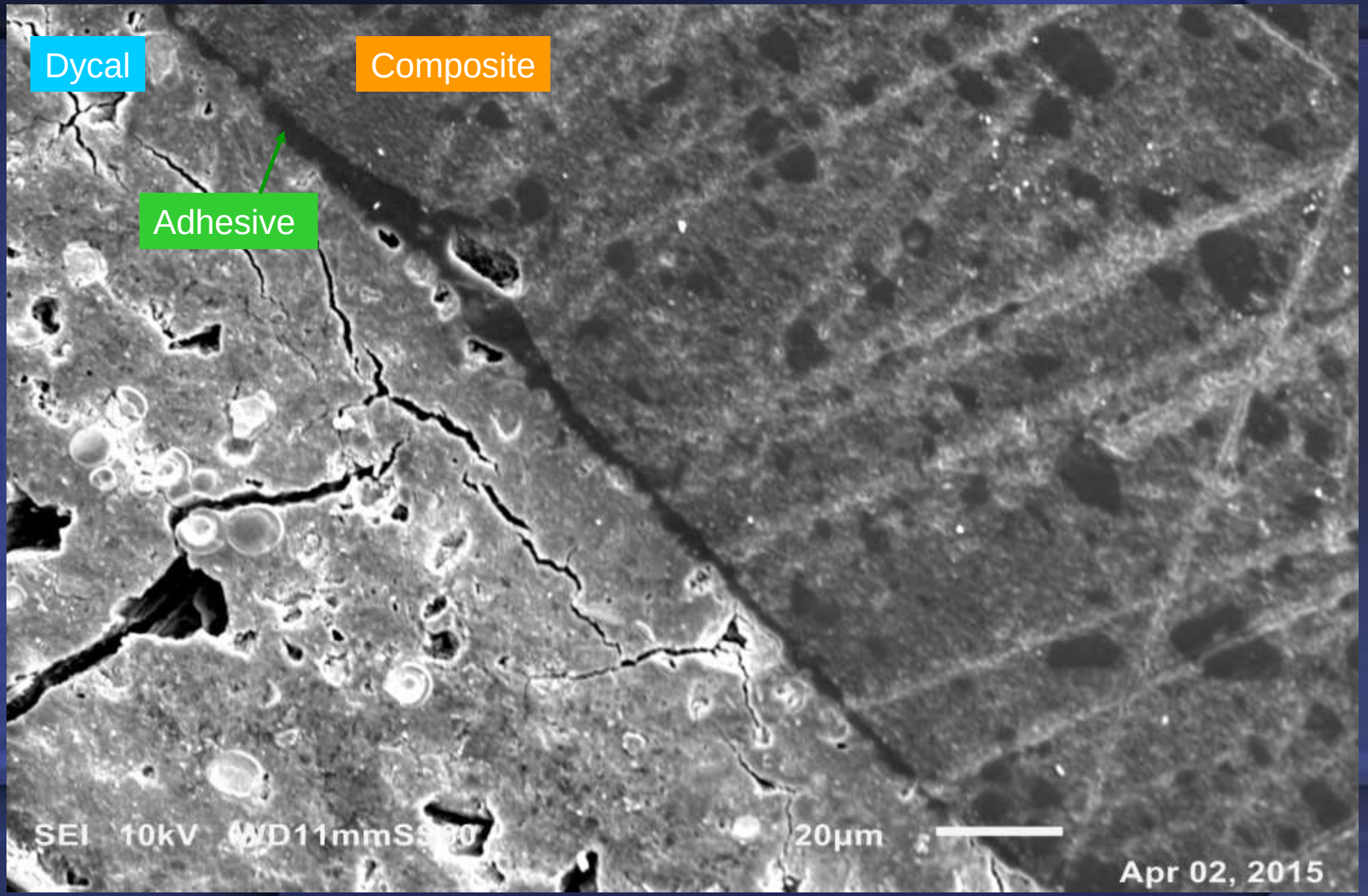
	Ca(ug/cm²)	Percentage
Control	**284.2** (0.0) d	**100.0%**
One-Step	**79.6** (23.8) c	**28.0%**
AB3	**31.2** (15.5) b	**11.0%**
ABSE	**44.9** (16.4) b	**15.8%**
AllBond Universal	**5.7** (2.0) a	**2.0%**

TheraCal (a calcium-release pulp capping material) disks was coated with different adhesives. Calcium release was measured after TheraCal discs were immersed in 37ºC-DI water for 1 day.

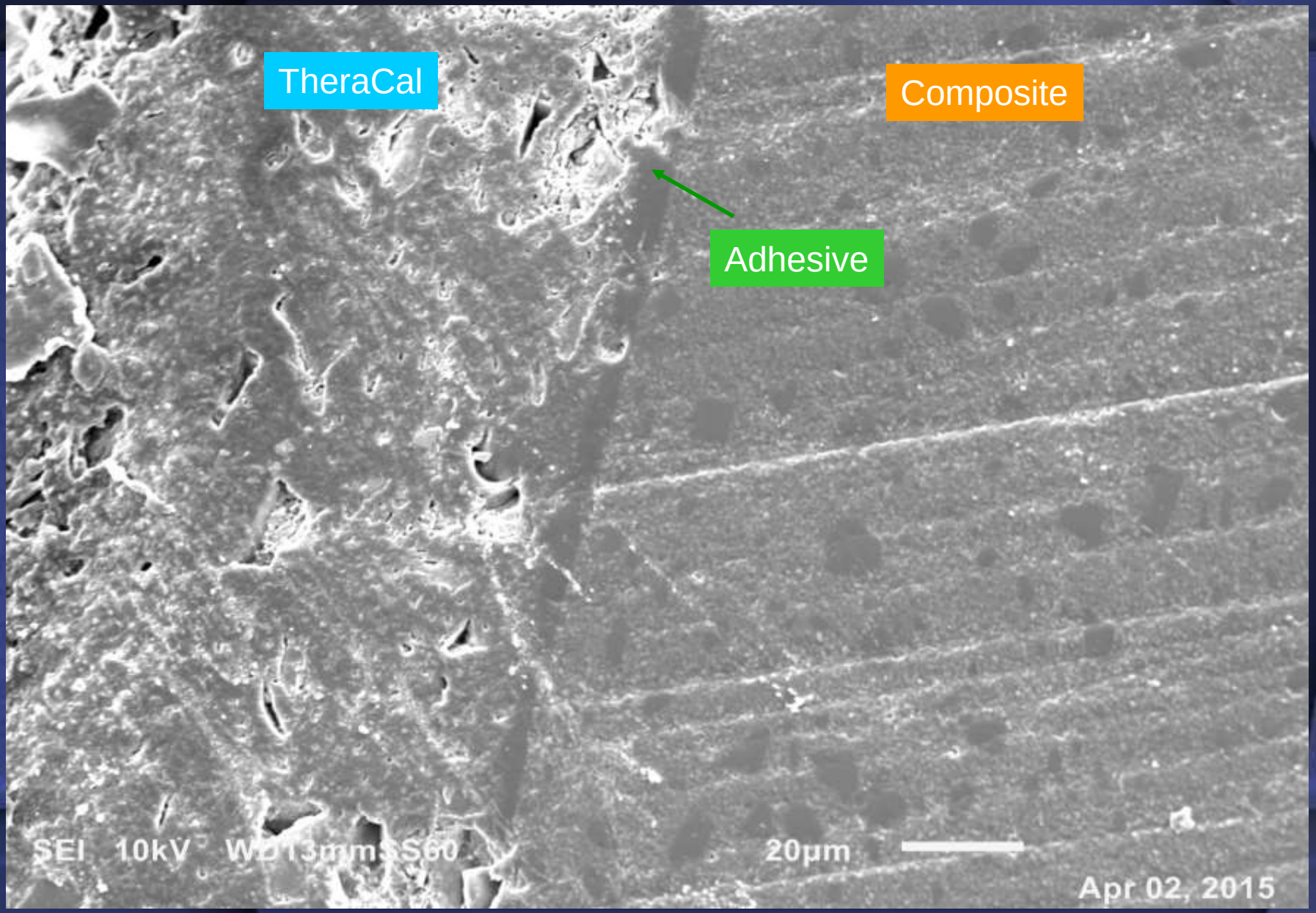
Shear bond strength (Dycal-RMGI): 0.0±0.0 Mpa the MUSH zone!!
Majority of Failure Modes: Adhesive failure between Dycal & Vitrebond



Shear bond strength (Dycal-Composite): 4.5±1.3 MPa
Majority of Failure Modes: Substrate-Dycal Broken



Shear bond strength (TheraCal-Composite): 15.0±4.1MPa
Majority of Failure Modes: Substrate-TheraCal Broken



Dental Materials Journal 2016; 35(6): 881–887

Shear bond strength of a novel light cured calcium silicate based-cement to resin composite using different adhesive systems

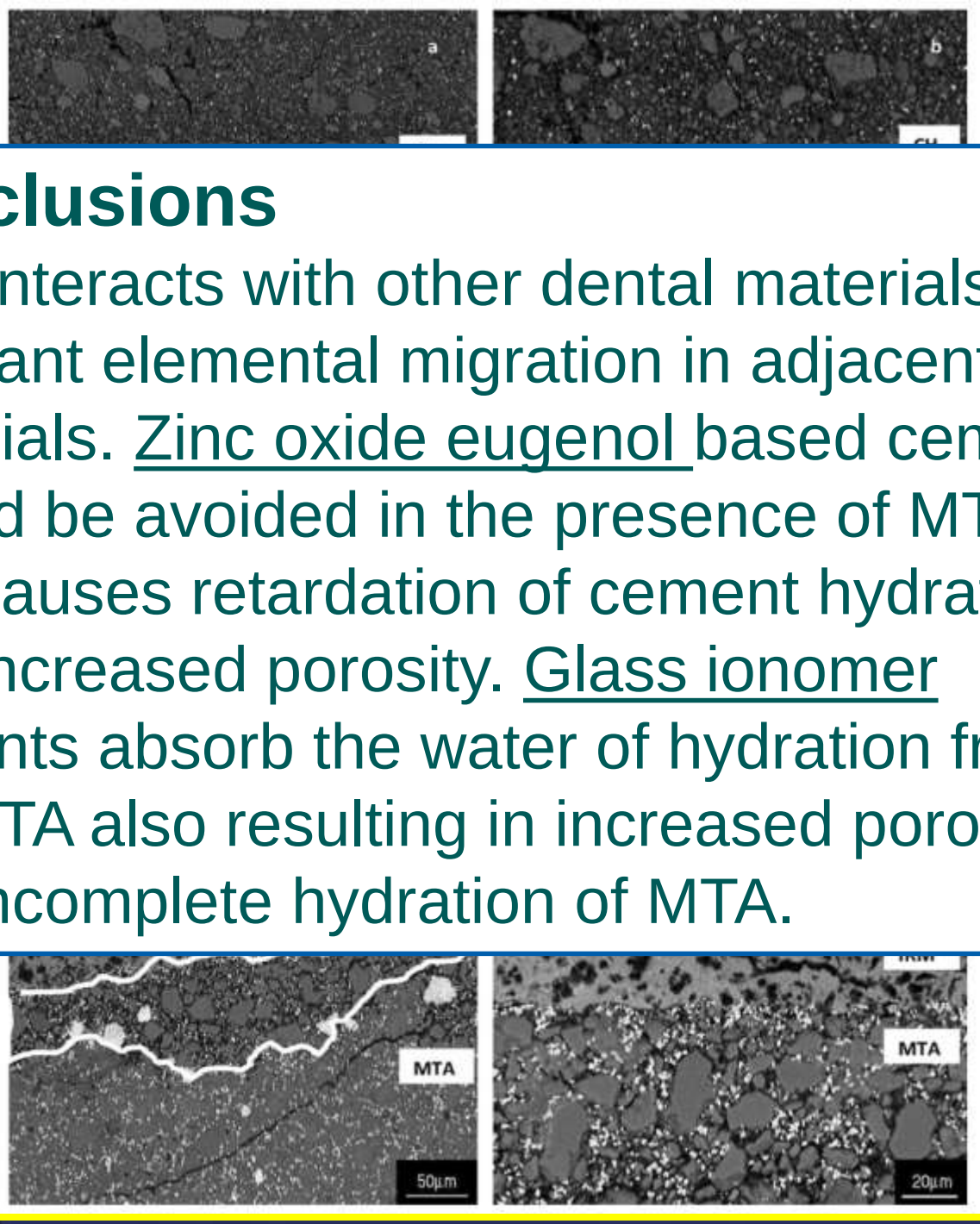
Hanan ALZRAIKAT[1], Nessrin A. TAHA[1], Deema QASRAWI[1] and Michael F. BURROW[2]

[1] *Department of Conservative Dentistry, Jordan University of Science and Technology, P.O.Box 3030, Irbid 22110, Jordan*
[2] *Chair of Biomaterials, Melbourne Dental School, The University of Melbourne, 720 Swanston Street, Victoria 3010, Australia*
Corresponding author, Hanan ALZRAIKAT; E-mail: hjsa@just.edu.jo

TheraCal LC displayed the highest SBS ($p<0.001$). MTA bonded with the 1-step self-etch adhesive showed the lowest SBS ($p<0.001$), while SBS of TheraCal LC and Fuji IX did not differ between either adhesive ($p>0.05$). **TheraCal LC is the preferred choice in pulp capping procedures when using resin composite restorations.**

Conclusions

MTA interacts with other dental materials with resultant elemental migration in adjacent materials. Zinc oxide eugenol based cements should be avoided in the presence of MTA as zinc causes retardation of cement hydration with increased porosity. Glass ionomer cements absorb the water of hydration from the MTA also resulting in increased porosity and incomplete hydration of MTA.



Important Concepts:

There Ain't No Such Thing As A Free Lunch

N ortant?

strength

JOCPD

Bond strength of different restorative materials to light-curable mineral trioxide

RESULTS:

The analysis of variance that compared the experimental groups revealed the presence of significant differences among the groups ($P < 0.001$). **The highest (19.3 MPa) and the lowest (3.4 MPa) bond strength value were recorded for the MB composite-TheraCal and the GIC-TheraCal, respectively**. There were significant differences in bond strength between the TheraCal and the MTA groups for the MB composite subgroup ($P < 0.001$) and the SB composite subgroup ($P < 0.05$); however, there was no significant difference in bond strength for the GIC subgroup ($P \not> 0.05$).

CONCLUSIONS:

The results from this in vitro study suggest that the new pulp capping material, known as **light-curable MTA, showed clinically acceptable and higher shear bond scores compared to MTA** when used with the MB composite.

S
A
m
d
T
T
s
S
F
te
stereomicroscope at ×25 magnification.

Bioactivity and Dental Materials

DIAGNOdent reading of 68
Odd radiolucency on radiograph

Bioactivity and Dental Materials

"Giant tubular dentin" defect in mesial fossa

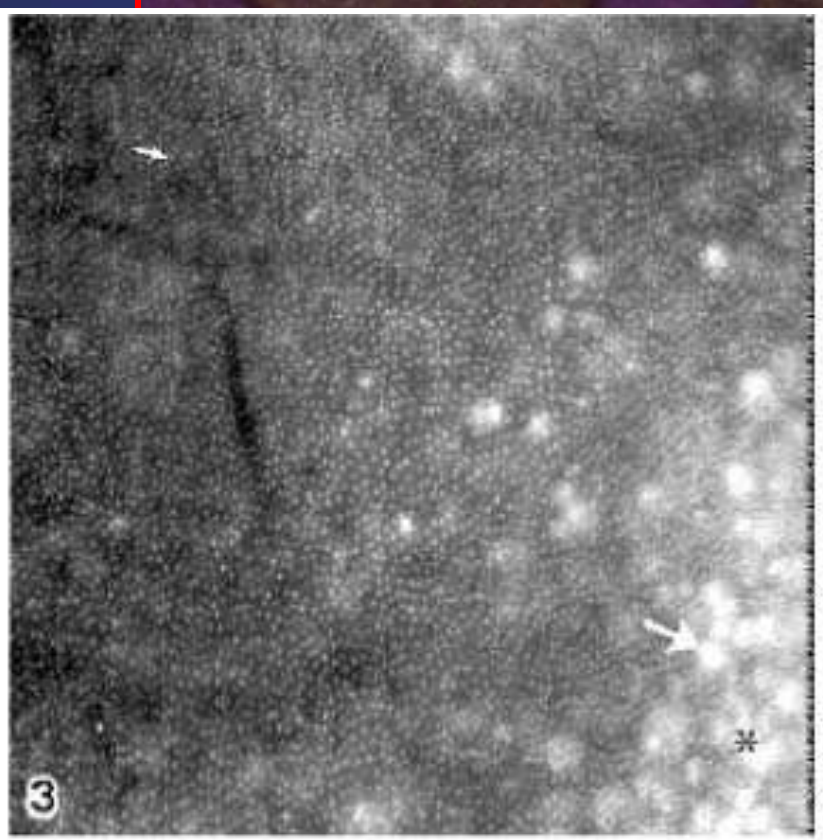


Figure 3. Transverse demineralized section of a non-erupted human deciduous incisor tooth showing dentinal tubule holes (small arrow), giant tubules (large arrow), and interglobular dentin (*). Picrosirius. Original magnification: 250X.

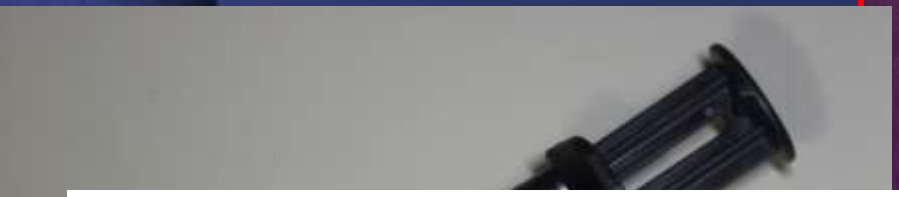
Bioactivity and Dental Materials

Selective etching of enamel for 30 seconds followed by application of semi-gel to dentin for **3** seconds

Uni-Etch with BAC

Bioactivity and Dental Materials

TheraCal DC placed on affected dentin for re-mineralization



Bioactivity and Dental Materials

Light cure for 20 seconds with at least 500 milliwatts/cm^2

Bioactivity and Dental Materials

ALLBond Universal exp applied to preparation creates glossy appearance to TheraCal exp

Bioactivity and Dental Materials

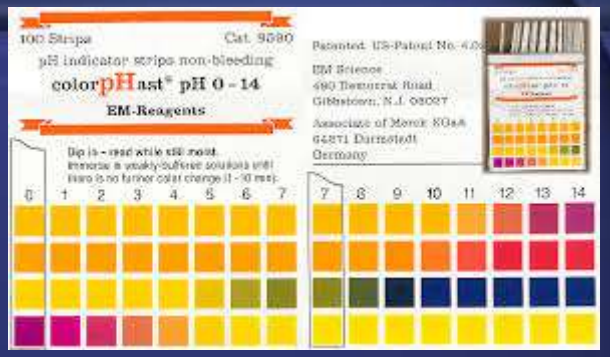
Light cure for ten seconds at 500 milliwatts/cm^2

Bioactivity and Dental Materials

Liner/base placed
Dentin replacement
-biomemetic
-bioactive
-biofunctional

A ase


1.09535.0001
100 Tests
MColorpHast™
pH-indicator strips (non-bleeding)
pH 0 - 14
Universal indicator
pH-Indikatorstäbchen (nicht blutend)
Bandelettes indicatrices de pH
(ne déteignant pas)
Tiras indicadoras del pH (no destiñen)
0 1 2 3 4 5 6 7


100 Strips
Cat. 9580
pH indicator strips non-bleeding
colorpHast® pH 0 - 14
EM-Reagents
EM Science
480 Democrat Road
Gibbstown, N.J. 08027
Associate of Merck KGaA
64271 Darmstadt
Germany
0 1 2 3 4 5 6 7
7 8 9 10 11 12 13 14

Non- Alkaline, No Ca release

RMGI- Fuji II LC acid/base

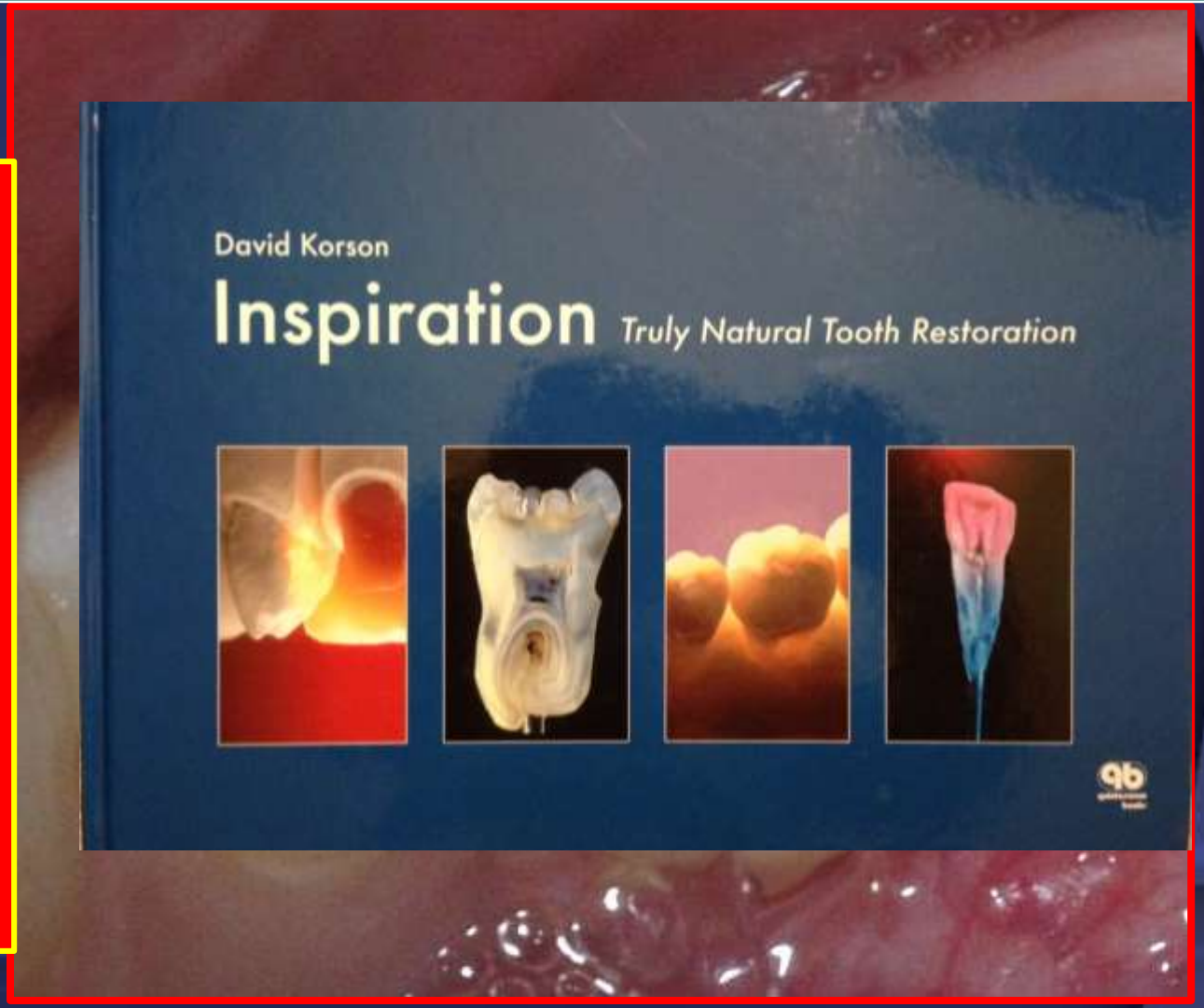
Apples and Oranges

Bioactivity and Dental Materials

Restoration completed by placement of a nano-hybrid restorative material, replacing the enamel

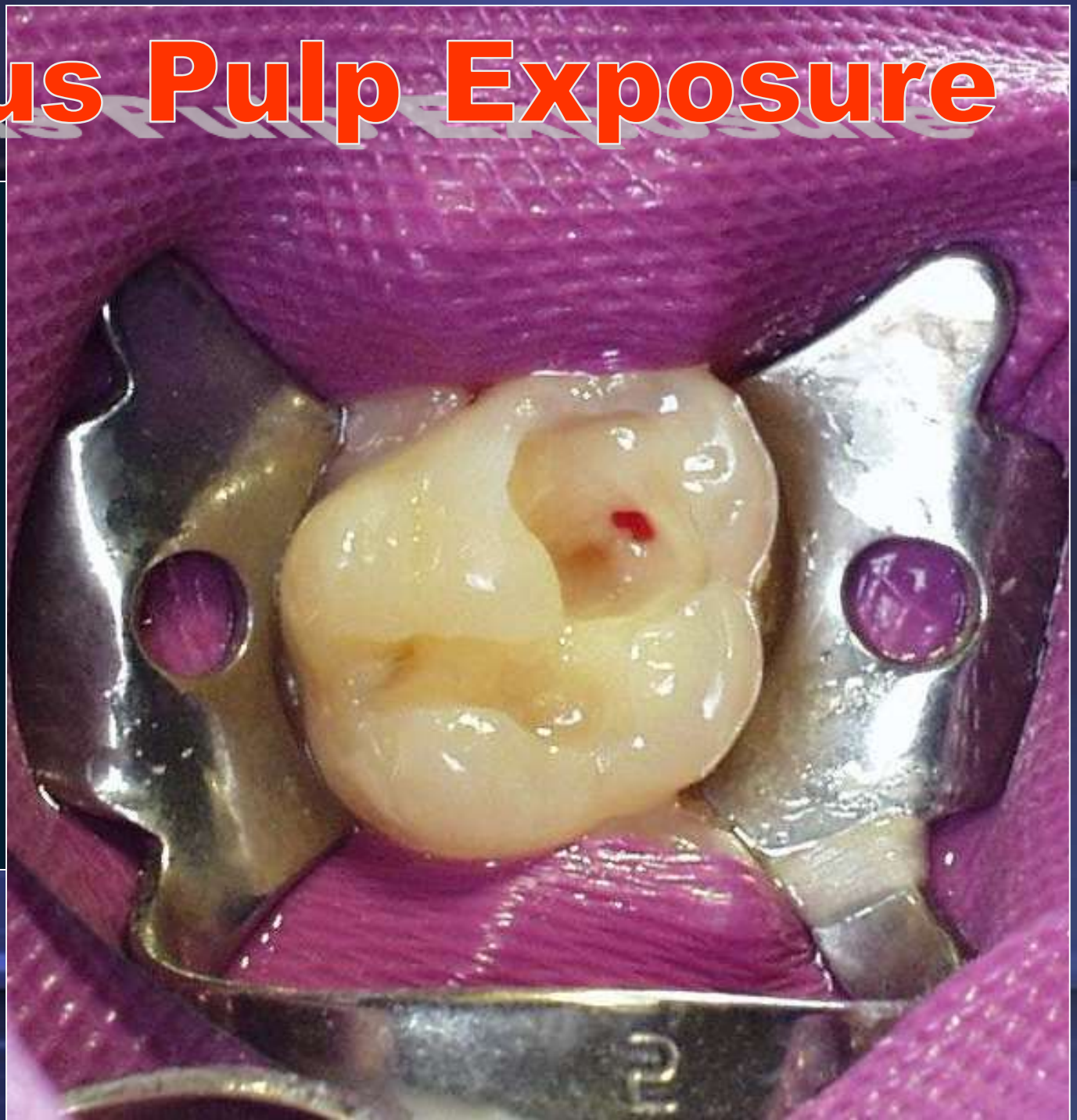
Bioactivity and Dental Materials

Rubber dam removed and occlusion checked - Restoration polished.



Carious Pulp Exposure

- Pulp exposure
- Not symptom-atic
- All decay removed



Easily placed

- TheraCal applied
- Thin layer- can see blush through it

resin based tricalcium silicate and dicalcium silicate

Follow Up- Recall

- Six month recall
- Totally asymptomatic
- Marginal integrity quite good

Follow Up- Recall

- Six years later
- Still totally as
- M in ac

Trauma

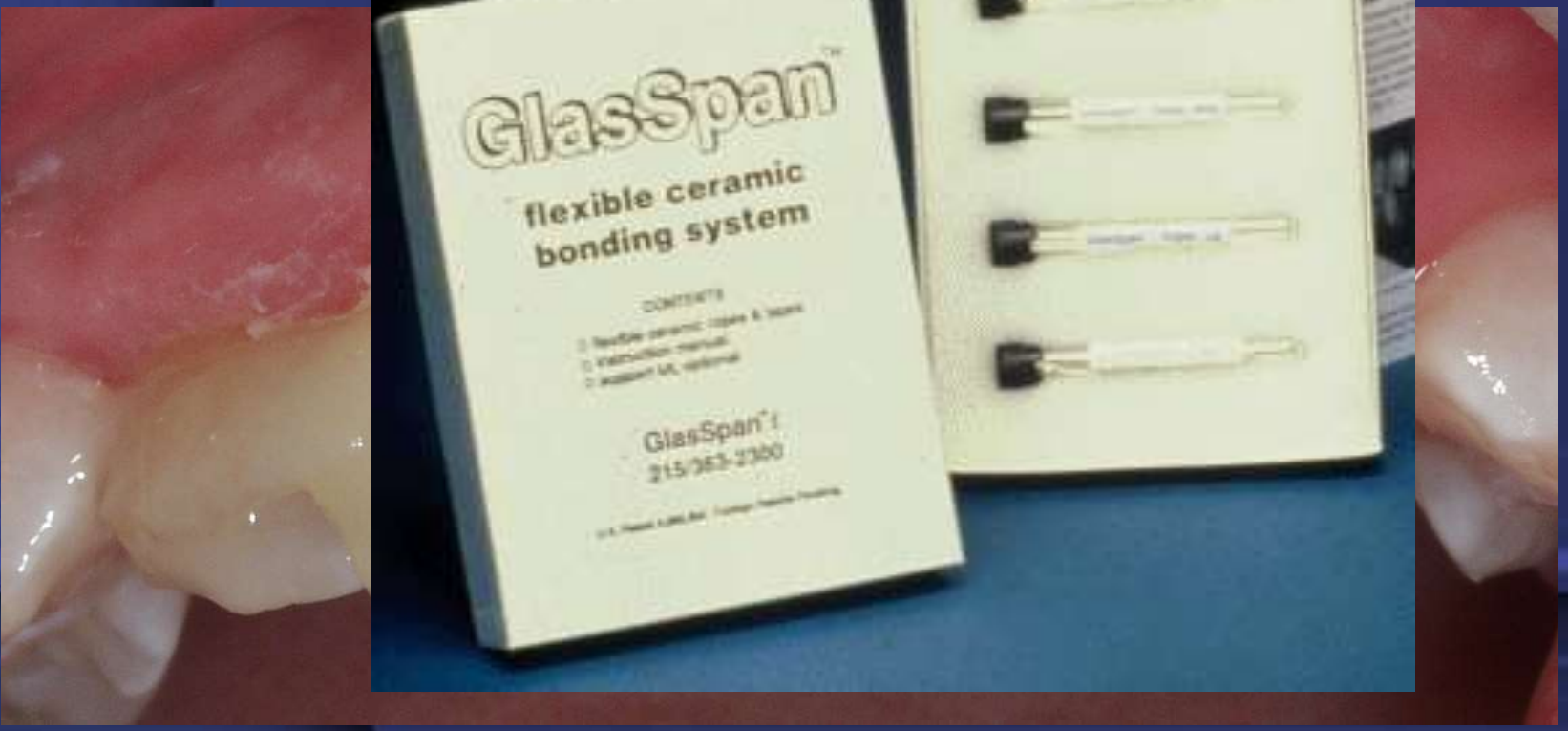
- Complicated profound crown fracture
- Pinpoint exposure
- ble

Trauma

- Complicated profound crown fracture
- Exposure protected by TheraCal
- Fragment re-attached

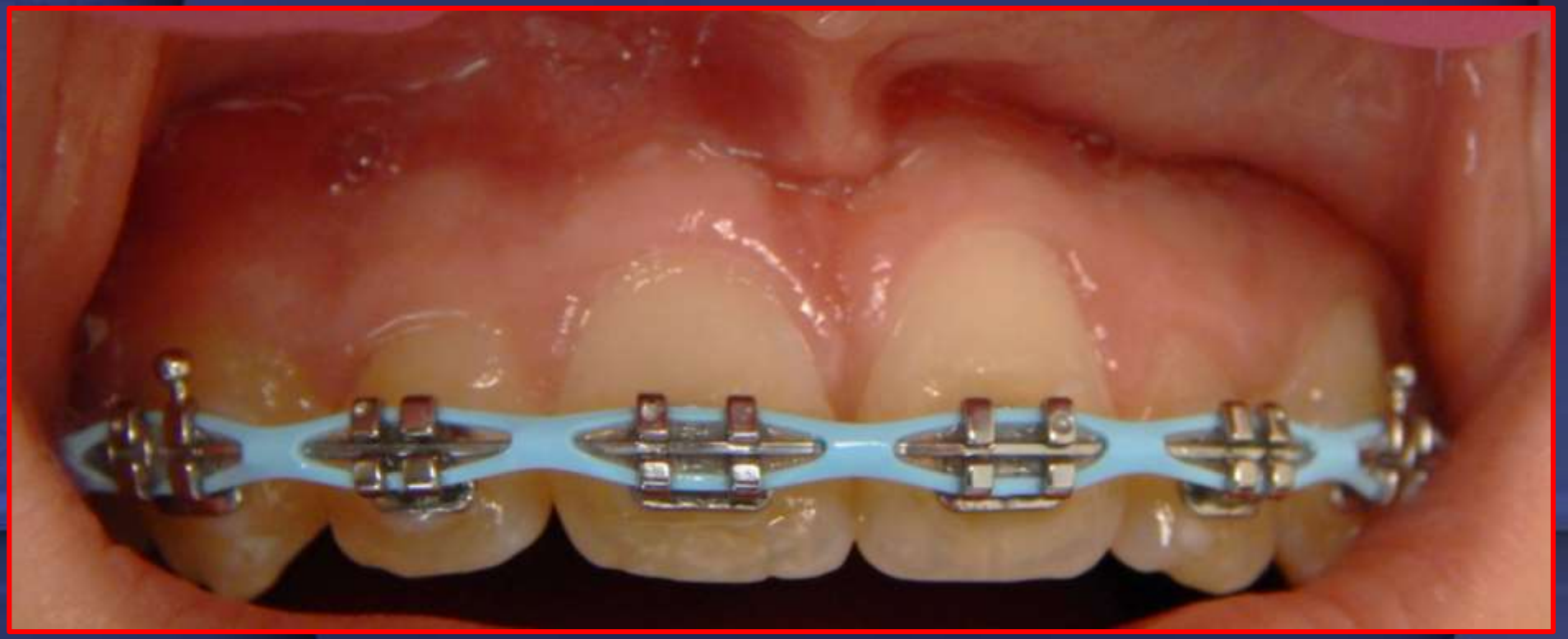
Trauma

- Complicated profound crown fracture
- GlasSp[illegible]ion of adjace[illegible]



- **Lateral luxation- TheraCal LC**
- **2 years later- in orthodontics**

GlasSpan splints TheraCal LC



- **4 years later- post orthodontics!**

GlasSpan splints- TheraCal LC

Esthetics- Problems

mom states that he is “not ideal dental patient”.

Esthetics- Problems

- Rubber dam isolation after STA anesthesia
- Patient very cooperative

Esthetics- Problems

- Extensive dental caries- history of sensitivity but not mobile, reversible pulpalitis

Esthetics- Problems

Garrison
Dental Solutions

All deep areas are covered with bioactive TheraCal LC to re-mineralize and to maintain vitality!!

Esthetics- Problems

- Restored with Activa Pulpdent restorative material- note the margins!

Esth m

- Ver tha
  me ur
  saic ST

DENTAL PRODUCTS RE

How to

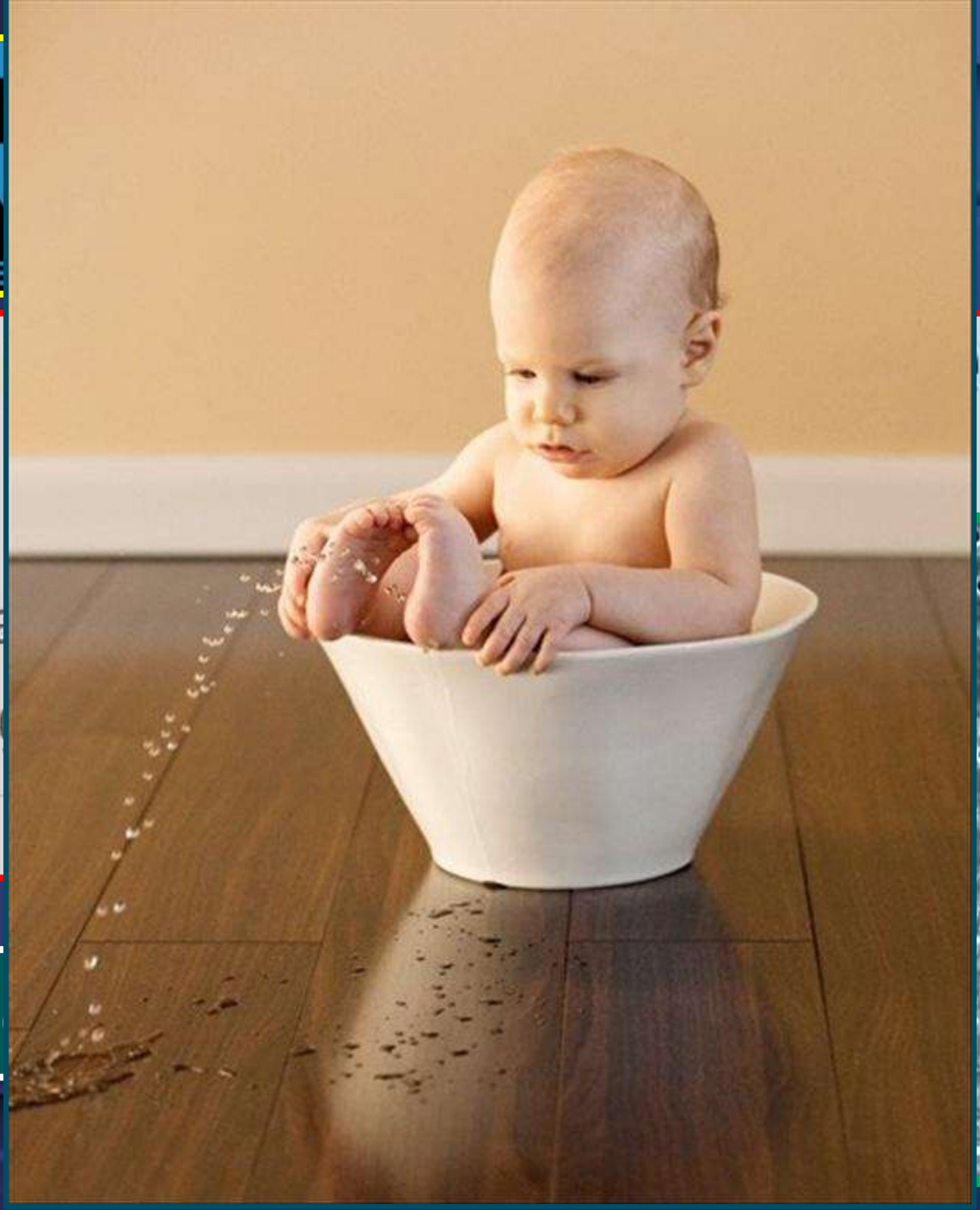
care

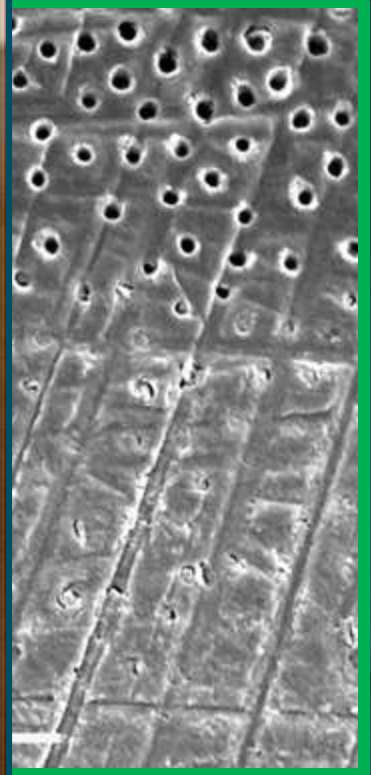
Why one pra

closest thin

April 20, 2018

better





The thr

Clinical Case

- Caries involving central and lateral incisors

Clinical Case

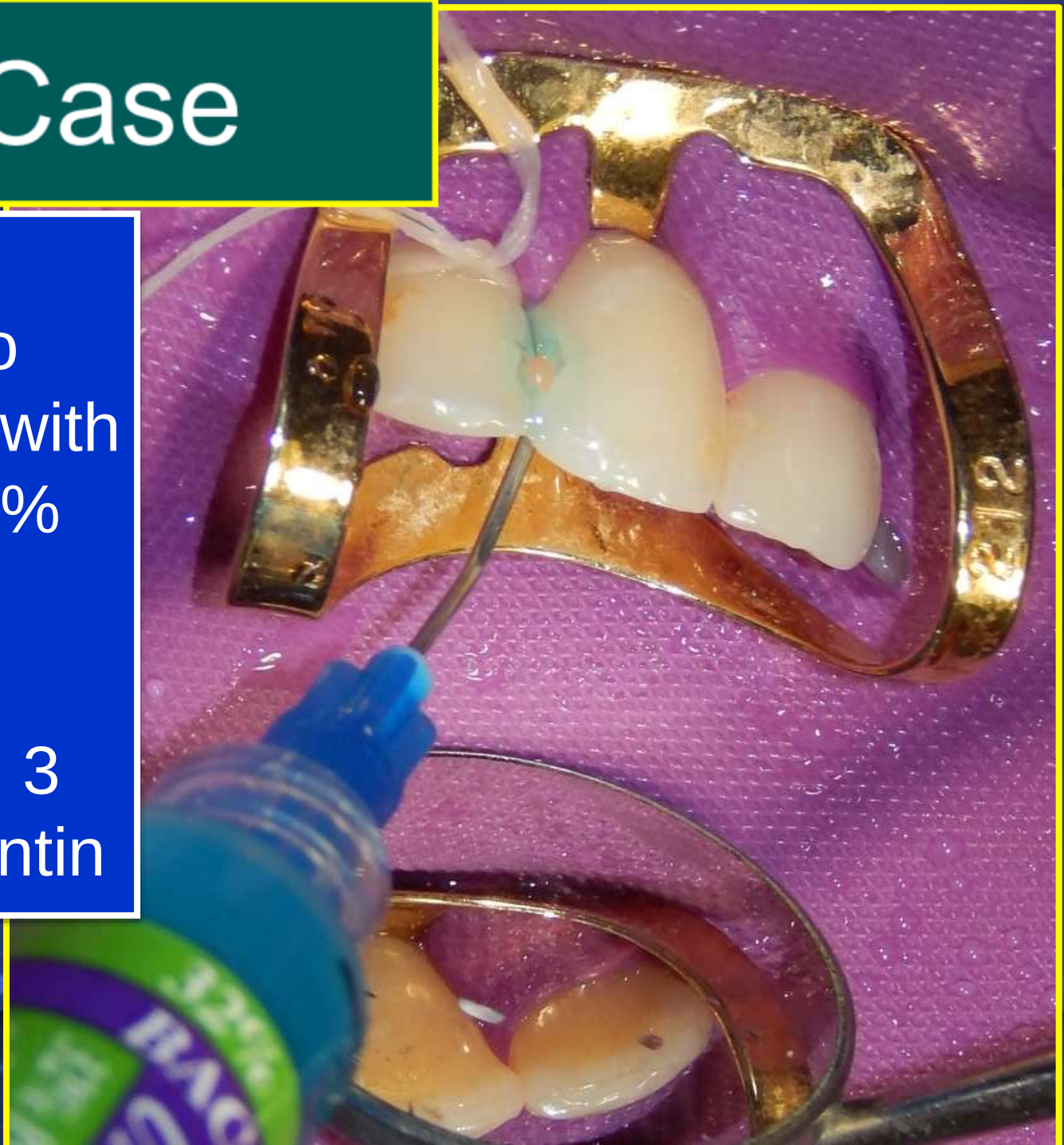
- Proper isolation critical for pulpal survival

Clinical Case

- Preparation performed, very soft dentin, caries close to pulp horns, straight in!

Clinical Case

- No pulp exposure so etched first with Uni Etch 32% with BAC
- 30 seconds enamel and 3 seconds dentin



Clinical Case

- Rinsing off etchant gel
- Rinse sufficient time to remove all etchant and debris

Clinical Case

- Placement of TheraCal- precise , but flash easily removed

Clinical Case

- Two coats of ALLBOND Universal

Clinical Case

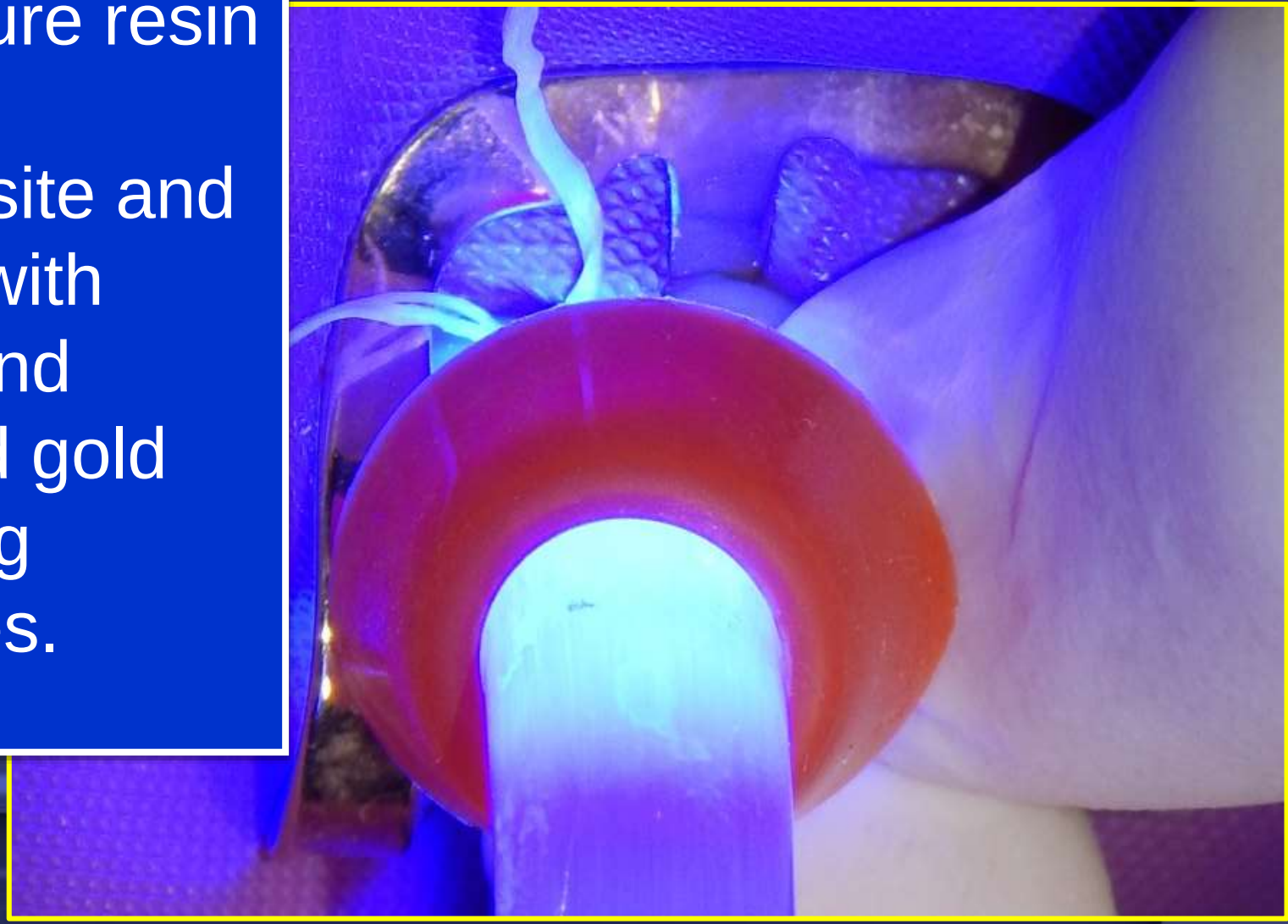
- Light cure ALLBOND Universal for 10 seconds-

Clinical Case

- Aelite Enamel place with composite non stick instrument and mylar strips

Clinical Case

- Light cure resin based composite and polish with discs and tapered gold finishing carbides.



Clinical Case

- Finished resin based composite restorations

Toxicity Concerns: Neural….

Human & Experimental Toxicology

A transient peak was observed in brain Al level of MTA Angelus group on day 7, while MTA Fillapex and Theracal LC groups reached highest brain Al level on day 60. Brain TBARS level, CAT, SOD and GPx activities transiently increased on day 7 and then returned to almost normal levels. *This in vivo study for the first time indicated that initial washout may have occurred in MTA Angelus, while element leaching after the setting is complete may have taken place for MTA Fillapex and Theracal LC*

Rats were killed 7, 30 or 60 days after operation. Brain tissues were obtained before killing.

HCSC Products

Estelite Sigma- TheraCal-Trauma

Estelite Sigma- TheraCal-Trauma

Upper left lateral incisor fracture with exposed pulp and mobile palatal segment. Diagnosis- complicated crown root fracture.

Estelite Sigma- TheraCal-Trauma

Post anesthesia, loose fragment removed, judged restorable, and pulp polyp excised with sterile spoon excavator

Estelite Sigma- TheraCal-Trauma

What?! No rubber dam??- was afraid of tissue movement and bleeding. Bad place for a clamp…mea culpa, mea culpa

Estelite Sigma- TheraCal-Trauma

Vista 3% sodium hypochlorite placed with slight but positive pressure for hemostasis and disinfection- judgement call on time necessary. Difficult picture for team member.

Estelite Sigma- TheraCal-Trauma

No bleeding,prepped for Miomir Cvek pulpotomy

Estelite Sigma- TheraCal-Trauma

Very carefully as to not instigate bleeding. Sufficient coverage.

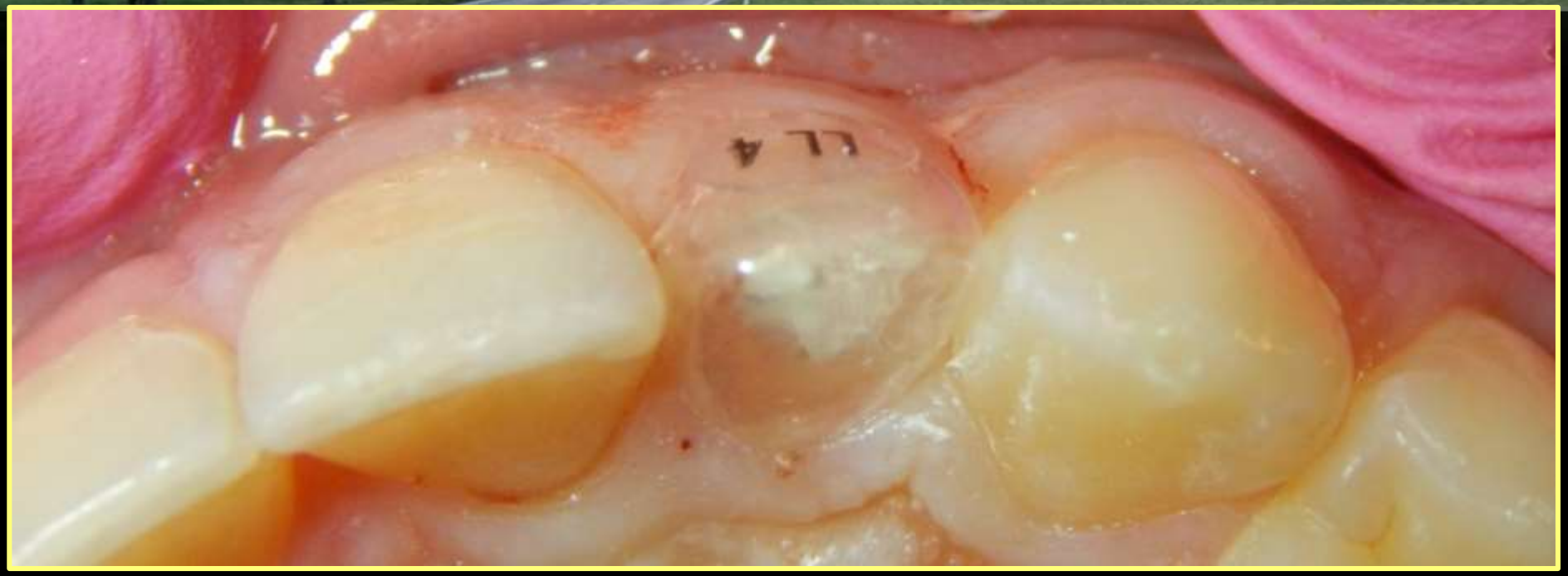
Estelite Sigma- TheraCal-Trauma

20 seconds light cure

Estelite Sigma- TheraCal-Trauma

Facial view of crown form

Estelite Sigma- TheraCal-Trauma



Palatal view, tight fit, but NO bleeding..

Estelite Sigma- TheraCal-Trauma

Poking air vents….

Only air needs to vent, NOT composite, dumb old ideas DIE hard… use a tight fit to decrease polishing and less voids, fill crown form carefully

Estelite Sigma- TheraCal-Trauma

Etched facial enamel first than went to palatal and dentin. Did not etch directly next to the TheraCal LC.

Estelite Sigma- TheraCal-Trauma

ALLBOND Universal applied and light cured. Thinned with air to insure open interproximals, nothing worse then bonding the contacts shut and being unable to seat crown form.

Estelite Sigma- TheraCal-Trauma

Light cure- Adhesive layer

Estelite Sigma- TheraCal-Trauma

Seat crown form and remove extruding composite with micro-brush lubed with adhesive resin or modeling resin

Estelite Sigma- TheraCal-Trauma

Light cure

Palatal, facial, then incisal. To reduce pull from dentin bond, which is the weakest.

Estelite Sigma- TheraCal-Trauma

Very natural looking lateral incisor- bleeding is from the polishing

Estelite Sigma- TheraCal-Trauma

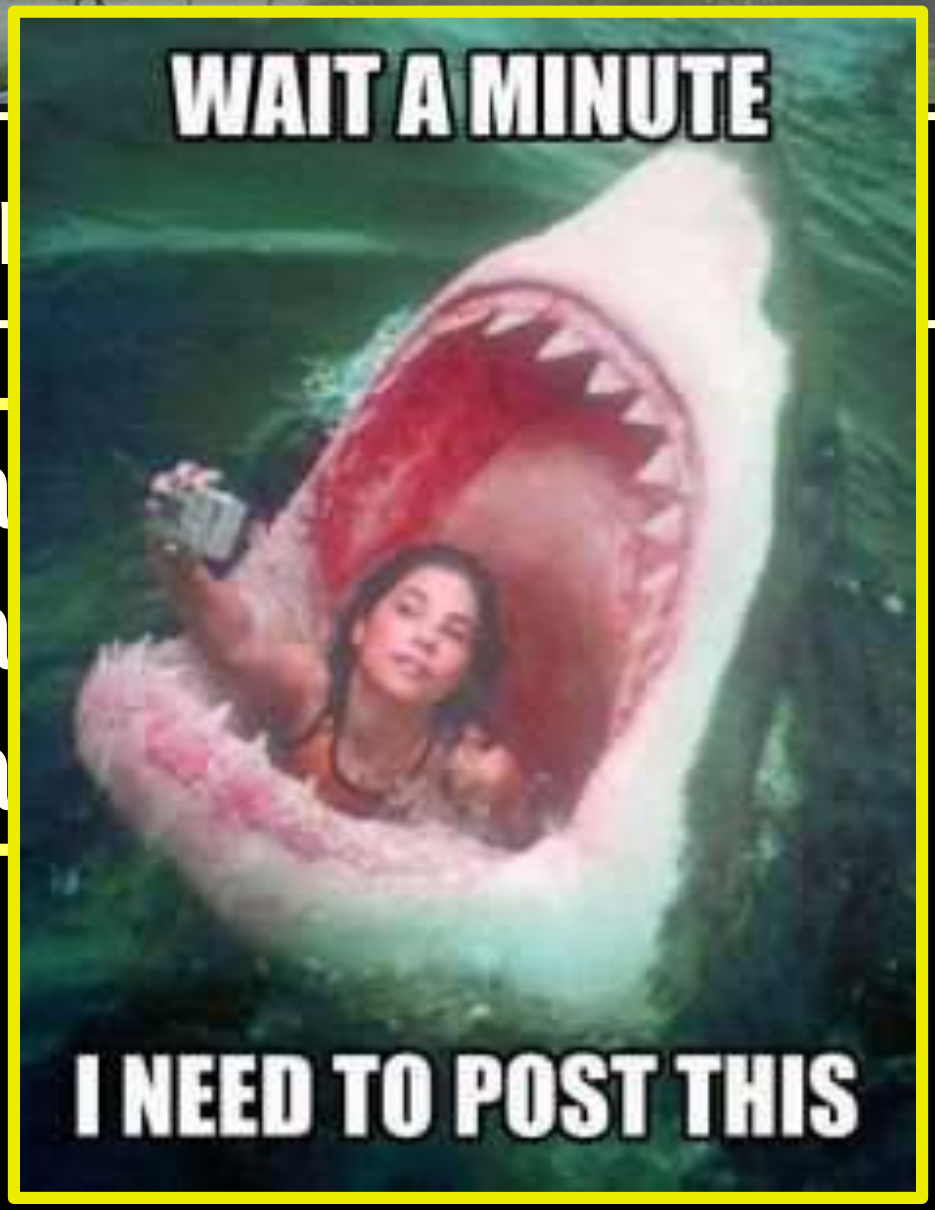
Palatal view– increased bulk for strength- not in occlusion

Estelite Sigma- TheraCal-Trauma

Post operative check at recare

Dicalciu licates

TheraCa
TheraCa
TheraCa



Bioactivity and Dental

"THE DOSE MAKES THE POISON"

APPLE SEEDS	PEARS	POTATOES	COURGETTES
			
CONTAIN AMYGDALIN ~0.6g/kg of seeds	CONTAIN FORMALDEHYDE ~0.06g/kg	CONTAIN SOLANIN ~0.2g/kg (higher in green potatoes)	CONTAIN CUCURBITACIN E Variable (higher in bitter courgettes)

ALL OF THE FOOD ITEMS ABOVE CONTAIN NATURAL CHEMICALS THAT ARE TOXIC TO HUMANS. HOWEVER, THEY ARE USUALLY PRESENT IN VERY SMALL AMOUNTS, FAR BELOW THE HARMFUL DOSE.

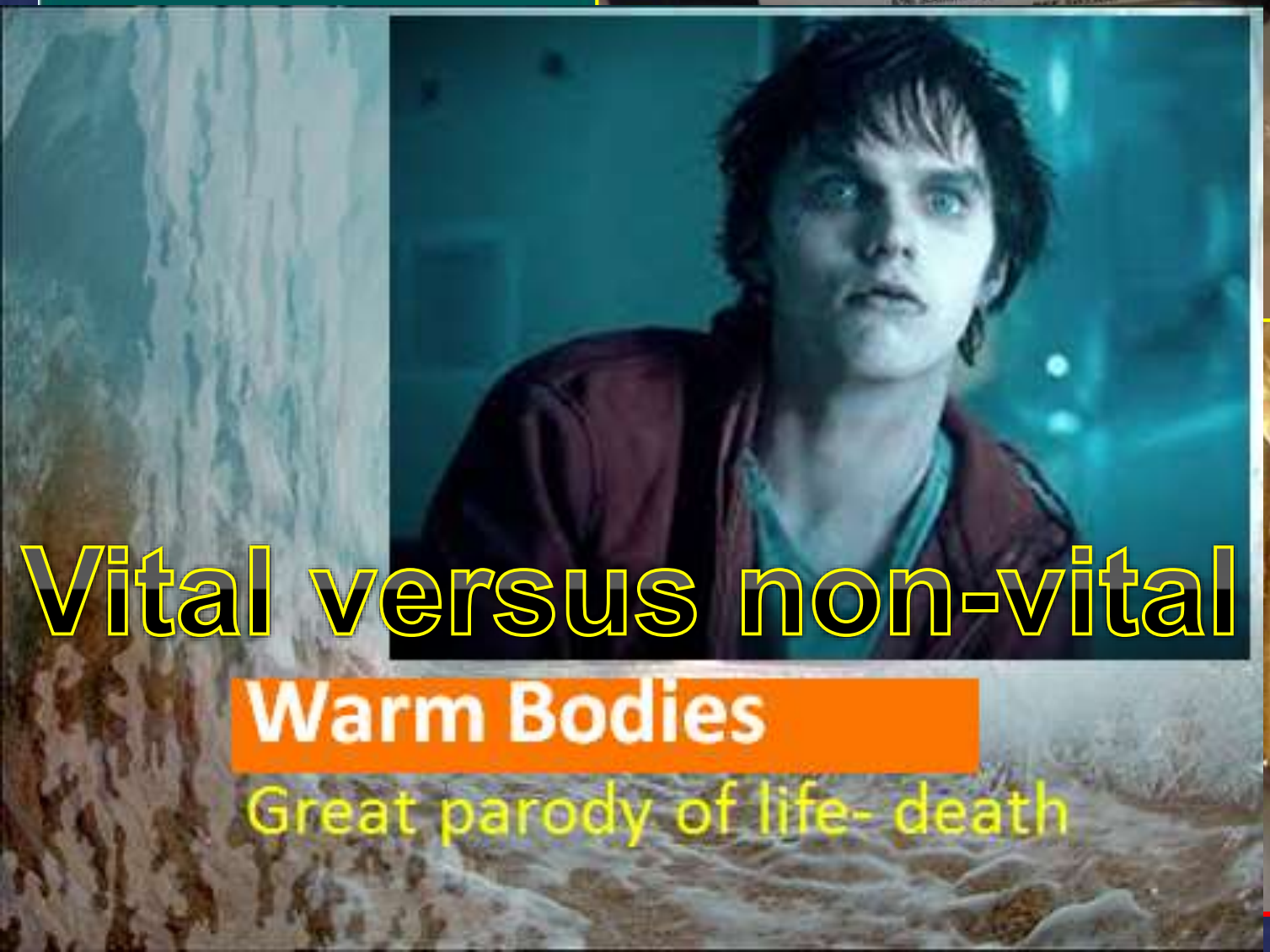
JUST BECAUSE A CHEMICAL IS PRESENT, DOES NOT MEAN THAT IT IS HARMFUL IN THE *AMOUNT* PRESENT.

Bioactivity and Dental Materials

Pulpally involved, pulp extirpated from chamber
Ferric sulfate placed for hemostasis

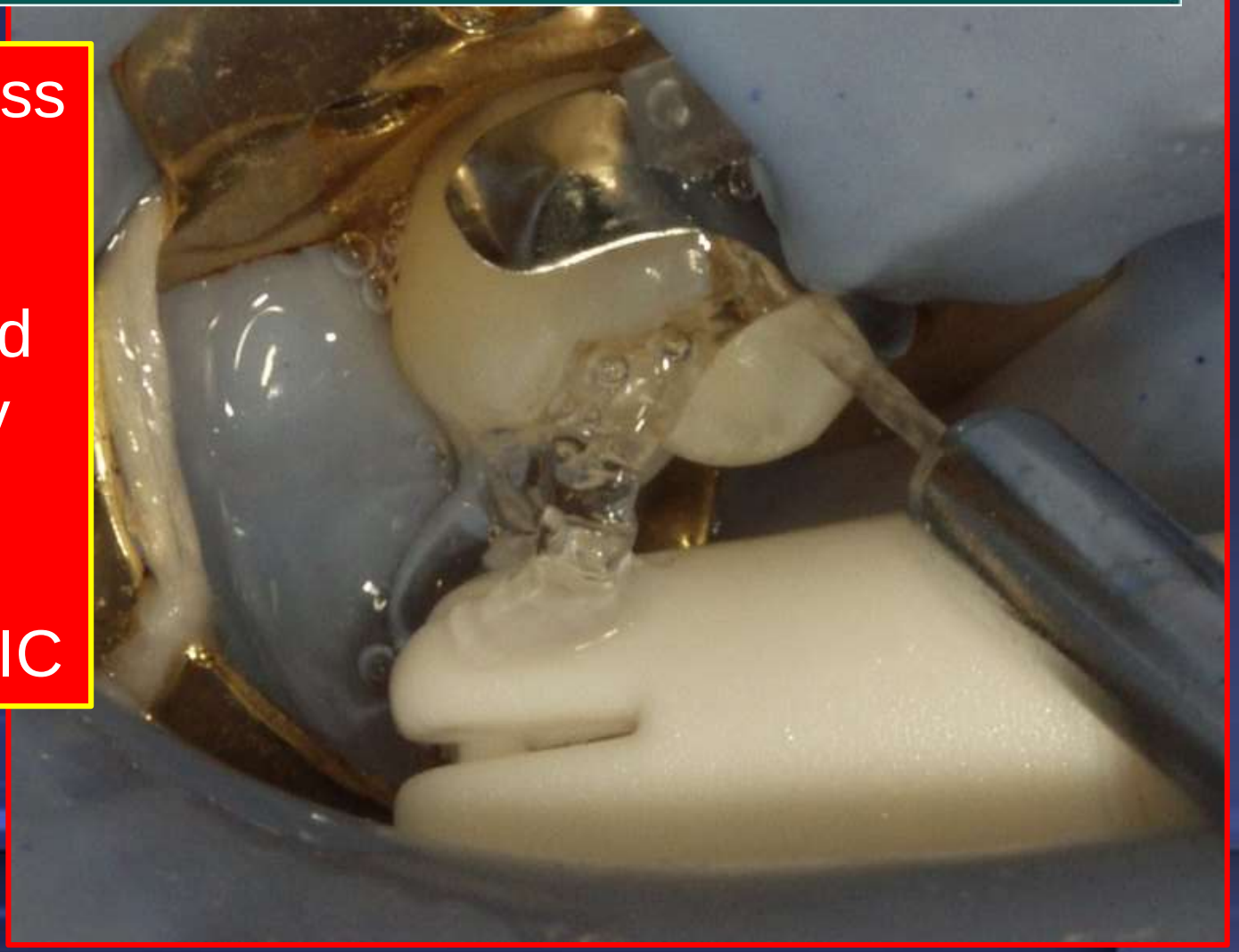
Bioact


Dental Products
Sodium Hypochlorite
6% Sodium Hypochlorite Solution


Vital versus non-vital
Warm Bodies
Great parody of life- death

Bioactivity and Dental Materials

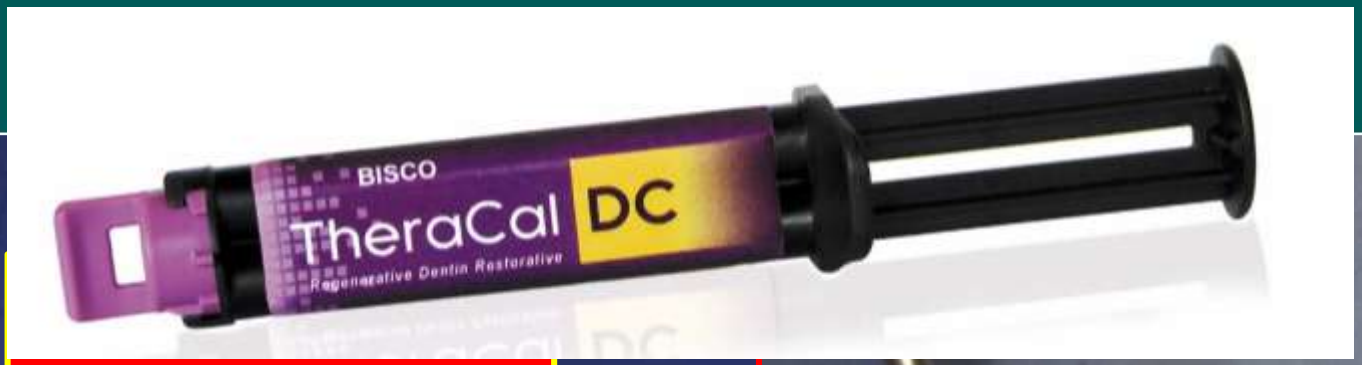
Remove excess sodium hypochlorite
If concentrated but water may contaminate chamber
PROBLEMATIC



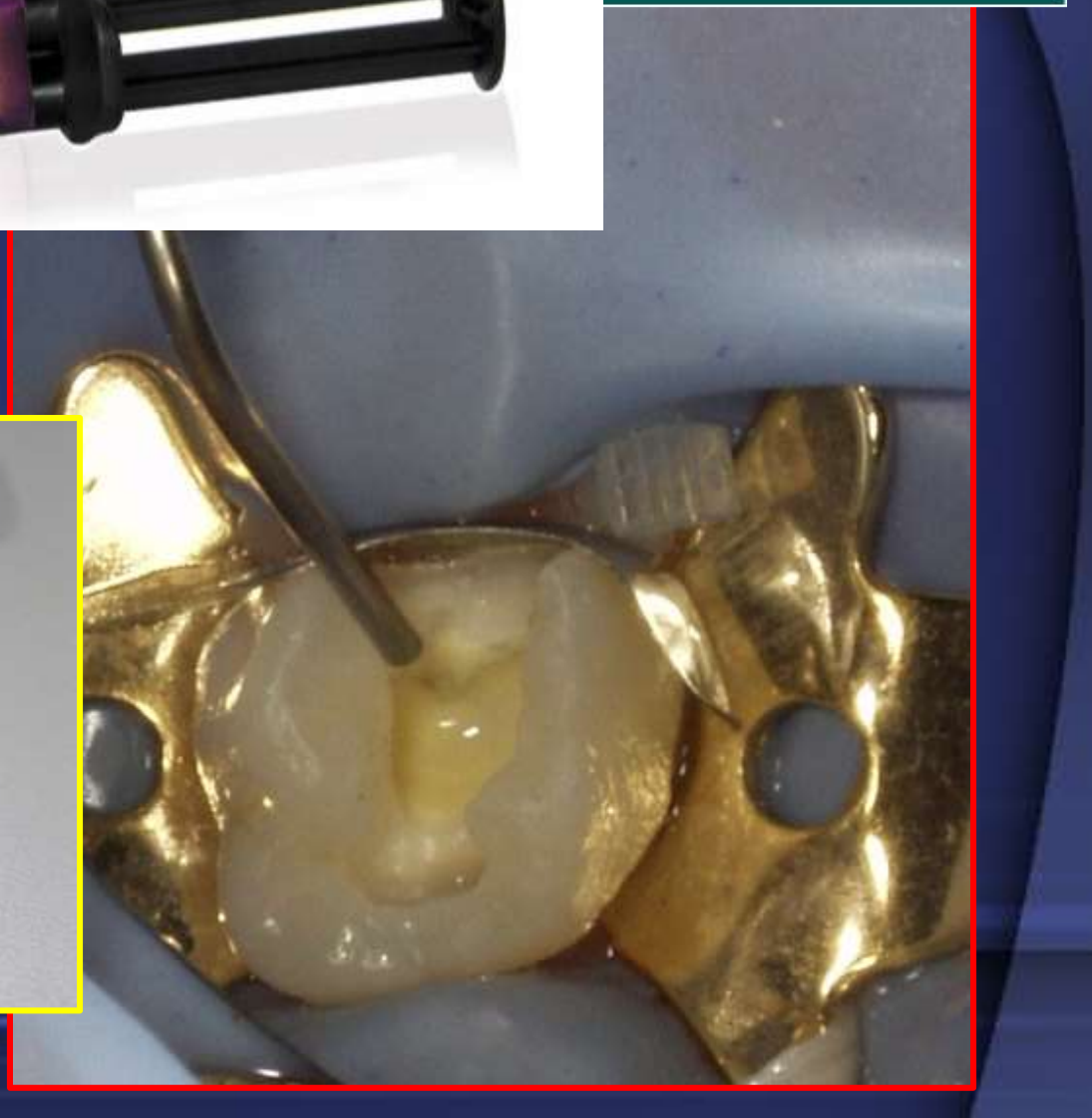
Bioactivity and Dental Materials

Hemostasis obtained, all pulp contents removed, essential for pulpal therapy success

Bioactivity and Dental



dressing-
TheraCal DC



Bioactivity and Dental Materials

Light cure to initiate polymerization but will dual cure completely due to proprietary technology

Bioactivity and Dental Materials

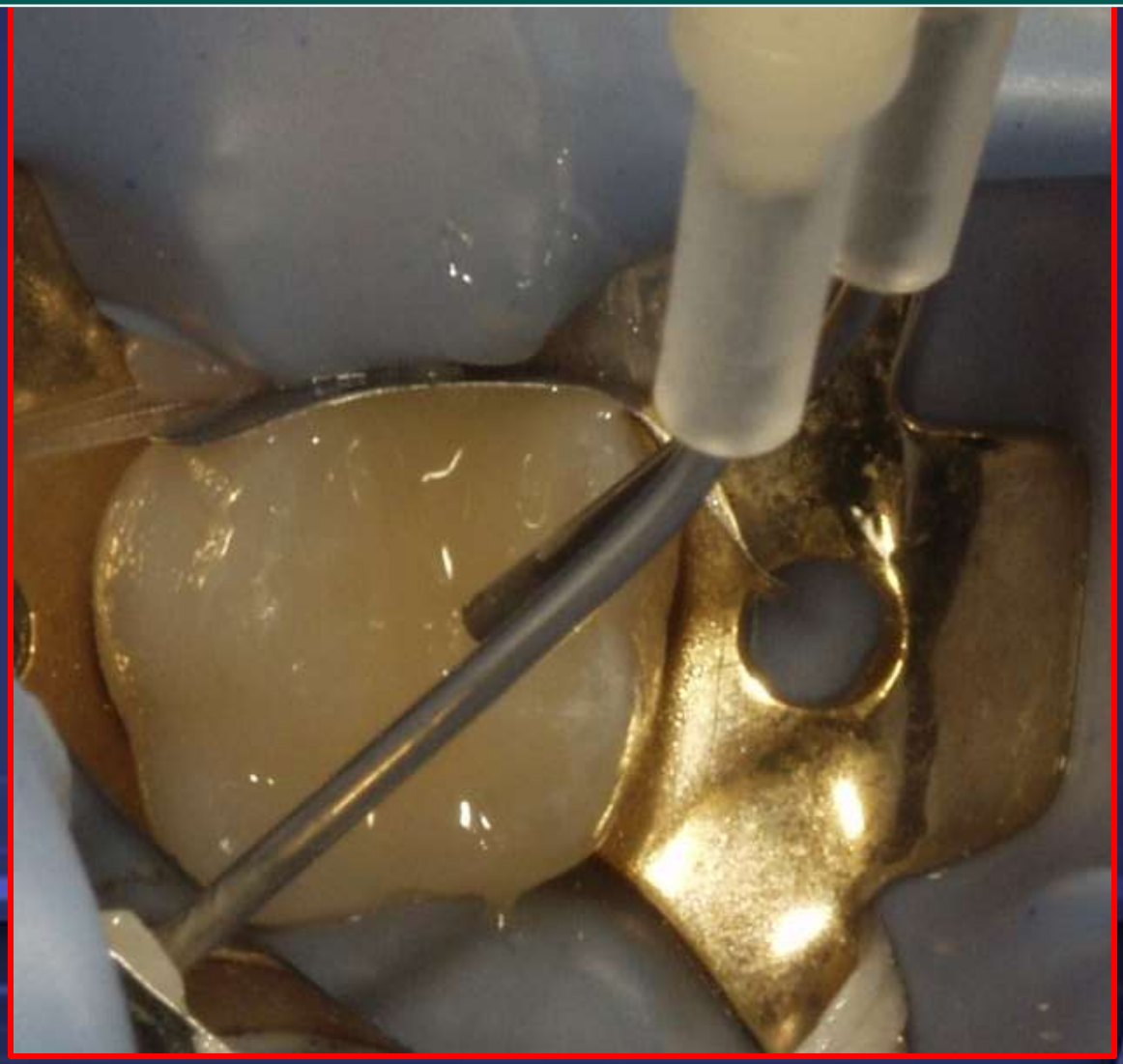
Etch enamel for 30 seconds with Uni Etch BAC
Rinse with copious water flow

Bioactivity and Dental Materials

Cured adhesive and TheraCal DC obturation of chamber

Bioactivity and Dental Materials

Inject dual cure RMGI or Activa into cavity preparation



Bioactivity and Dental Materials

Explorer tine to evenly spread Activa with out void incorporation “Pulse” cure

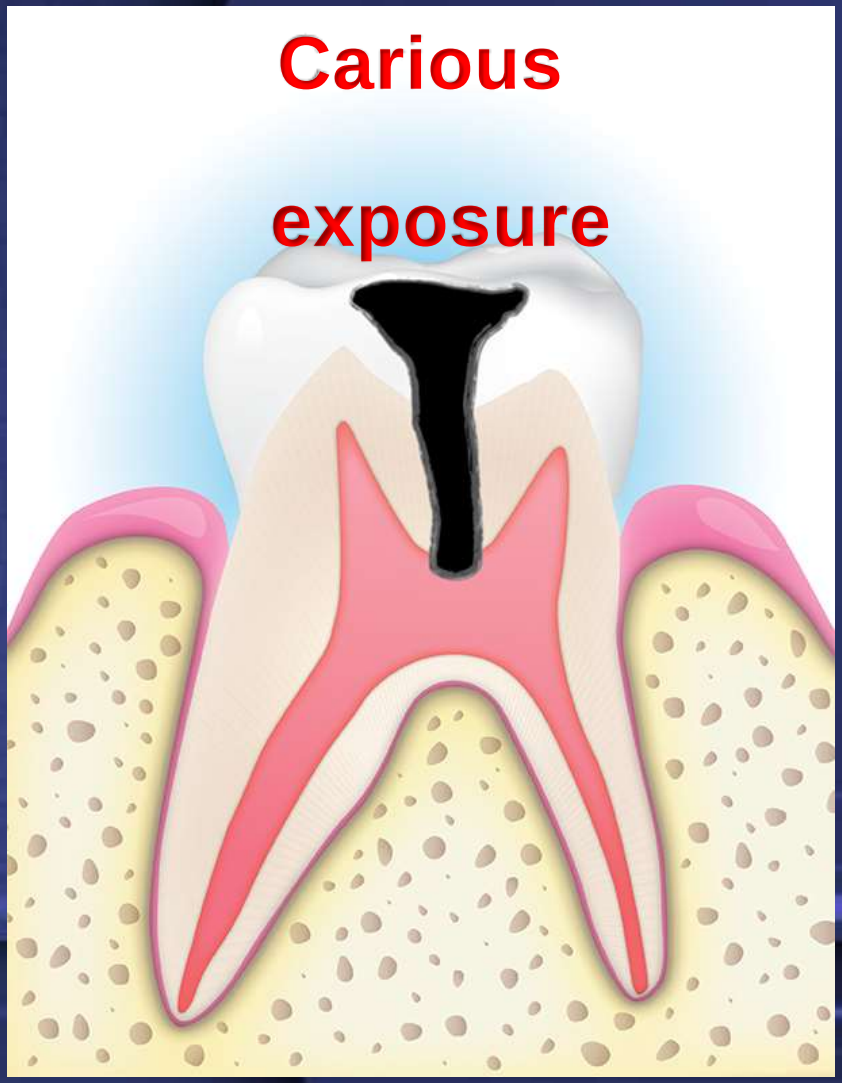
Bioactivity and Dental Materials

Matrix and wedge removed
Note gross anatomy

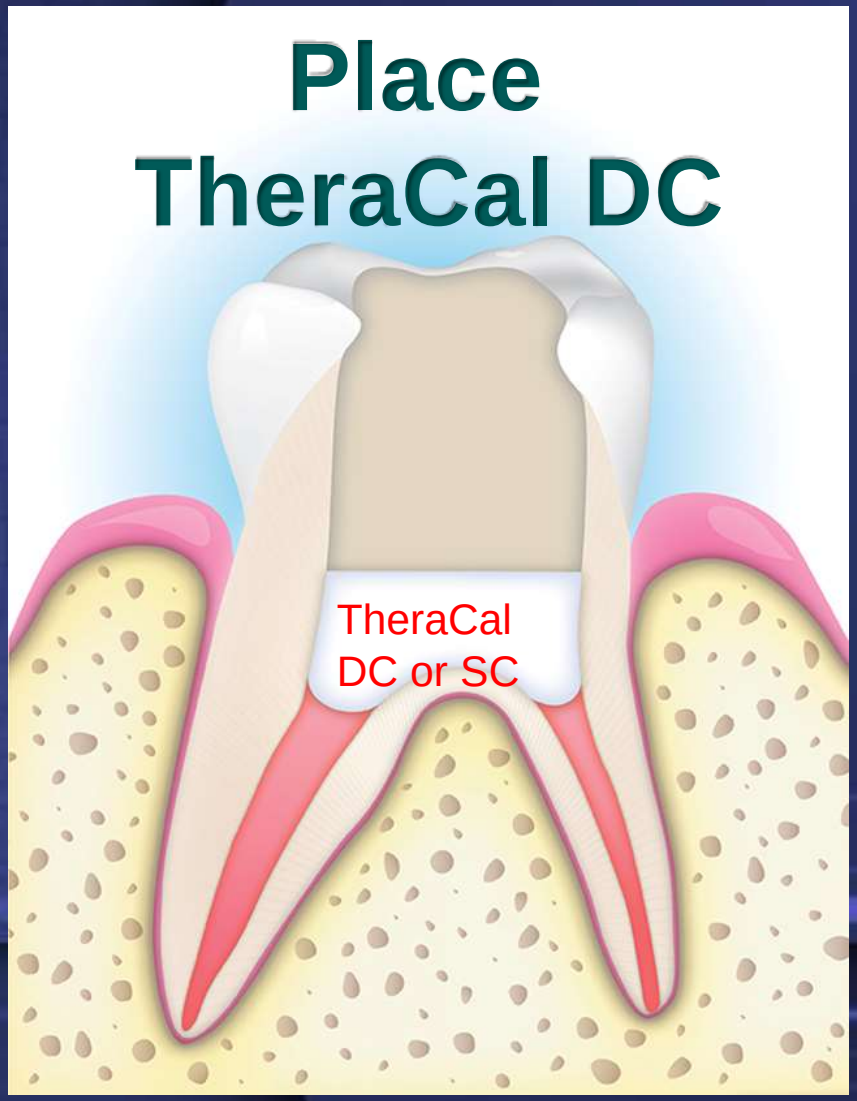
Bioactivity and Dental Materials

Post operative visit

TheraCal DC directions

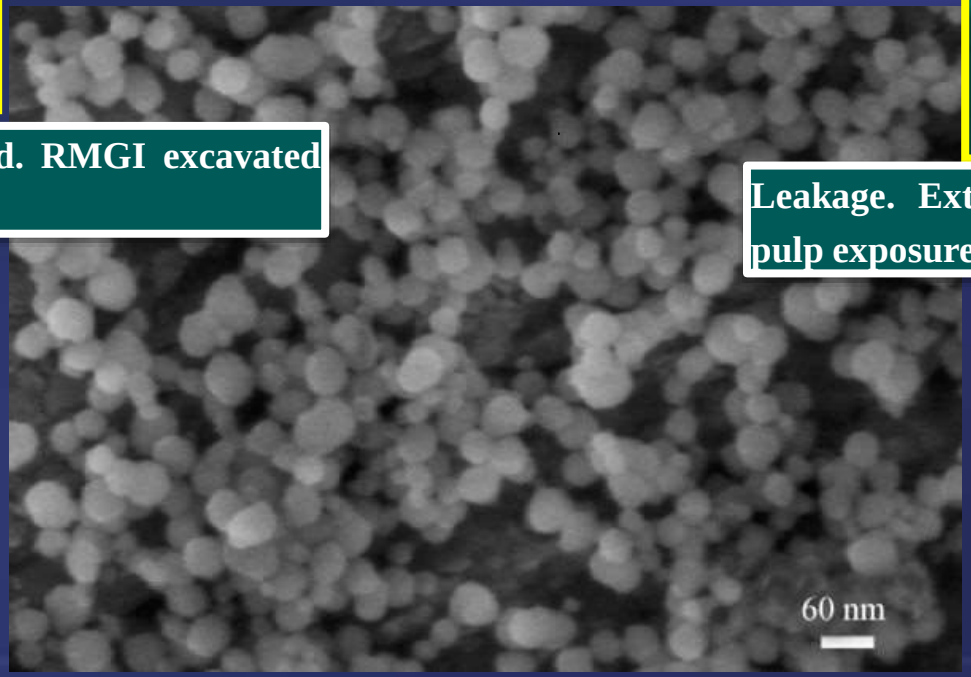


TheraCal DC directions



Clinical Implications

"Grey" composite removed. RMGI excavated with mush layer exposed.



Leakage. Extensive decay removed with pulp exposure. History of pain.

TheraCal: Placed after hemostasis.
All infected dentin removed. Affected may re-mineralize.
Etch and adhesive placed.

Dual cured resin based composite placed and polished.

AADR-TheraCal- 2018

- **Retrospective Study of Calcium Hydroxide and TheraCal for Pulp Capping**

Ali Alqahtani, University of Michigan

Peter Yaman, University of Michigan

Joseph Dennison, University of Michigan

Neville McDonald, University of Michigan

- **Objectives: To compare the clinical success rate of TheraCal (light-cured, resin-modified calcium silicate) to calcium hydroxide as pulp-capping materials in permanent teeth with closed apices.**

AADR-TheraCal

- Methods: This study involved a retrospective electronic record review. Post-operative data were collected from **60 patients for each material involving 69 teeth using calcium hydroxide and 79 teeth using TheraCal**. The treatment was categorized as clinically successful if the tooth was still present at the succeeding appointment and no further pulpal treatments or root canal therapy were needed. However, if the tooth was extracted or additional pulpal treatment was done, the tooth was categorized as unsuccessful.

AADR-TheraCal

- Results: There was no significant difference between the clinical success rate of TheraCal (67 successful, 12 failures) for 84.8% and calcium hydroxide (59 successful, 10 failures) for 85.5% using Fisher's exact test ($p<0.05$). Indirect pulp capping success for calcium hydroxide was 93% and for Theracal 88**%. Direct pulp capping success for calcium hydroxide was 50% and for Theracal 69%.**

- **Conclusions: Based on this retrospective data, Theracal may be considered an equivalent treatment to calcium hydroxide as both a direct and indirect pulp capping material.**

AADR- TheraCal- 2018

- **Calcium-ion Release from Pulp-Capping Agents: Diffusion Through Various Dentin Thicknesses**

Erica Mueller , Midwestern University
Dustin Mueller, Midwestern University
M. Teresa Pulido, Midwestern University
John Mitchell, Midwestern University

- **Objectives: An important property of pulp-capping materials is Ca-ion release, which leads to biological deposition of reparative dentin. This study examined the ability of Ca2+ ions to diffuse through varying remaining dentin thicknesses (RDT) to affect cells in the pulp chamber.**

- **Methods: Caries-free, extracted human molars were selected and ground to remove the roots at the CEJ. Standardized class 1 occlusal cavities were prepared on the coronal side. Pulp tissue was excised and the pulp-side dentin removed to obtain a standardized pulp-side chamber. Teeth were divided into four groups based on their RDT values: 0.5mm, 1mm. 1.5mm and 2mm (±0.2 mm). RDT was measured using a digital caliper.**

AADR- TheraCal- 2018

- Samples were immersed in EDTA, rinsed with deionized water, and each RDT group (N=10 each) was randomly divided into two further groups: one received Dycal (Dentsply, Caulk, Milford, DE, USA) and the other received TheraCal (Bisco Dental, Schaumburg, IL, USA). Direct pulp-capping was performed according to the manufacturer's instructions. Coronal obturations were completed with composite (Empress Direct, Ivoclar Vivadent, Amherst, NY, USA), and the external/outer surface of each tooth was covered with nail varnish, except the pulpal cavity.

- Samples were stored at 37°C in 10 mL of deionized water. For 0mm RDT, discs of TheraCal and Dycal were placed directly into 10 mL of deionized water. As a negative control, both occlusal and pulpal cavities were filled with composite. Ca^{2+} ion concentration was measured using a Ca^{2+} ion-selective electrode at 2 hours, 24 hours and 48 hours following placement. Ion release values were compared using ANOVA with post-hoc Tukey ($\alpha=0.05$).

- **Conclusions: Use of both TheraCal and Dycal resulted in significant Ca^{2+} ions diffusion through up to 2mm thicknesses of dentin.**

Esthetics- Problems

- No time to play golf- yet to be a dentist

Esthetics- Anterior Problems

- General Anesthesia Case (not mine)- patient had come to our office first- then had case done by another peds

SSC with facings- yuck

Esthetics- Anterior Problems

- General Anesthesia Case (not mine)- mom unhappy with esthetics but teeth mobile- red gingiva- no drainage

Going!!!- what in canals?

6 months

Esthetics- Anterior Problems

- General Anesthesia Case (not mine)- mom wanted new PA at one year

Gone!!!- dissolved

Esthetics- Anterior Problems

- General Anesthesia Case (not mine)- no abscesses but roots totally resorbing- other office refuse to tell what was used. Disappearing act.

Three Years

Esthetics- Pulpectomy

PULPDENT: Makers of the Original Calcium Hydroxide Paste

Since developing the first pre-mixed calcium hydroxide aqueous methylcellulose pulpal dressing in 1947, the Pulpdent name has been synonymous with calcium hydroxide and is the standard against which all others are measured.

- What to use? Needs to be biocompatible, resorbable but not dissolvable, both radiopaque and antibacterial.

Forendo Paste
with iodoform

Pre-mixed calcium hydroxide paste with iodoform in a silicone oil base – a strong disinfectant

- Creamy consistency – non-setting
- Radiopaque
- Syringe delivery with curved applicator tips
- Available in a 2.2 gm syringe with 20 curved applicator tips for direct dispensing into the root canal

Competes with Vitapex, Diapex and Metapex

- Forendo- non-dissolvable, silicone oil, but radiopaque and antibacterial.

Esthetics- Problems

children

spot to

ventive

Bioactivity and Dental Materials

NeoMTA-technique

Hypoplastic first primary molar-depth cuts made for ZR crown. Decay implies need for pulpal therapy.

Bioactivity and Dental Materials

NeoMTA-technique

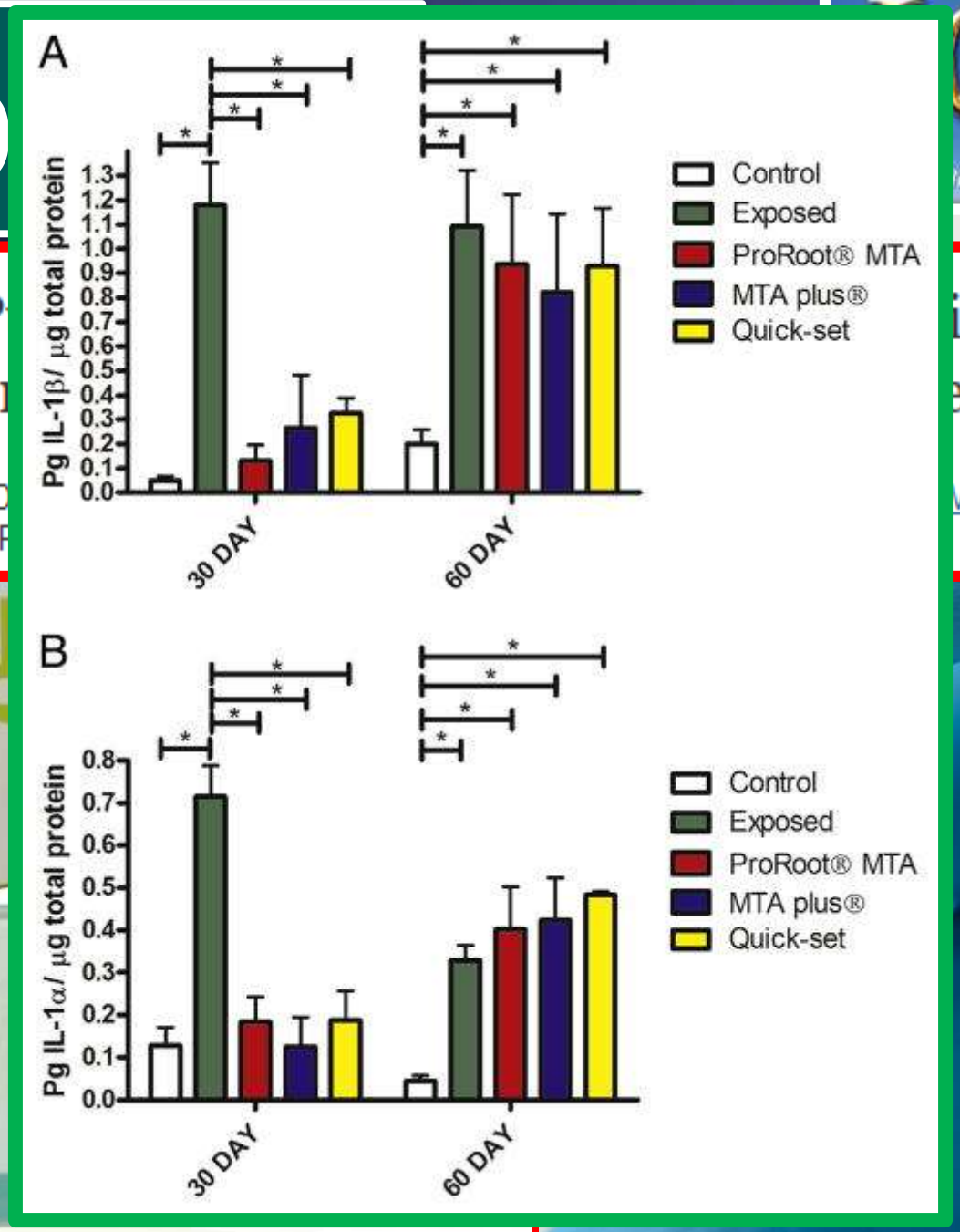
Ragged, hemorrhagic pulp, debris present and hypoplastic, hypomineralized tooth structure

Bioactivity and Dental Materials

NeoMTA-technique

Debris removed and hemostasis obtained with cotton pellets damp with sodium hypochlorite (Vista, comes in 3 or 6% and in 3 or 12 ml. DOESN'T last long!!

Neo



OE

al of Endodontics

Capping a P
Cement: Co

icate
egates

Phillip R. Kramer, PhD
Lynne A. Opperman, P

M. Primus, PhD,

d Dental

Bioactivity and Dental Materials

NeoMTA-technique

After pellet of NeoMTA placed much faster to protect with Te It from Centrix. Sets with water contact. Seals crown preparat starts immedia

Bioactivity and Dental Materials

NeoMTA-technique

Bioactivity and Dental Materials

NeoMTA-technique

Bioa

Step by Step Instruc

1

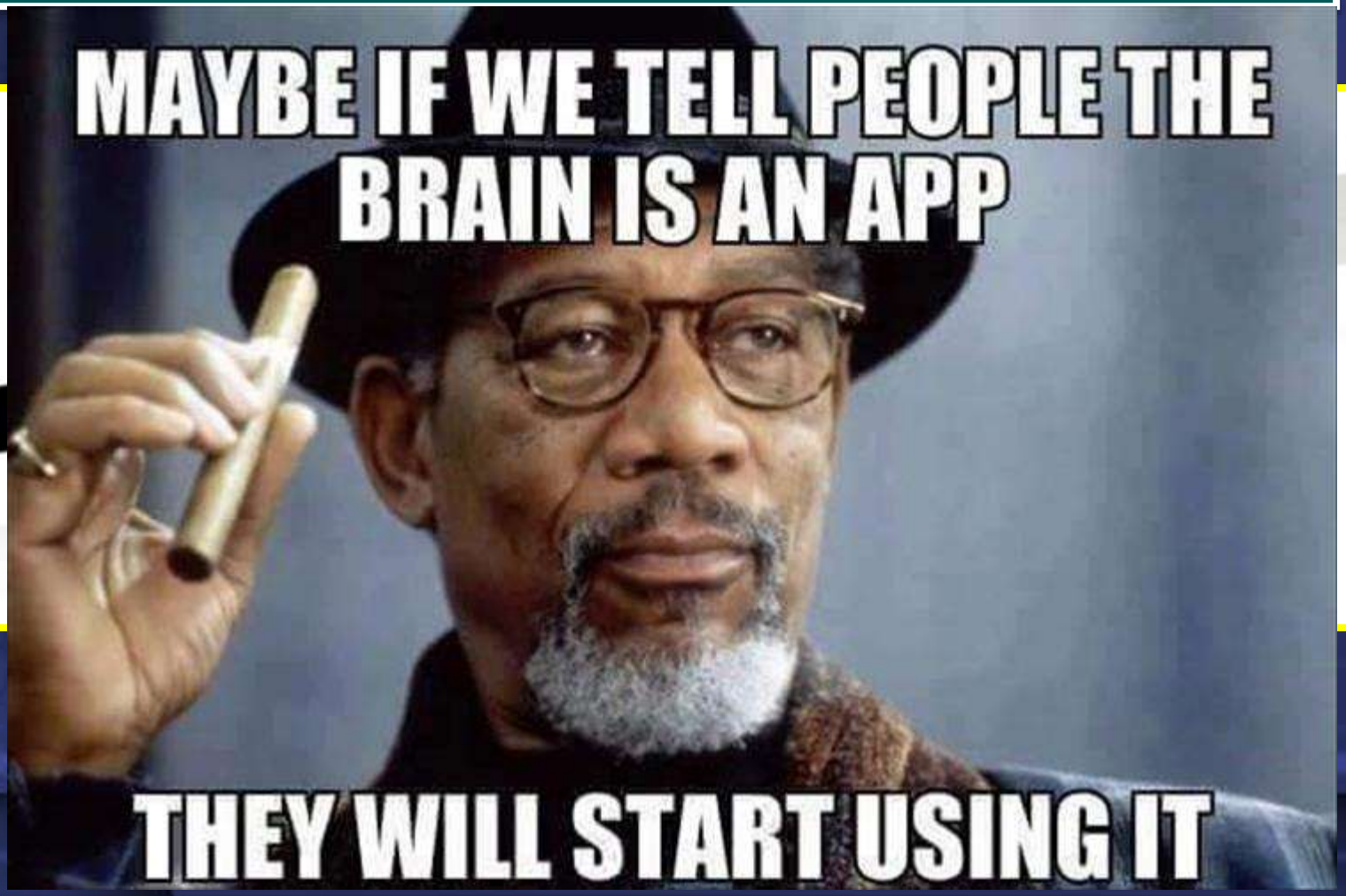
After try-in, thoroughly rinse the restoration with water spray and dry with oil-free air.

5

Dry with oil-free a

water

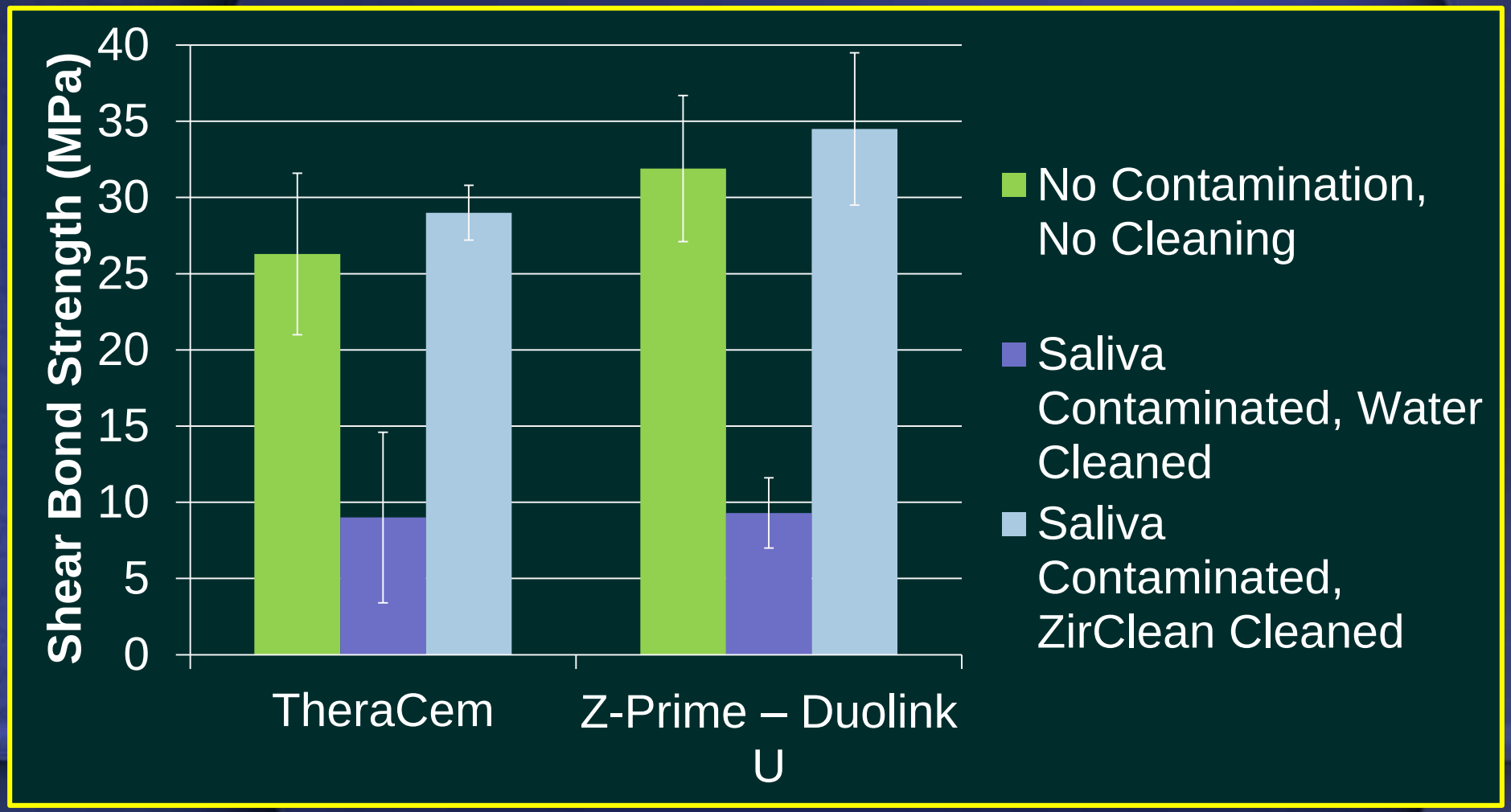
Universal Cleaning Gel



Instructions for Use:

- Protective eyewear and gloves should be worn by operator and assistant.
- After try-in, thoroughly rinse the restoration with water spray and dry with oil-free air.
- Remove cap from ZirClean, securely attach tip and verify flow of material prior to application.
- Cover all bonded surfaces of the restoration with a layer of ZirClean.
- Allow **20 seconds** for the cleaning action of ZirClean to take effect, then **thoroughly rinse with water spray** and dry with oil-free air.
- Next, prime the bonding surface of the restoration with a suitable primer (e.g. **Z-PRIME™ Plus* or PORCELAIN PRIMER***) according to manufacturer's instructions.

Bond strength on Zirconia



Bioactivity and Dental Materials

NeoMTA-technique

adjacent dentition.

Bioactivity and Dental Materials

Corresponding crown is now cemented with NuSmile BioCem Universal BioActive cement- using a cotton tip applicator to stabilize. TheraCem is also great!

Bioactivity and Dental Materials

NeoMTA-technique

Tack cure with light unit before cleaning off excess. Length of tack cure depends on output of light.

Bioactivity and Dental Materials

NeoMTA-technique

Extra cement may now be removed with scaler and floss. Majority of bleeding from second molar gingiva and not crown. No blanching of tissue from crown. Dryze from Parkell very useful in controlling pre-cementation bleeding.

recurrent caries

~50% of restoration failures

Dent Mater 2012;28:974-984.

Four Types of Cements

Bonding Procedure (require bonding agent)

- **Light-cure veneer Resin cement**

- **Dual-cure Resin cement**

Luting Procedure (do not require bonding agent)

- **Self-adhesive Resin cement**

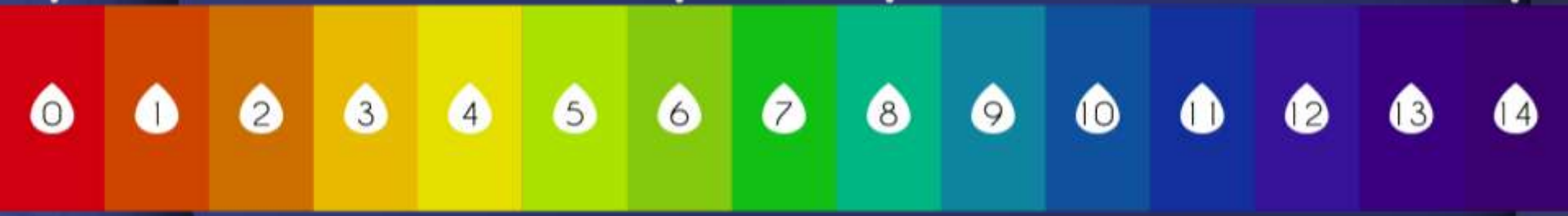
Cariogenic — Strong

- **(Resin-modified) Glass ionomer cement**

Cariostatic/Bioactive (F^-/Ca^{2+} release) — Weak

ACIDIC

ALKALINE



- **More friendly to pulp, e.g. $Ca(OH)_2$, MTA**
- **May inhibit bacteria**
- **Neutralize local acid**

J Endod 2016;42:1355–1361

pH 3.7-4.3

2.0-2.8

pH 3.8 3.2 3. 2.4 2.4

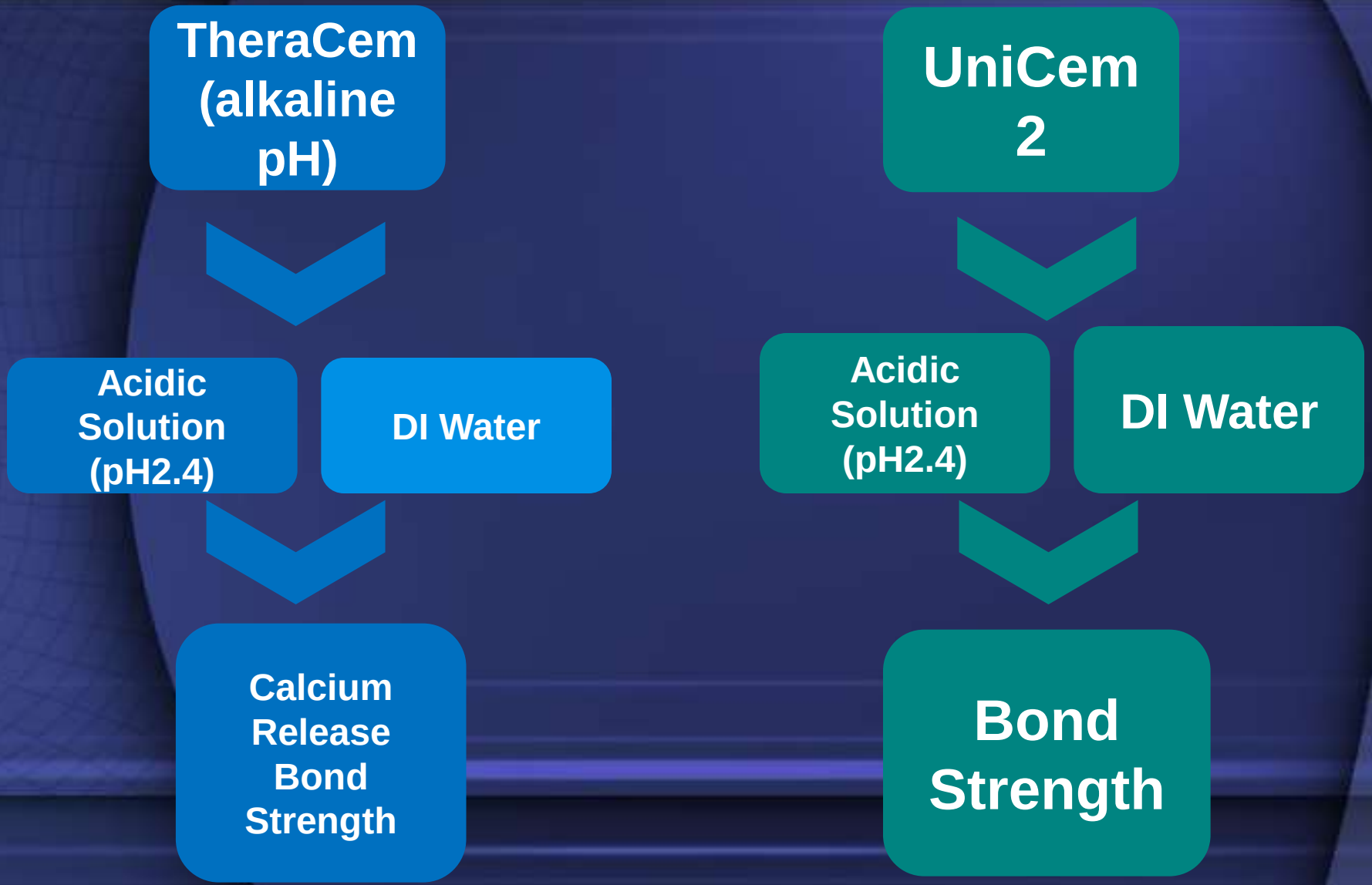
pH o ne
fo


BISCO
TheraCem™
Dual-Cured

alkaline


MMMM SQ ISH MMMM D
SUPER
BIG
Relax ... it's a
diet soda.

PURPOSE


TheraCem (alkaline pH)
Acidic Solution (pH2.4)
DI Water
Calcium Release Bond Strength
UniCem 2
Acidic Solution (pH2.4)
DI Water
Bond Strength

MATERIALS & METHODS

Calcium Release Test

Disks preparation (2cm-diameter, 1.0 mm-thick, n=3) with TheraCem (self-cured 15min/37ºC)

Storage in 0.1 N Lactic Acid Solution (pH2.4, 37ºC)

Storage in DI Water at 37ºC

Test calcium release after 1, 5, 7, 14 days (with new DI water or acid solution being replenished after each test)

Shear Bond Strength Test

ISO 29022:2013 Dentistry – Adhesion
Notched-edge shear bond strength test

Ultradent jig, area 4.5mm^2

Zirconia (sandblasted with alumina sand)

TheraCem (S/C 15min/37°C)

UniCem2 (S/C15min/37°C)

in Lactic Acid (pH2.4, 37ºC)

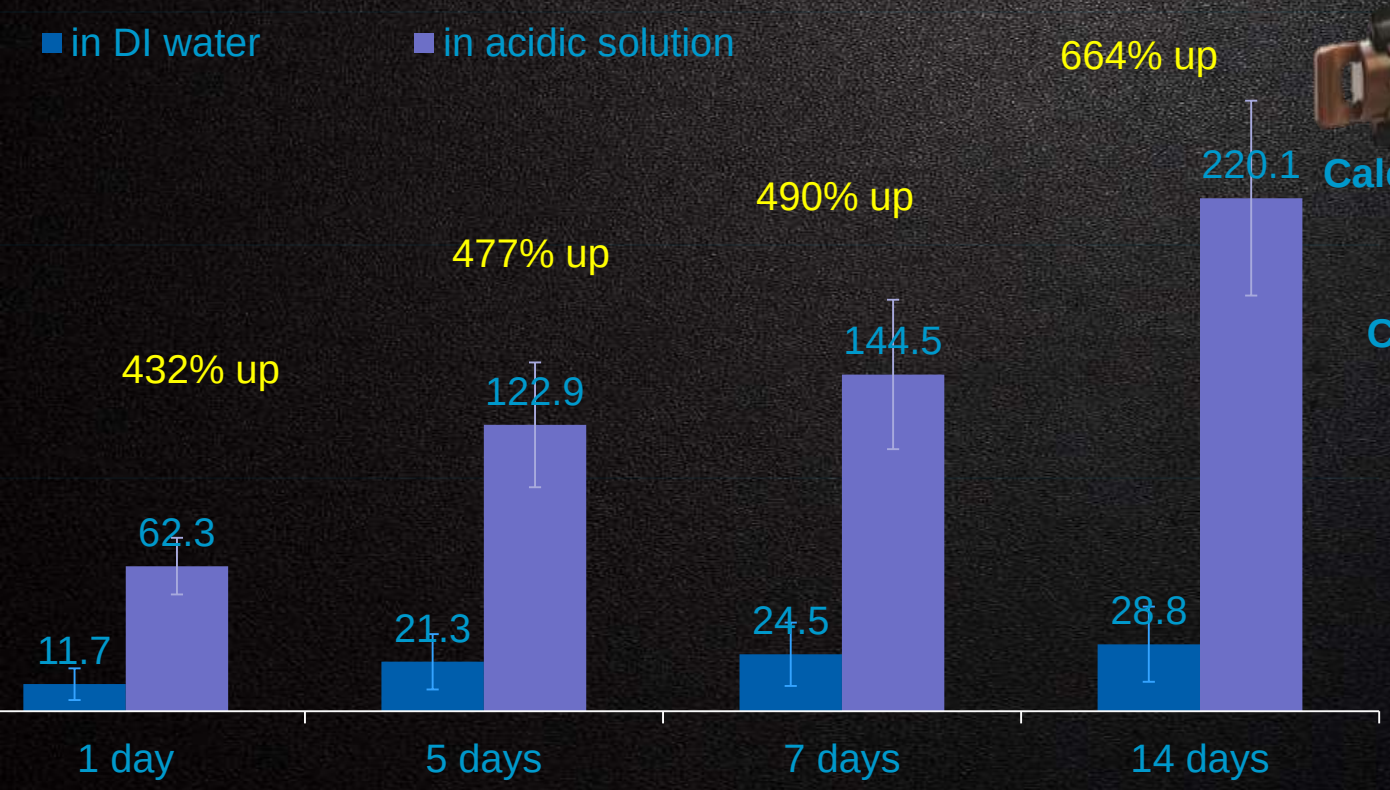
Storage in DI Water at 37ºC

Tested by Universal Testing Machine (Instron, 1mm/min), n=5

SEM examination of debonded cement surface

RESULTS & DISCUSSION

Accumulative Calcium Release of TheraCEM (ug/cm2)



Calcium silicate

↓ Water/Hydration

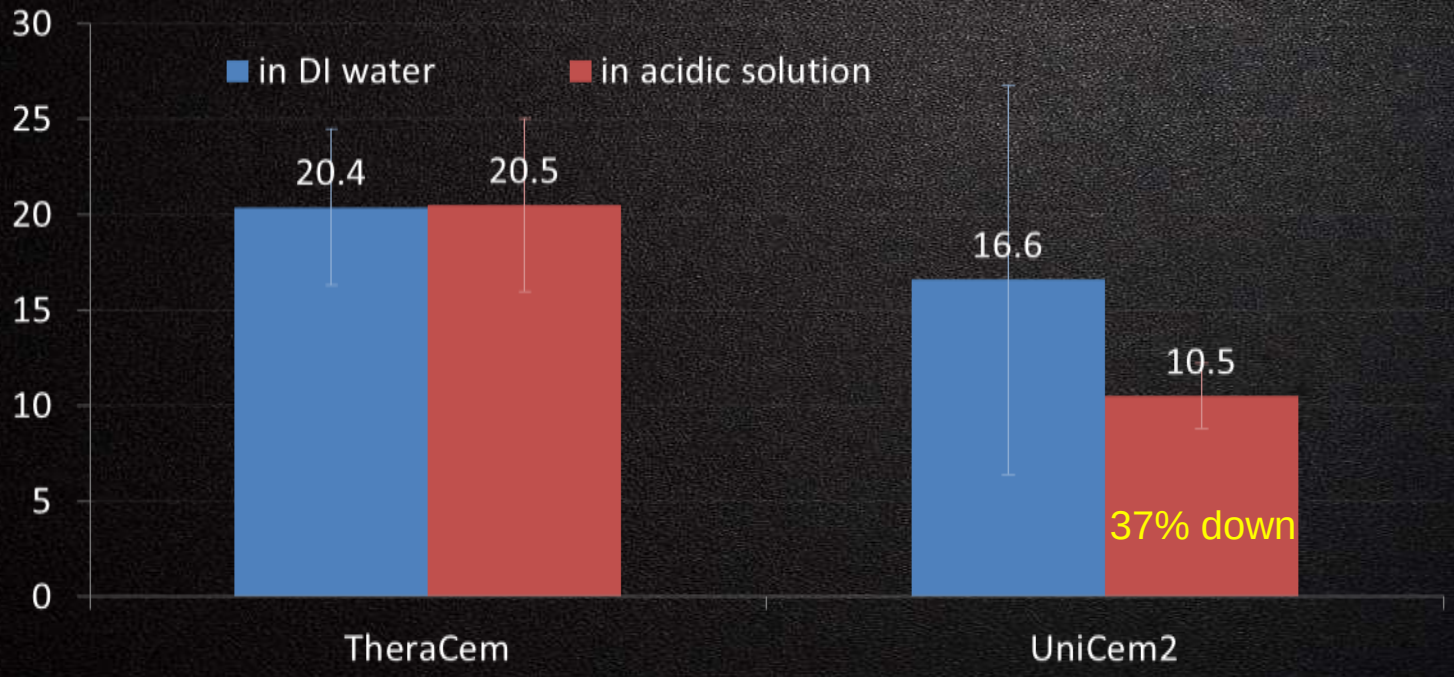
$Ca(OH)_2$ by-product

↓ H^+

Ca^{2+}

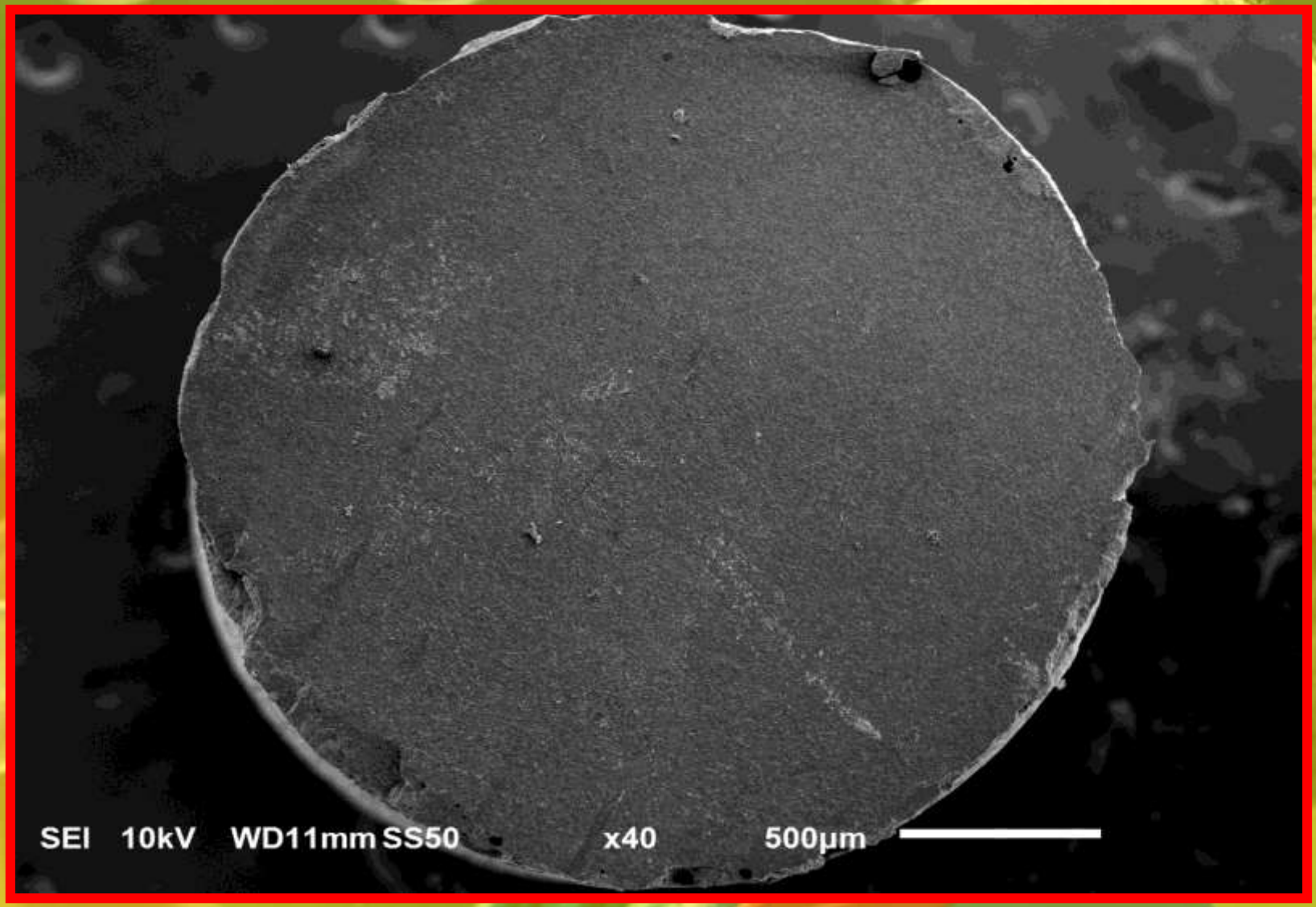
Storage Time

Shear Bond Strength on Zirconia (MPa)



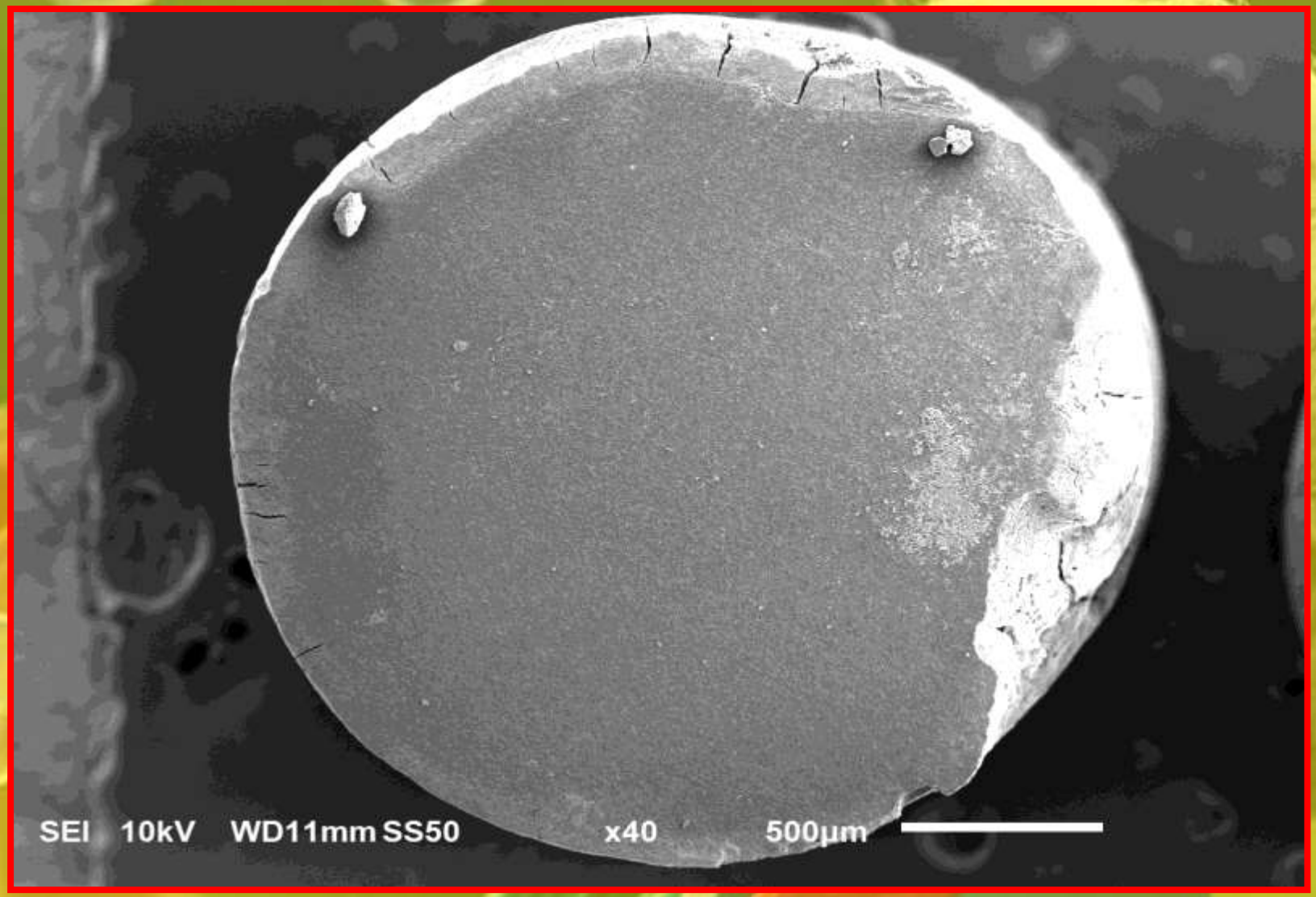
UniCem2 (water)

Normal Cohesive fracture



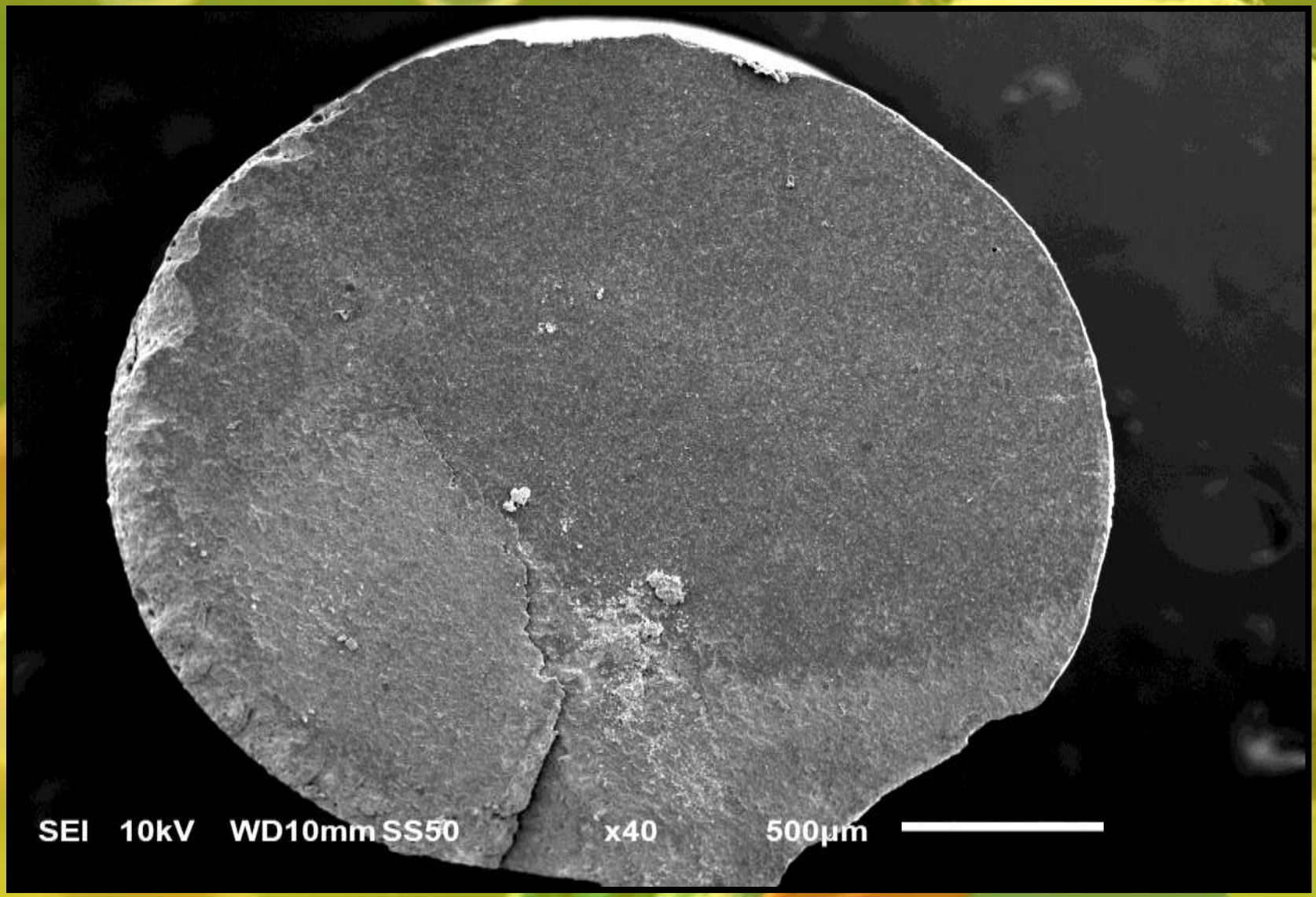
UniCem2 (acid)

Marginal Degradation



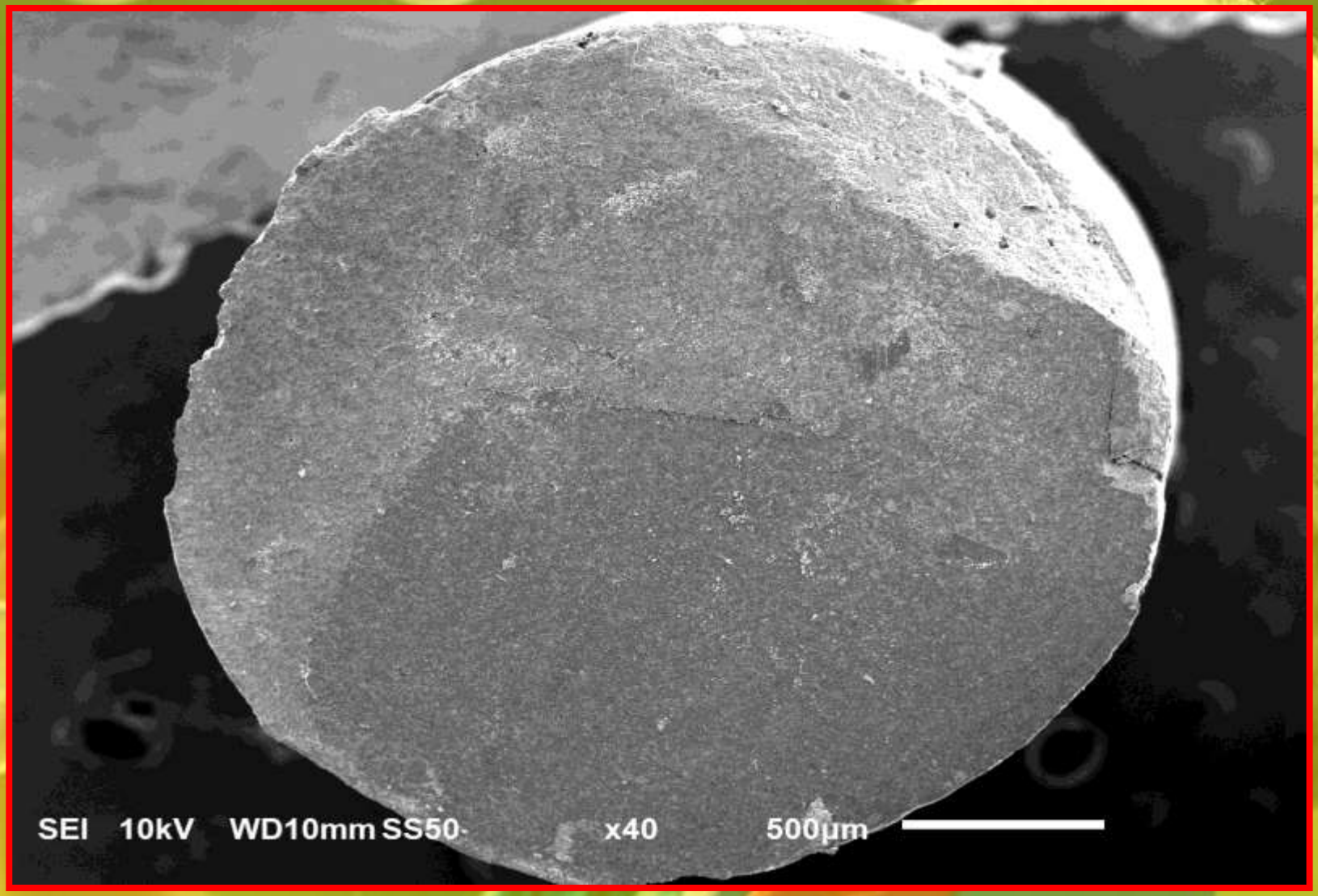
TheraCem (water)

Normal Cohesive fracture



TheraCem (acid)

Normal Cohesive fracture

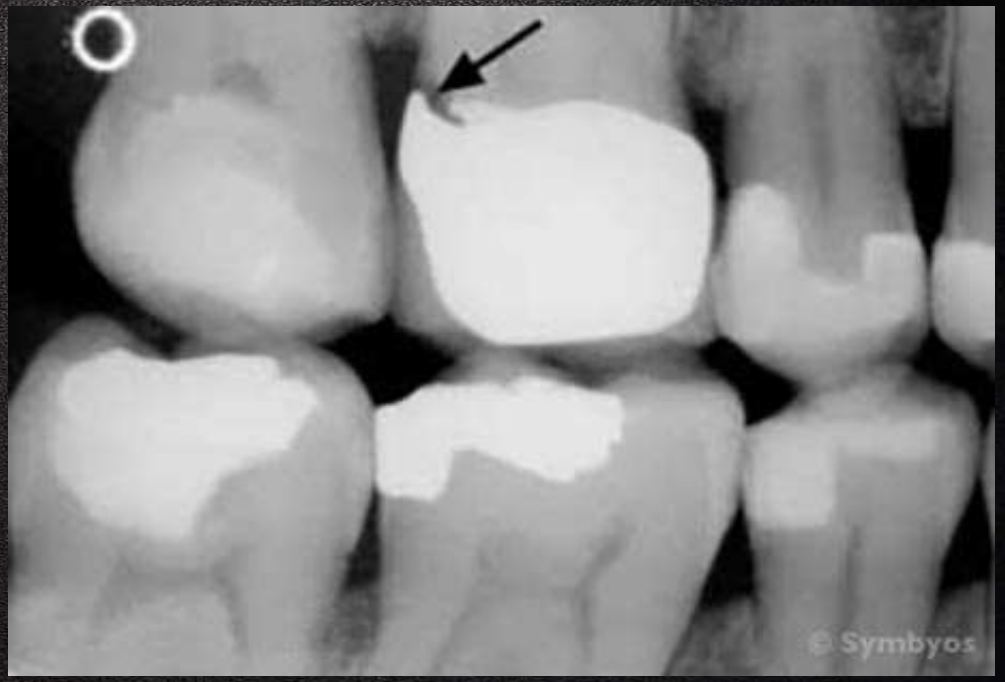


“Smart” Materials

ACKNOWLEDGEMENTS

Co-authors

Rebecca Wang
Jie Yang
Byoung In Suh



谢谢 grazie Je vous remercie Thank you ขอขอบคุณ Спасибо
Danke gracias 謝謝 ありがとうございました 고맙습니다

BISCO

Zirconium Crowns for Pediatric Dentistry

Remove rubber dam and clean up flash

Old zirconium

Bulk Fill

Bulk Fill-

- Depth of Cure- essential!
- Low Young's Modulus
- Low Shrinkage
- Properties- wear resistance, compressive strength, tensile strength

Fusion Wedges- Case 1

Interproximal caries on mesial first molar and distal second premolar

Fusion Wedges- Case 1

Proper isolation is necessary for patient safety and for a quality restoration.

Features & Benefits

Garrison Dental Solutions

Features & Benefits

<u>A real softie</u>.

3D Fusion's Soft-Face over-mold allows the wedge to do what no other wedge can truly do – actually adapt to interproximal irregularities.

Garrison Dental Solutions

Features & Benefits

Keep it clean (and dry!)

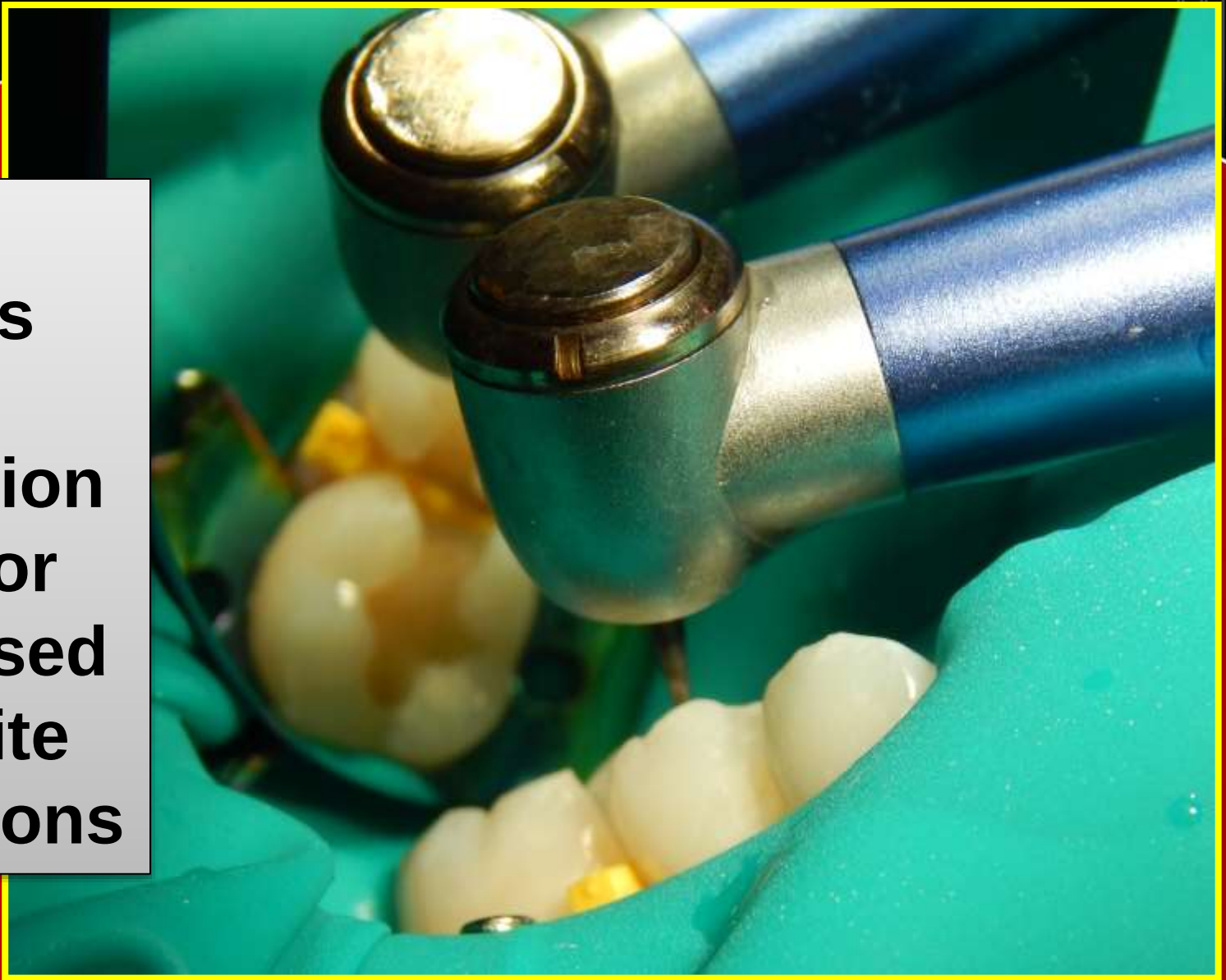
3D Fusion's patent pending design easily follows the contours of the teeth sealing things up nice and tight while preventing overhangs.

Fusion Wedges- Case 1

Pre-wedging provides for isolation and proper contact. Prep into the wedge for ideal "extension for prevention".

Fusion Wedges- Case 1

330 bur produces correct preparation design for resin based composite restorations



Fusion Wedges- Case 1

Number 4 round bur to remove decay and to round axial-pulpal line angels. This reduces stress from occlusal forces.

Fusion Wedges- Case 1

Properly prepared preparations for a resin based composite resin. Note condition of wedge….

Fusion Wedges- Case 1

Garrison matrix, wedge and bitine place to separate teeth and provide for proper restoration.

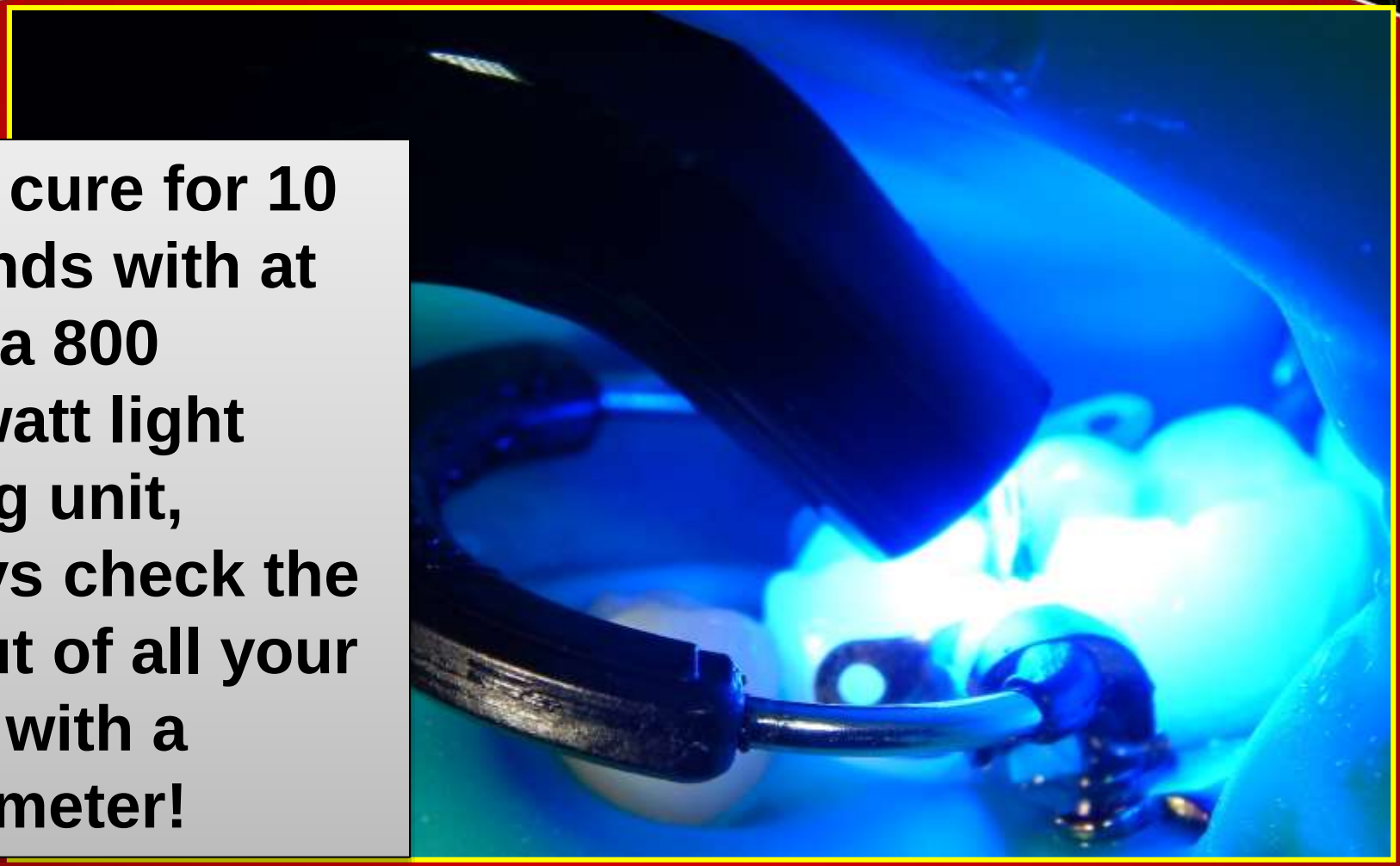
Fusion Wedges- Case 1

Bisco Uni-Etch for total etch starting with enamel for 20 seconds then dentin for 3 seconds.

Fusion Wedges- Case 1

After total etch a universal adhesive is placed, ALLBOND Universal, in two coats, then light cured.

Fusion Wedges- Case 1



Light cure for 10 seconds with at least a 800 milliwatt light curing unit, always check the output of all your units with a radiometer!

Fusion Wedges- Case 1

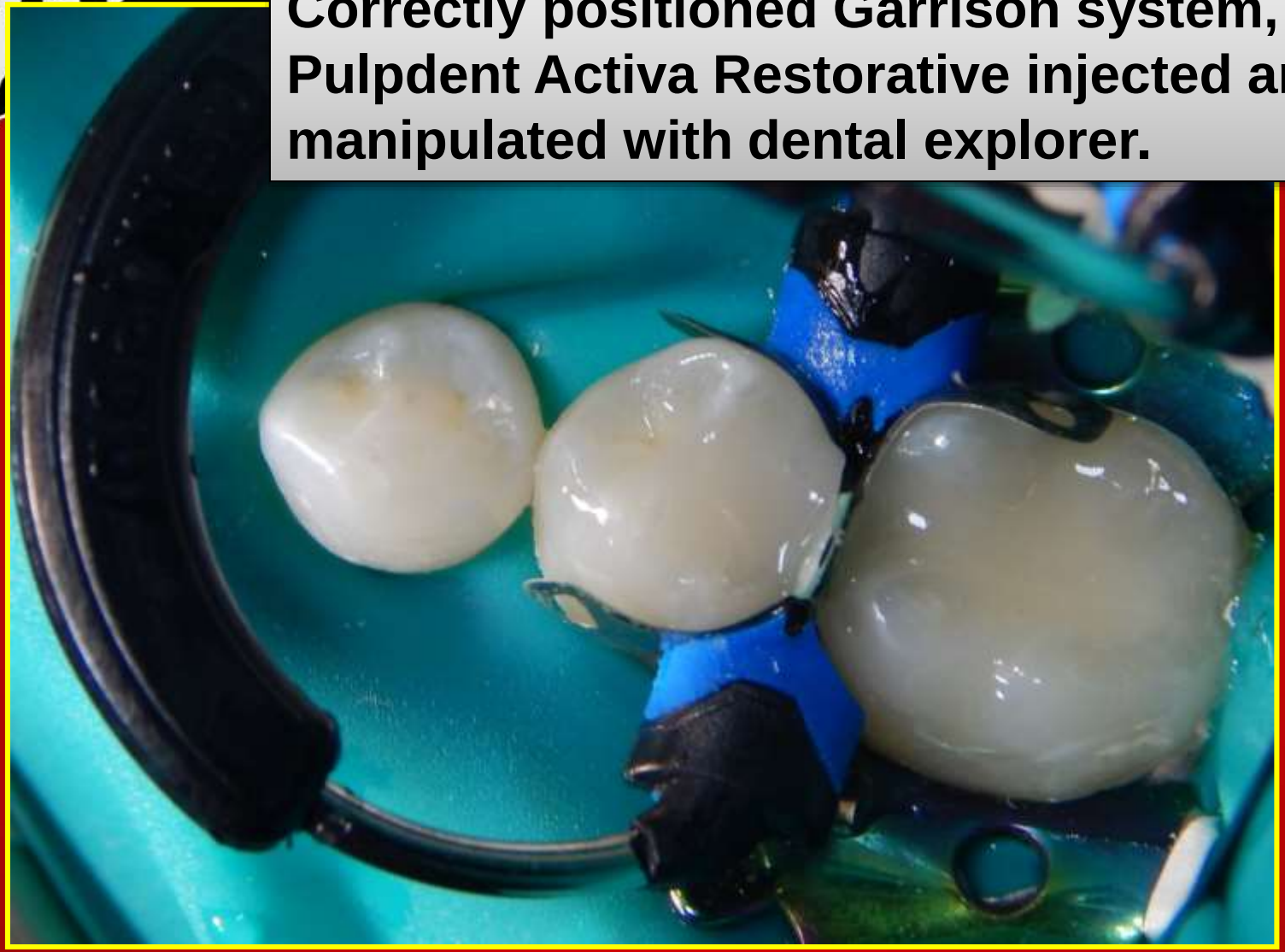
Inject Activa Restorative Dual Cure Restorative Resin Based Bioactive Material.

Garrison Wedges and Matrix

Light cure Activa Restorative from Pulpdent in layers, but remember it is dual cured. The autocure continues, don't remove matrix until it is done!!!

Fusion Wedges- Case 1

Correctly positioned Garrison system, Pulpdent Activa Restorative injected and manipulated with dental explorer.

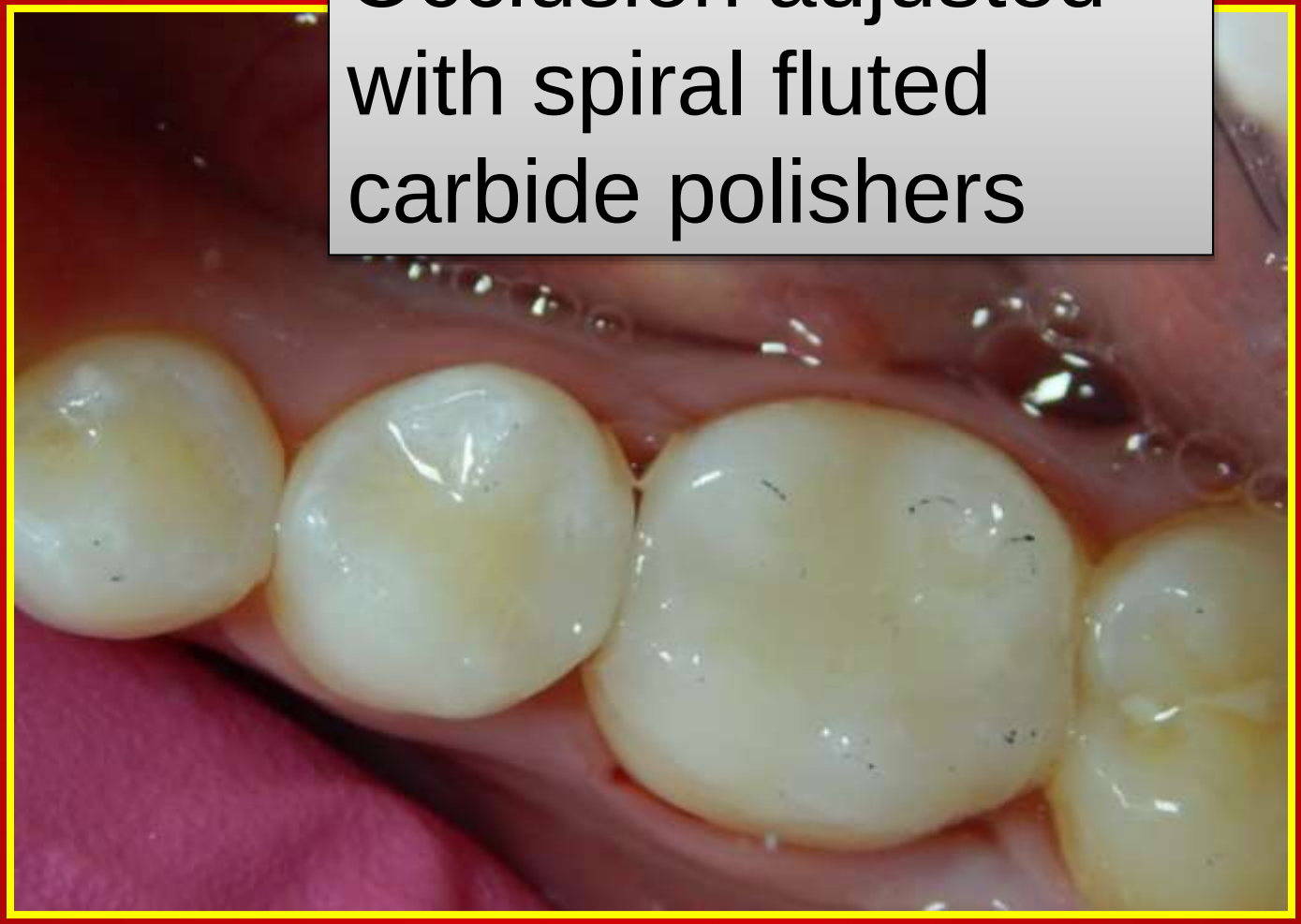


Fusion Wedges- Case 1

Garrison Fusion bitine, matrix and wedge removed. Normal contours evident, leads to correct specific microbiome for contact area.

Fusion Wedges- Case 1

Occlusion adjusted with spiral fluted carbide polishers



Features & Benefits

Garrison Dental Solutions

Wrap it up – Full Curve bands wrap further around the tooth, out of the way, making ring placement easier. Still dead-soft and a skinny 0.0015” thin, they’re the perfect choice.

Garrison- Fusion Matrix and Wedges

- Clinical Cases: Interproximal Form
- Dental Caries- mesial distal premolar and mesial molar

Garrison- Fusion Matrix and Wedges

Rubber dam and pre-wedge with Garrison Fusion Wedges Protects tissue and rubber dam, opens contacts

Garrison- Fusion Matrix and Wedges

Preparations with contacts opened, tissue and dam protected- no bleeding

Garrison- Fusion Matrix and Wedges

Fusion Matrixes placed and Garrison bitine ring placed for mesial contact of pre-molar

Garrison- Fusion Matrix and Wedges

Total etch-enamel for 30 seconds and dentin for 3 seconds

Garrison- Fusion Matrix and Wedges

ALLBOND Universal adhesive placed, two coats and dwell time of 10-15 seconds

Garrison- Fusion Matrix and Wedges

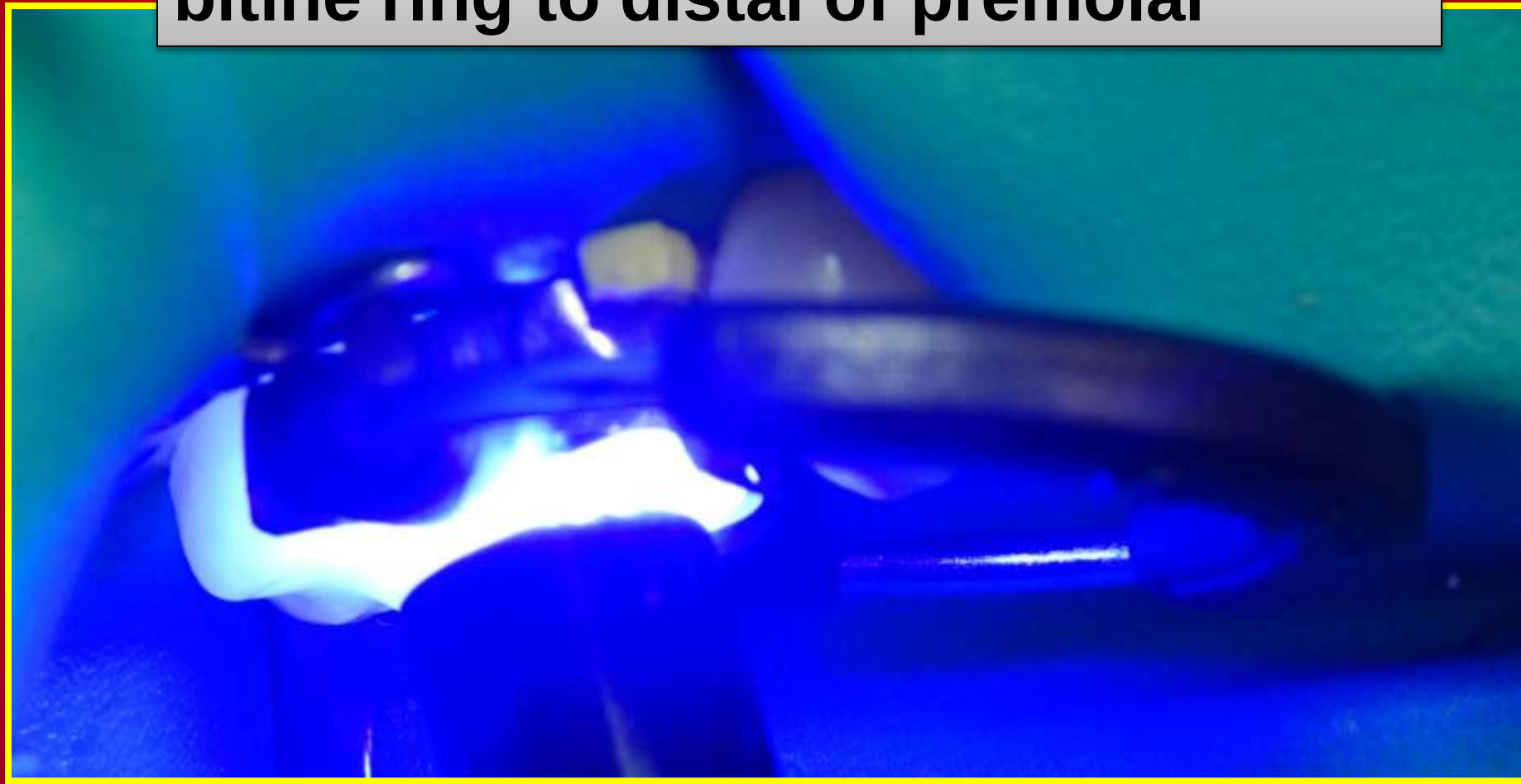
Light cure of adhesive with minimum of 500 milliwatts for 10 seconds- but 20 seconds best due to deep box preparations and matrix band blockage of light

Garrison- Fusion Matrix and Wedges

Very Important! Mesial box filled with composite- graded slope to distal axial pulpal angle

Garrison- Fusion Matrix and Wedges

Light cure for 20 seconds- and move bitine ring to distal of premolar



Garrison- Fusion Matrix and Wedges

Now fill distal of premolar and mesial of molar with composite- in layers or with new bulk fill. This was done with Activa-Pulpdent

Light cure distal of premolar and mesial of molar- should have great contacts and contour!

W

Don’t cure just the surface!!!

Don’t use T bands or Tofflemires!

Garrison- Fusion Matrix and Wedges

No polishing- only bitine, matrixes and wedges removed. Now create anatomy with raptor bur and polish with spiral gold fluted carbide.

Garrison- Fusion Matrix and Wedges

Occlusion adjusted and contacts checked with floss- very tight!!!!!

New Rings

Short & Tall Rings

The two main separator rings, short (blue) and tall (orange), are the heart of the new Composi-Tight® 3D Fusion™ system. These are your "go-to" rings and will be used for the majority of restorations.

Garrison- Fusion Matrix and Wedges

New Garrison bitines

Garrison- Fusion Matrix and Wedges

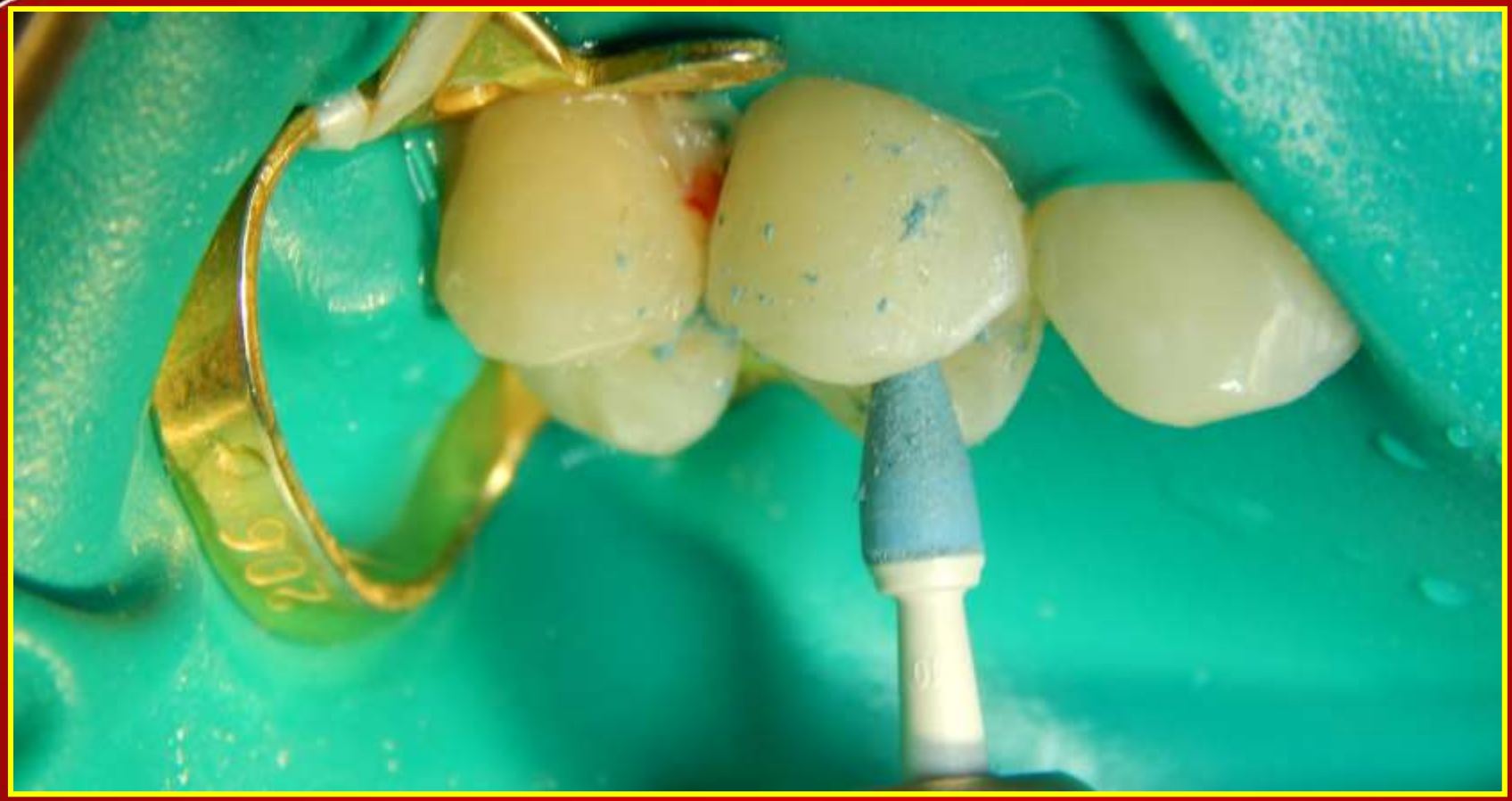
Fits over clamp, wedges, on short teeth

Garrison- Fusion Matrix and Wedges

Normal contour and contact

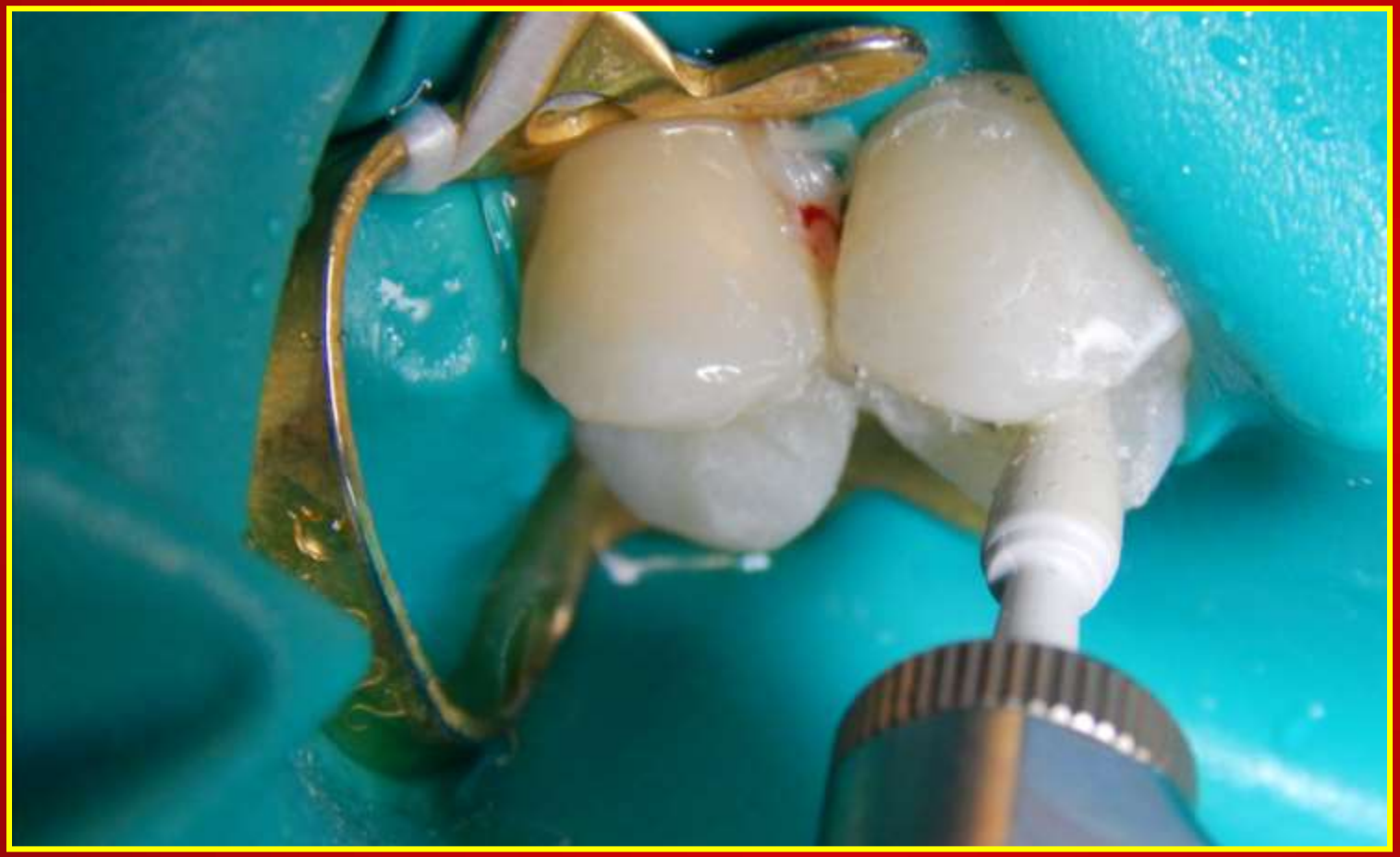
Garrison- Fusion Matrix and Wedges

Garrison polishers- new!!!



Garrison- Fusion Matrix and Wedges

Garrison polishers- Rally



Garrison- Fusion Matrix and Wedges

Rally polishers- final result

Components & Use

Starter Kit

Rally™ polishers are single-patient resin polishing devices designed for the final polishing of all accessible composite resin and hybrid ceramics restorations. A full range of applications are covered with three grits (fine, medium and coarse) and two shapes (point and cup).

The Rally ™ starter kit contains everything you need:

- Fine points and cups
- Medium points and cups
- Coarse points and cups

Components

Reveal HD

Bulk Fill


A brand for a company is like a reputation for a person. You earn a reputation by trying to do hard things well.
- Jeff Bezos, CEO of Amazon.com


BISCO
REVEAL
HD Bulk
REVEAL
HD Bulk
BISCO

Reveal HD Bulk

REVEAL HD Bulk is a light-activated restorative composite, optimized to allow for simpler and faster posterior restorations.

REVEAL HD Bulk combines superior levels of handling, depth of cure, and polishability thanks to it's proprietary *HD Filler Technology*, to perform as an optimum functional and aesthetic bulk fill composite.

Why Bulk Fill?

Save

PRODUCT	Depth of Cure (mm)	Radio-Opactiy (mm Al)	Hardness Degree of Conversion (%)	Compressive Strength (MPa)	Volumetric Shrinkage (%)	Hardness (Top/Bottom)
REVEAL HD Bulk	6.04	4.00	97.0	370.0	2.31	67.0
Voco X-Tra Fill	4.15	3.00	96.0	292.0	2.26	71.5
Kerr Sonic Fill 2	3.06	1.60	94.0	222.0	1.88	70.0
Ivoclar Tetric EvoCeram	3.32	3.50	88.0	207.0	2.36	65.0
Densply SureFill SDR (Flowable)	3.97	3.10	85.0	222.0	4.31	31.5
3M Filtek One	3.88	2.80	91.0	250.0	2.25	64.0
3M Filtek Bulk Fill	3.91	3.00	95.0	236.0	2.51	64.5

By The Numbers

Depth of Cure

Radiopacity

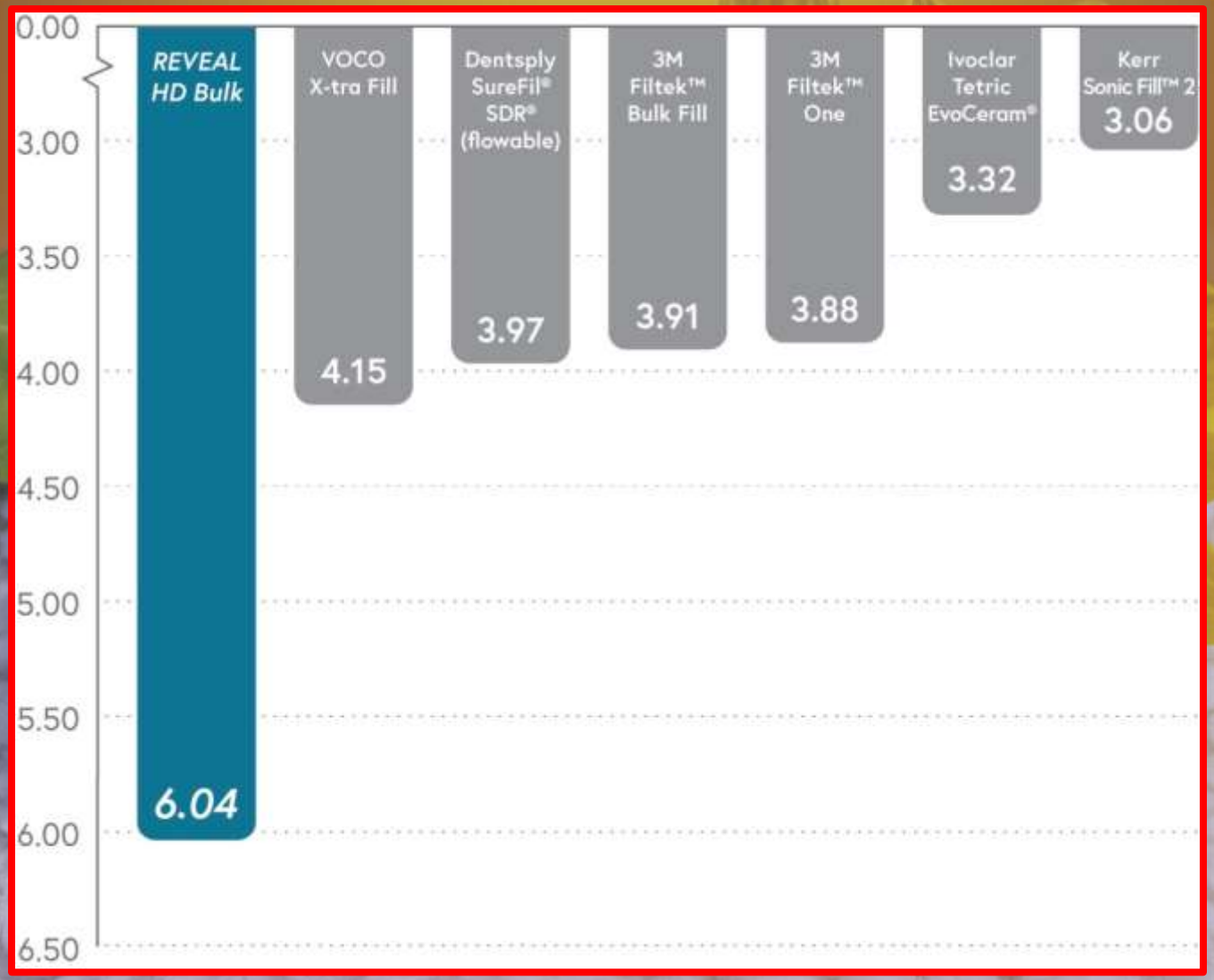
Compressive Strength

Top-To-Bottom Hardness

Volumetric Shrinkage

Hardness Degree of Conversion

Depth of Cure



The Truth About Curing

Indication	Increment Depth	All halogen lights (with output of 550-1000 mW/cm²)	LED lights (with output 1000-2000 mW/cm²)
Core Build-up and Class II Direct Restorations	5 mm	20 sec occlusal, 20 sec buccal, 20 sec lingual	10 sec occlusal, 10 sec buccal, 10 sec lingual
All indications listed (except Core Build-up and deeper Class II Direct Restorations)	4 mm	40 sec	20 sec
Anterior or shallow Class I Restorations	≤ 3mm	20 sec	10 sec

***Recommended Curing Times**

Adequate curing is essential for restorative function. Uncured or undercured composite material is far more likely to experience some form of clinical failure. Kerr recommends regular inspections of your curing lights to ensure they are functioning and providing the expected irradiance. SonicFill 2 is intended to be cured by a halogen or LED light with a minimum light intensity of 650 mW/cm² and a light wavelength output within the 400-520 nm range. Please refer to the table below for curing recommendations.

All times refer to a single occlusal surface cure. In any posterior restoration, Kerr recommends additional 10 second cures on both the buccal and lingual surfaces of the tooth.

Curing Method	All Shades
Optilux (or light with output 650 – 1000 mW/cm²)	20 Seconds
Demi Ultra / Demi Plus (or light with output >1000 mW/cm²)	10 seconds

3.6 Curing

SonicFill SDR flowable material is designed to be cured in increments up to a 4mm depth/thickness.

- Light cure each area of the restoration surface with a suitable visible light curing unit designed to cure materials containing camphorquinone (CQ) inhibator, i.e. spectral output containing 470nm. Minimum light output must be at least 550mW/cm².

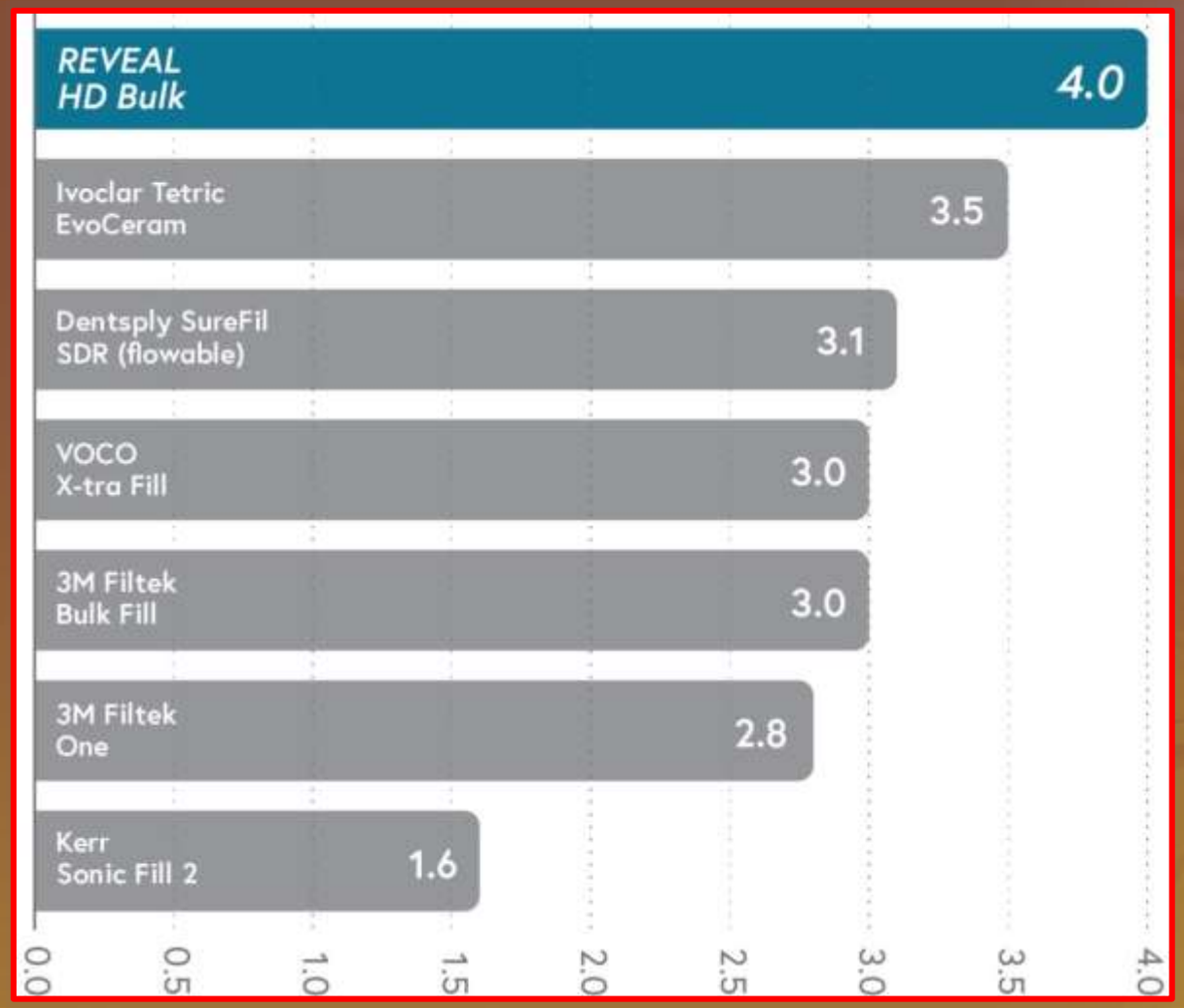
CAUTION

Pulp Injury due to excessive heat - curing output >2000 mW/cm²

- Check Curing Light manufacturer's literature for stated output.
- Consult Curing Light manufacturer's Directions for compatibility curing recommendations
- Do not use table below for recommended curing times with output >2000 mW/cm².

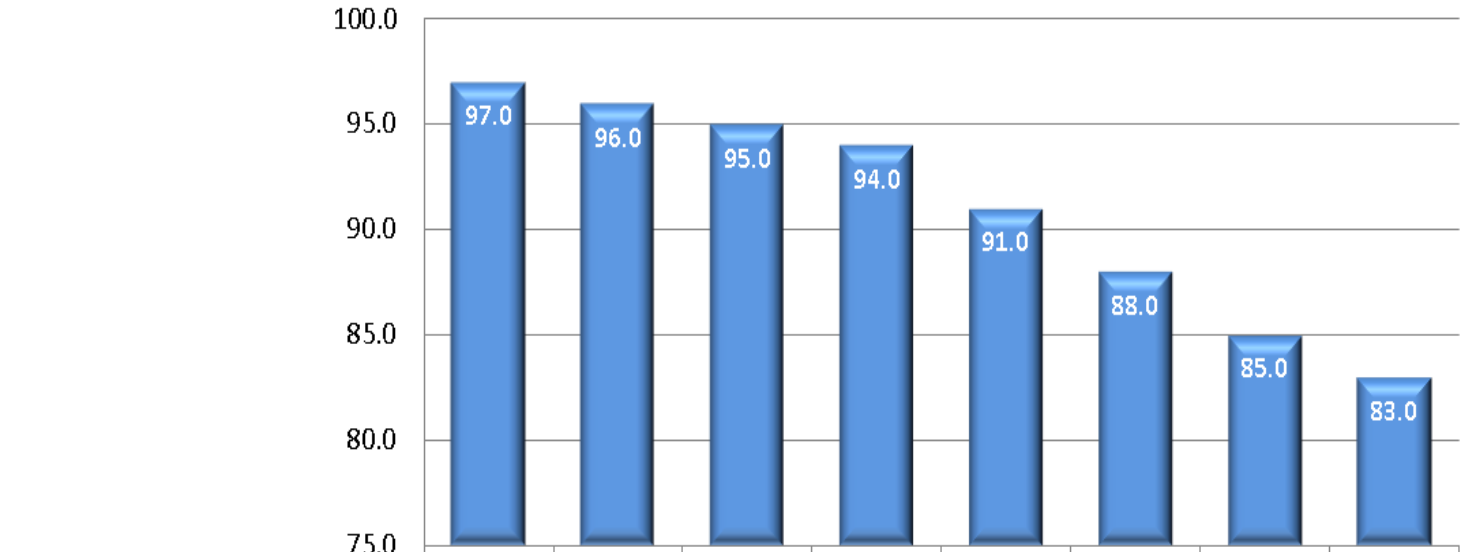
Curing Recommendations*

Shade	Light Output	Cure Time: 2mm	Cure Time: 4mm
Universal	Halogen and LED Lights 550-1000 mW/cm²	20"	20"
	High Power LED Lights 1000-2000 mW/cm²	10"	10"
A1, A2, A3	Halogen and LED Lights 550-1000 mW/cm²	20"	40"
	High Power LED Lights 1000-2000 mW/cm²	10"	25"



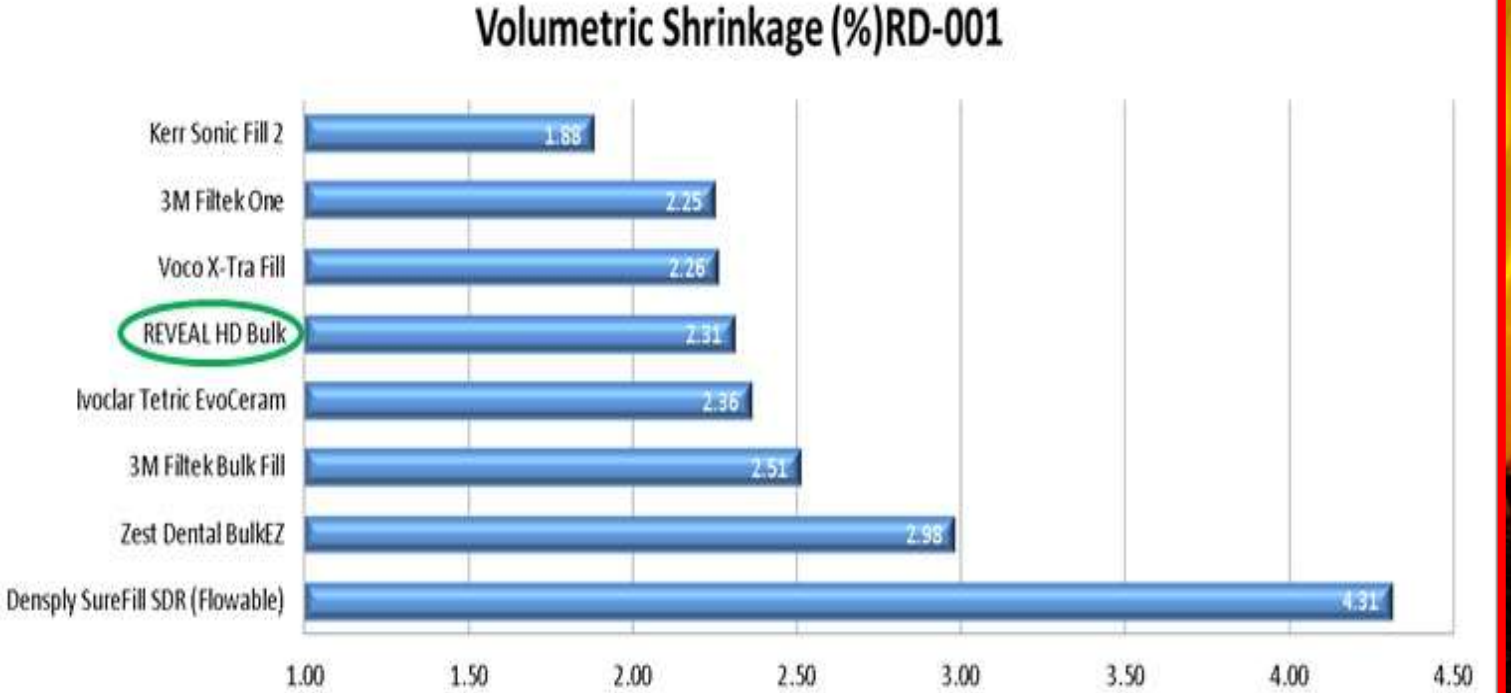
Radiopacity

Compressive Strength



Hardness Degree of Conversion (%)	97.0	96.0	95.0	94.0	91.0	88.0	85.0	83.0

Degree of Conversion (Hardness)



	Densply SureFill SDR (Flowable)	Zest Dental BulkEZ	3M Filtek Bulk Fill	Ivoclar Tetric EvoCeram	REVEAL HD Bulk	Voco X-Tra Fill	3M Filtek One	Kerr Sonic Fill 2
Volumetric Shrinkage (%)RD-001	4.31	2.98	2.51	2.36	2.31	2.26	2.25	1.88

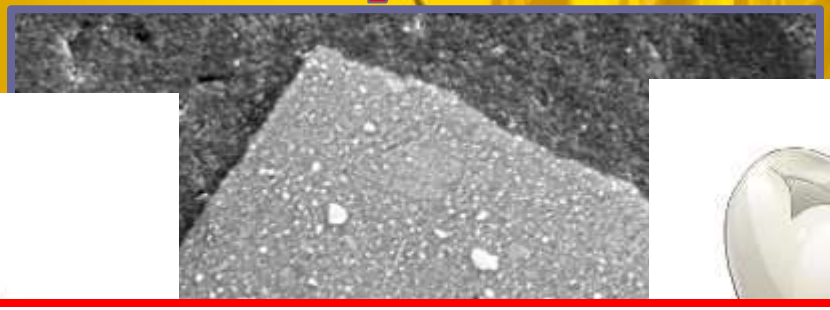
Volumetric Shrinkage

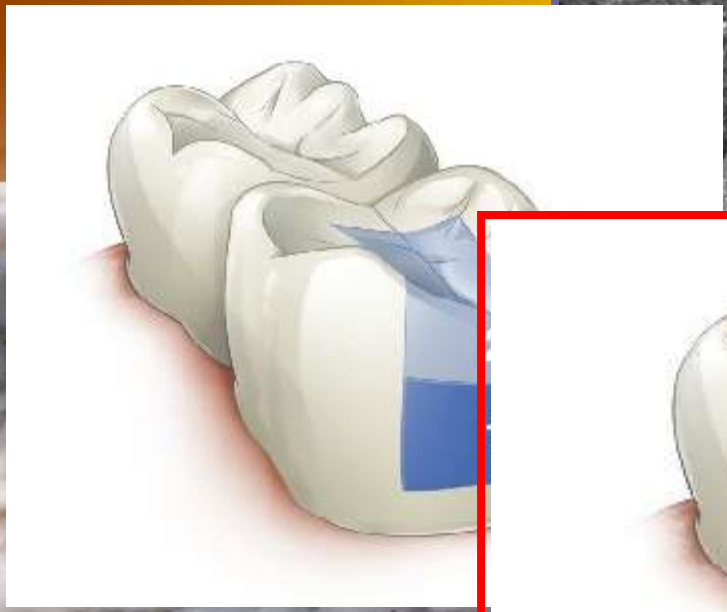
HD Filler Technology

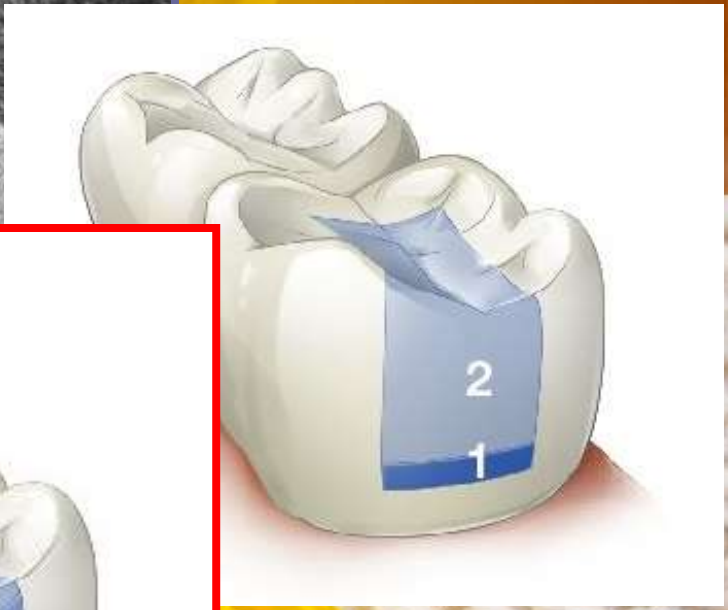
Prepolymerized Filler (PPF)

Depth of Cure

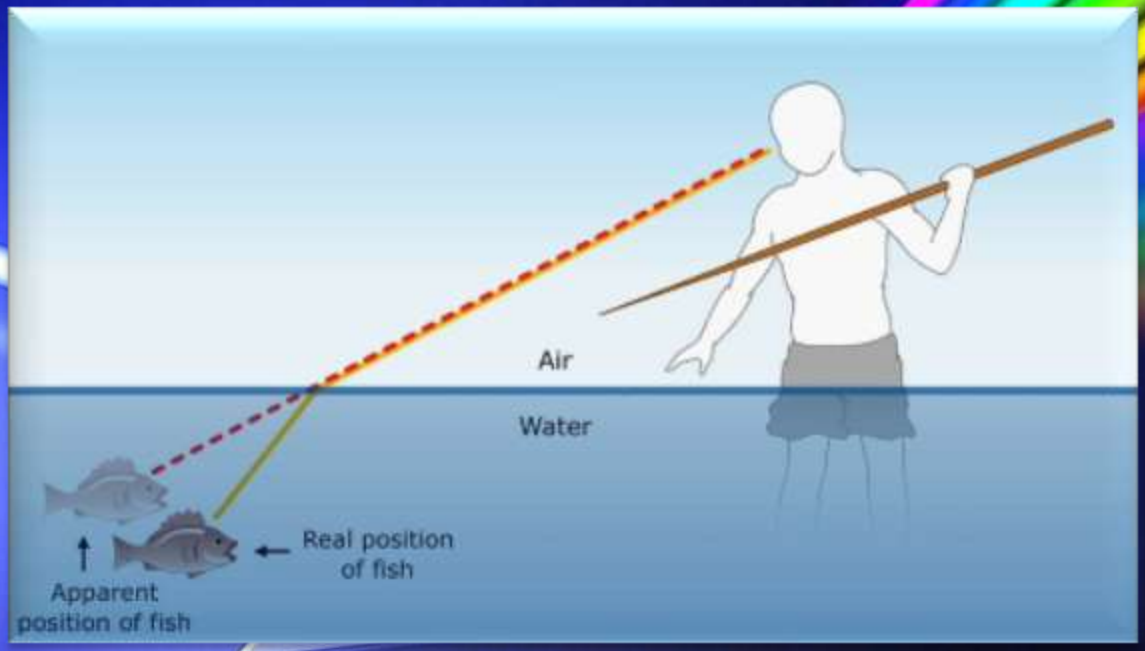
Wear/Polishability Handling





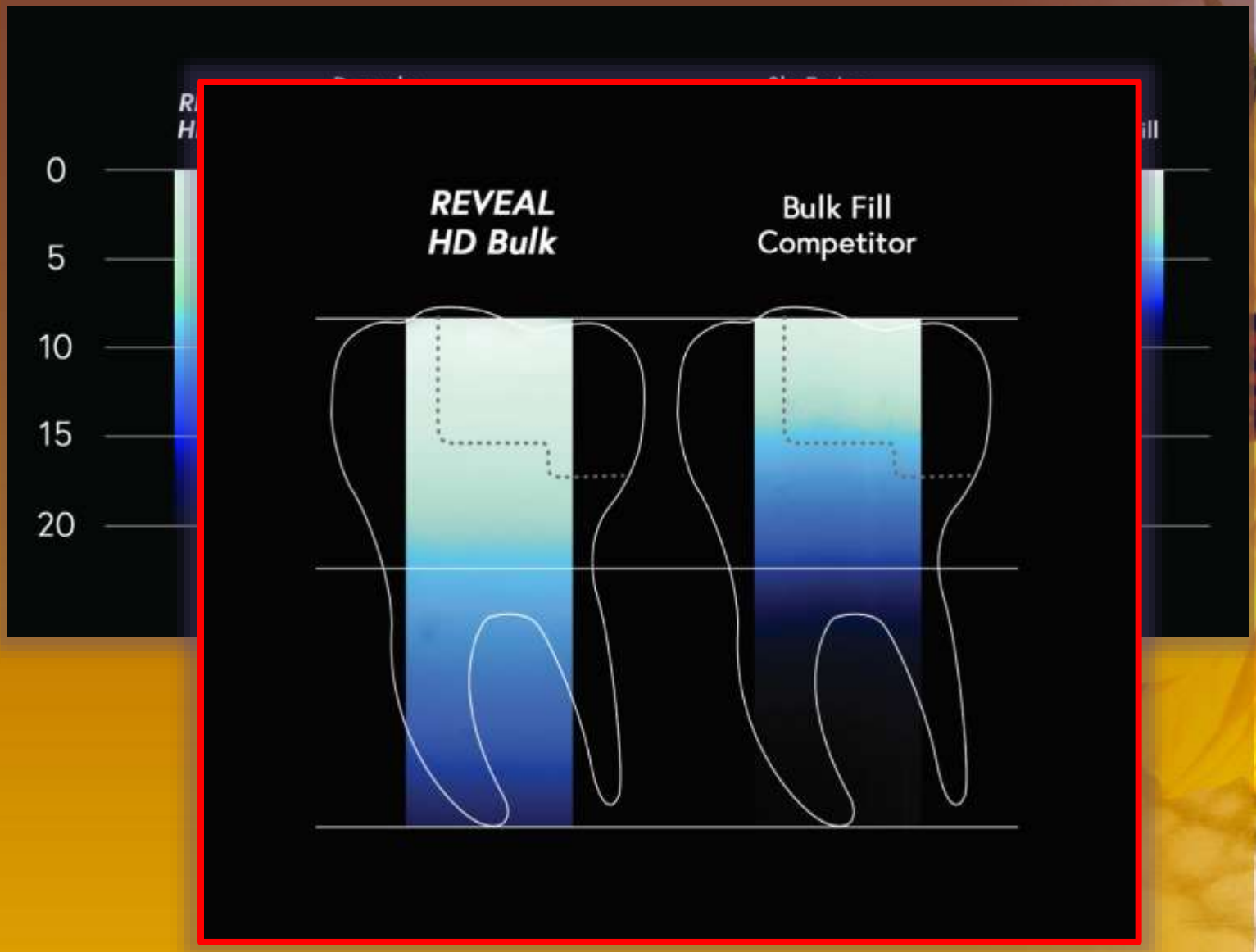


Refractive Indices

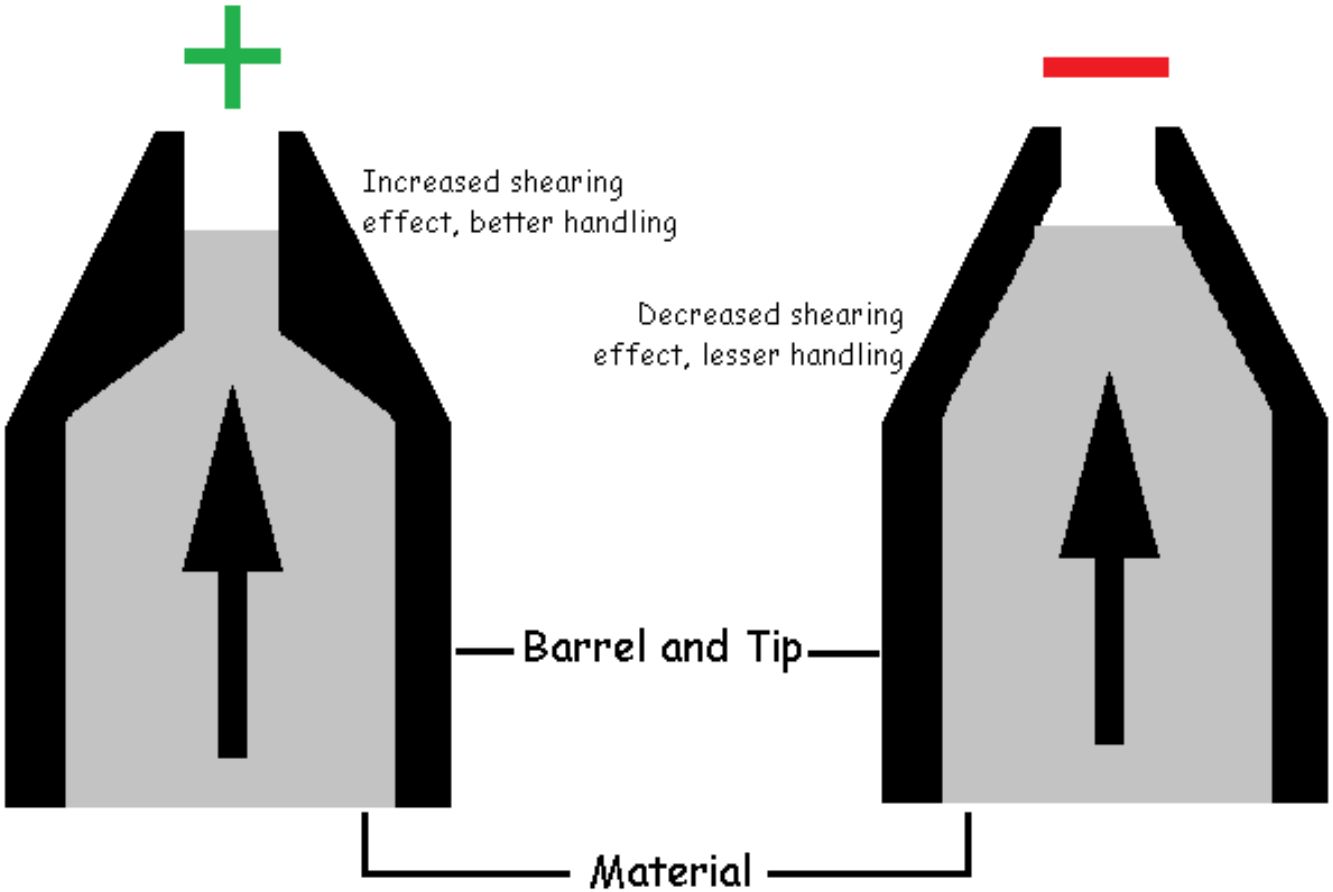


Refractive Indices

Light Transmission



Shearing Effect



Clinical Case 1:

- Dental caries- distal of first premolar
- Odd shaped and larger tooth
- STA used

Clinical Case 1:

- Pre-wedge

Clinical Case 1:

- Prophylaxis!

Clinical Case 1:

- Garrison-wedge, matrix and bitine ring

Clinical Case 1:

- 30 second etch of enamel and 3 second dentin etch

Clinical Case 1:

- Apply Universal Adhesive - two coats

Clinical Case 1:

- Light Cure for at least 10 seconds
- Regularly check lights with radiometer (eBay 20$?)

Clinical Case 1:

- Reveal
- Bulk Fill- A2
- Will look trans-luscent

Clinical Case 1:

- **Bulk fill-dentin replacement**

Clinical Case 1:

- **Universal Flowable Composite for Enamel Layer**

Clinical Case 1:

- Esthetic-durable and quick

Clinical Case 1:

- Adjust occlusion
- Polish with Carbides and Points
- Floss contacts

Clinical Case 1:

- Power cure for 20 seconds
- Hardens exposed surface

Clinical Case 2:

- Deep caries of maxillary second pre-molar

Clinical Case 2:

- Rubber dam placed
- Pre-wedged
- STA only

Clinical Case 2:

- Pumice prophylaxis

Clinical Case 2:

- Classic “Ireland” Preparation

Clinical Case 2:

- Deep Caries
- Close to pulp

Clinical Case 2:

- Very deep preparation but all caries removed

Clinical Case 2:

- Etch-enamel for 30 –dentin for 3 seconds

Clinical Case 2:

- TheraCal LC placed in deep portions of preparation.
- Will re-mineralize the affected dentin
- Protects pulp

al Case 2:

- Light cure TheraCal LC for 20 seconds- could use TheraCal SC or DC

Clinical Case 2:

- Apply Universal adhesive-

ALLBOND

Universal

Clinical Case 2:

- Light cure adhesive layer and further cure TheraCal LC

Clinical Case 2:

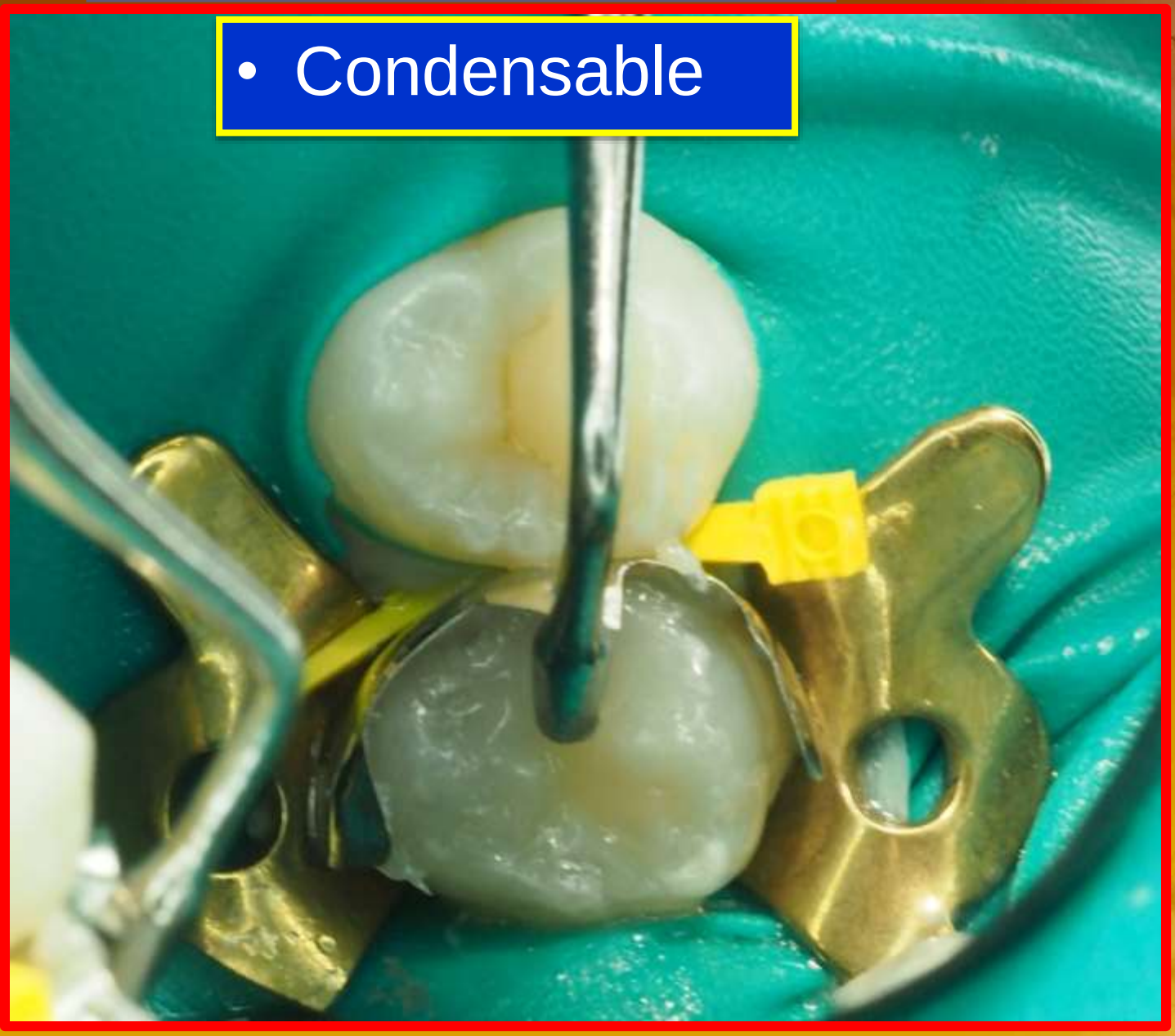
- Cured adhesive and TheraCal

Clinical Case 2:

- Inject Reveal HD Bulk Fill

Clinical Case 2:

- Condensable



Clinical Case 2:

- Dentin replacement
- - could be one fill

Clinical Case 2:

- Power Cure Bulk Fill HD
- Cure buccal and lingual
- Peel back Sectional Matrix

Clinical Case 2:

- Place enamel layer- Estelite Sigma Quick OA1

Case 2:

ondenser

ne enamel

- Peel back matrix

Clinical Case 2:

- Raptor bur creates anatomy
- Polish with fluted carbide
- Remove overhangs

Clinical Case 2:

am
st
occlusion
- Polish

Estelite Bulk Fill *Flow*

Mark Cannon DDS MS- Prof. Division of Dentistry
Dept. of Otolaryngology, Feinberg School of Medicine
Northwestern University, Chicago, IL USA

Case 1: Second Primary Molar

- Occlusal Caries second molar- to be restored with Estelite Bulk Fill Flow

Case 1: Second Primary Molar

- Occlusal Caries- removed , deep preparation

Case 1: Second Primary Molar

- Etching of the enamel for 30 seconds

Case 1: Second Primary Molar

- No etchant on dentin surfaces- yet!

Case 1: Second Primary Molar

- Etchant is applied to dentin surfaces for 3 seconds to remove smear layer only

Case 1: Second Primary Molar

- Copious rinsing of the preparation removes all etchant debris and calcium phosphate salts

Case 1: Second Primary Molar

- Application of base/liner (TheraCal LC) to deepest portions of preparation

Case 1: Second Primary Molar

- Light curing for 20 seconds with intense light source

Demi Ultra
1400-1650
milliwatts

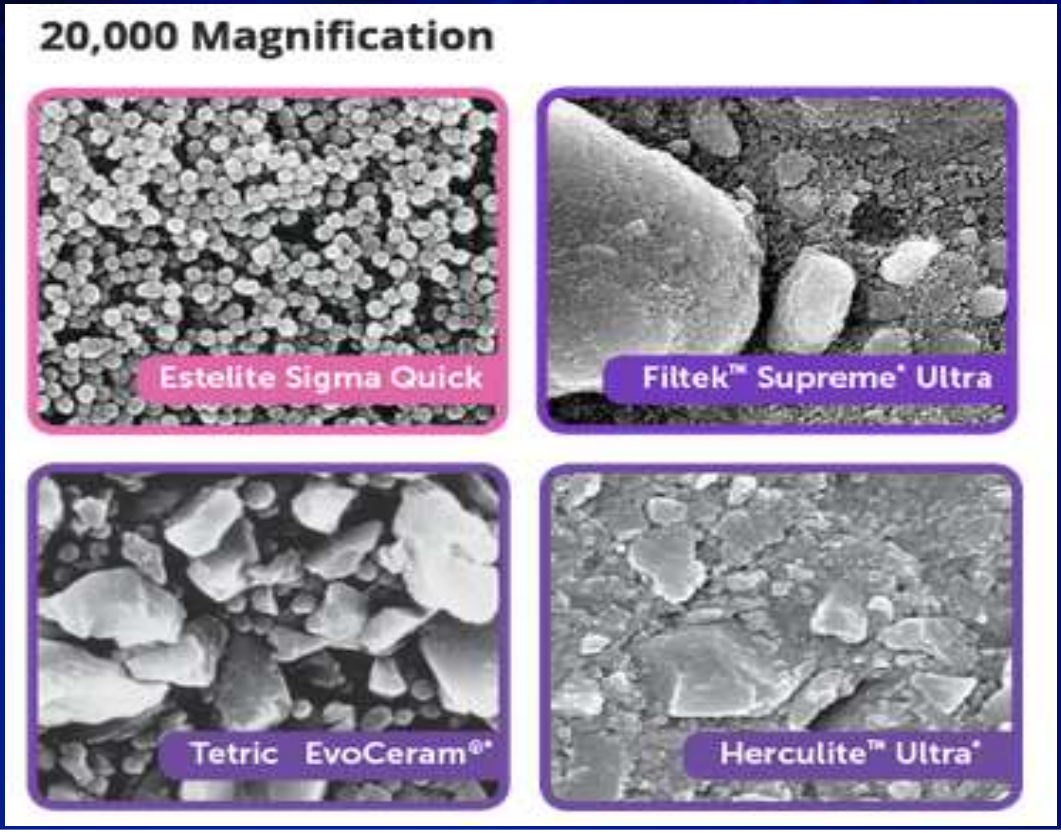
Case 1: Second Primary Molar

- Application of seventh generation universal adhesive – two coats! Light cure 10 seconds

Case 1: Second Primary Molar

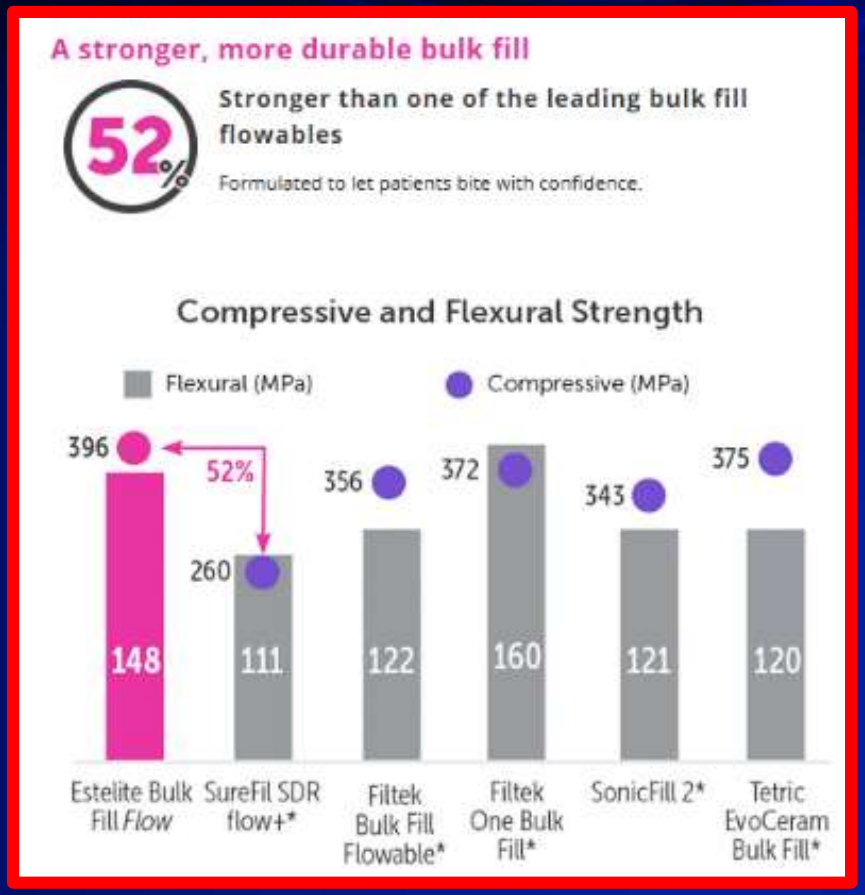
- Estelite Bulk Fill Flow is injected into preparation and teased into place with explorer tine.

Estelite Bulk Fill *Flow*

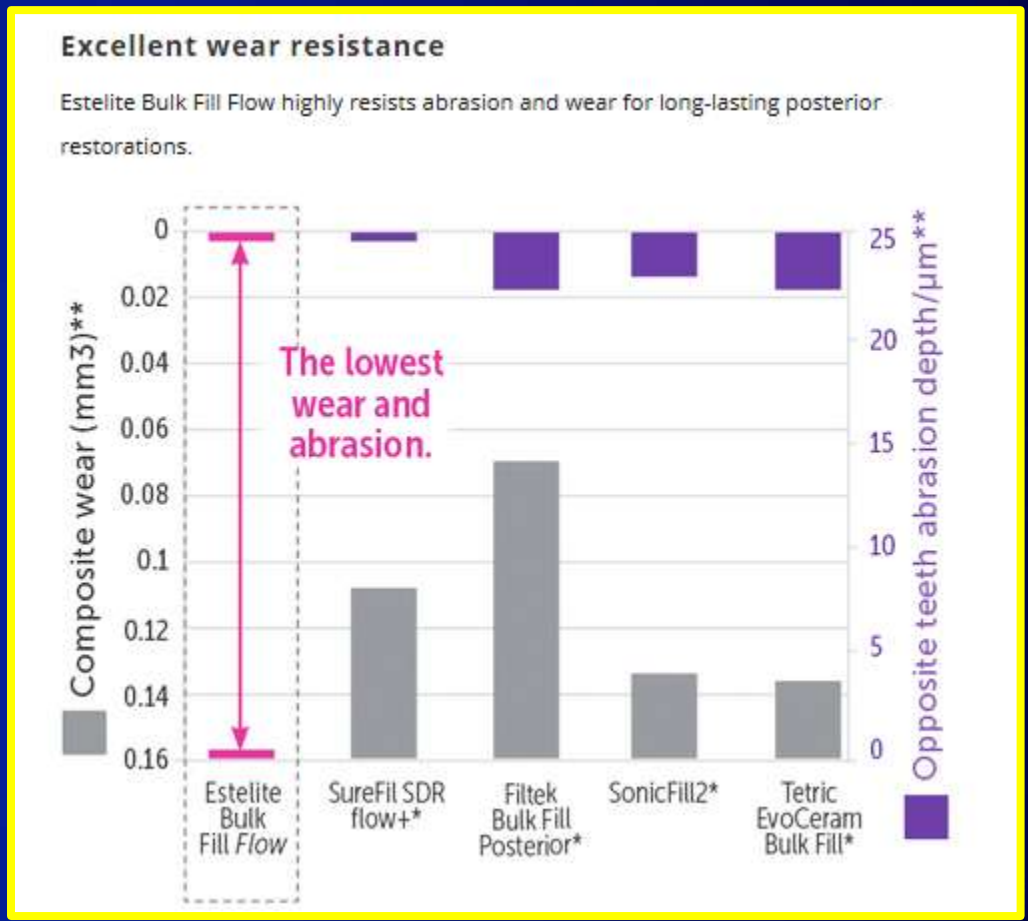


- Developed over 25 years ago by Tokuyama's Research & Development Team in Japan, Estelite's spherical filler particles have won numerous awards for delivering superior benefits to Dentists and patients alike. With an average particle size of **200 nanometers (supra-nano),** the spherical filler particles are the foundation to delivering simple, lasting and beautiful results.

Estelite Bulk Fill Flow



Physical Properties and wear resistance

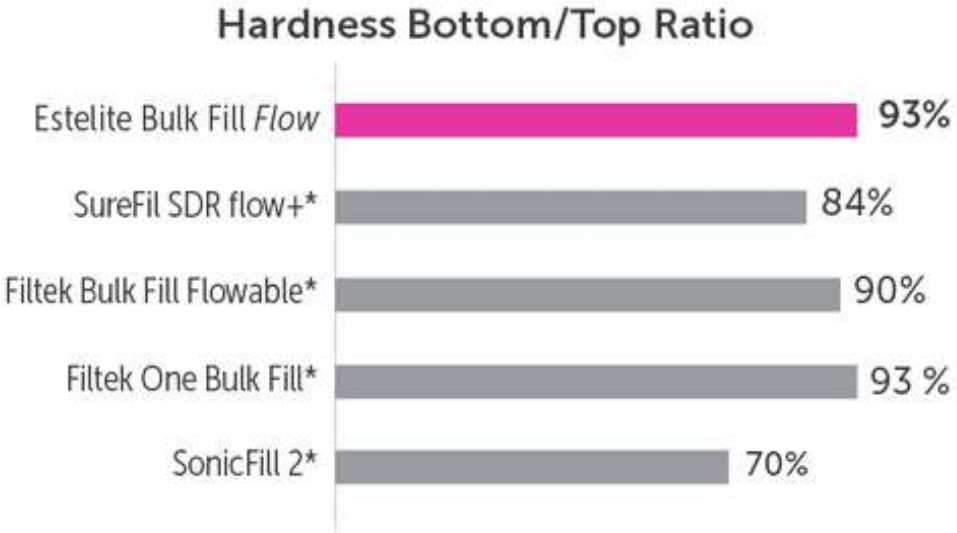


Estelite Bulk Fill Flow

Deep curing and lower stress due to spherical fillers

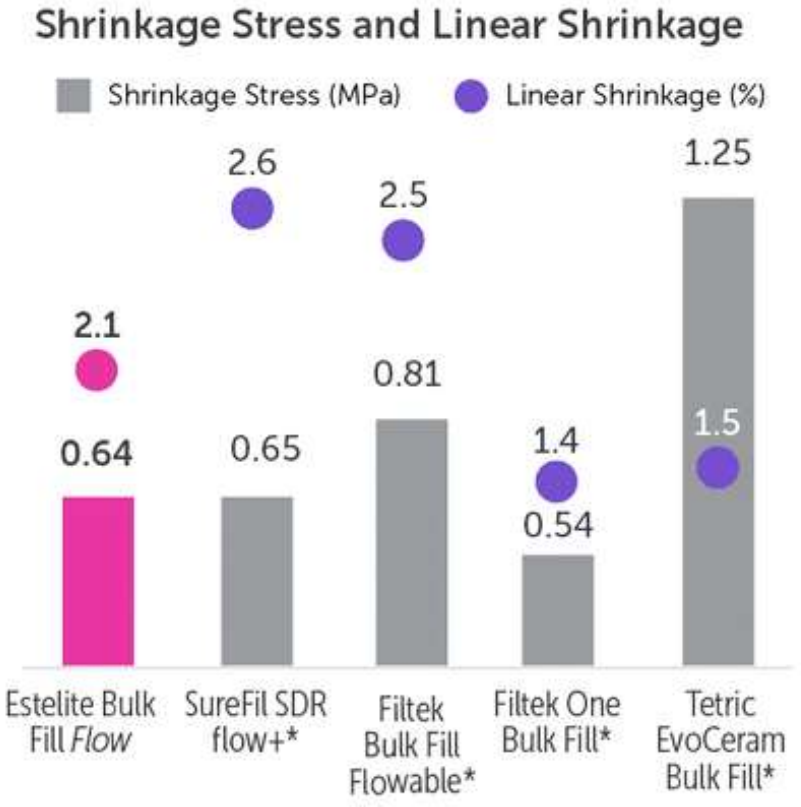
Cured to the bottom of the restoration

Thanks to its high translucency at placement, Estelite Bulk Fill Flow cures all the way to the bottom of a 4mm deep restoration in only 10 seconds.



Minimal shrinkage stress

The spherical fillers used in Estelite Bulk Fill Flow reduce shrinkage stress and linear shrinkage to a minimum.



Estelite Bulk Fill Flow

A bulk fill for worry-free restorations

The best cavity adaptation

Estelite Bulk Fill Flow easily adapts to the cavity, flowing into the nooks and crannies, providing an excellent marginal seal and preventing restoration failure.

*Marginal failure, gaps, and voids were common in other tested brands.

- Marginal sealing and restoration adaptation, no SonicFill voids

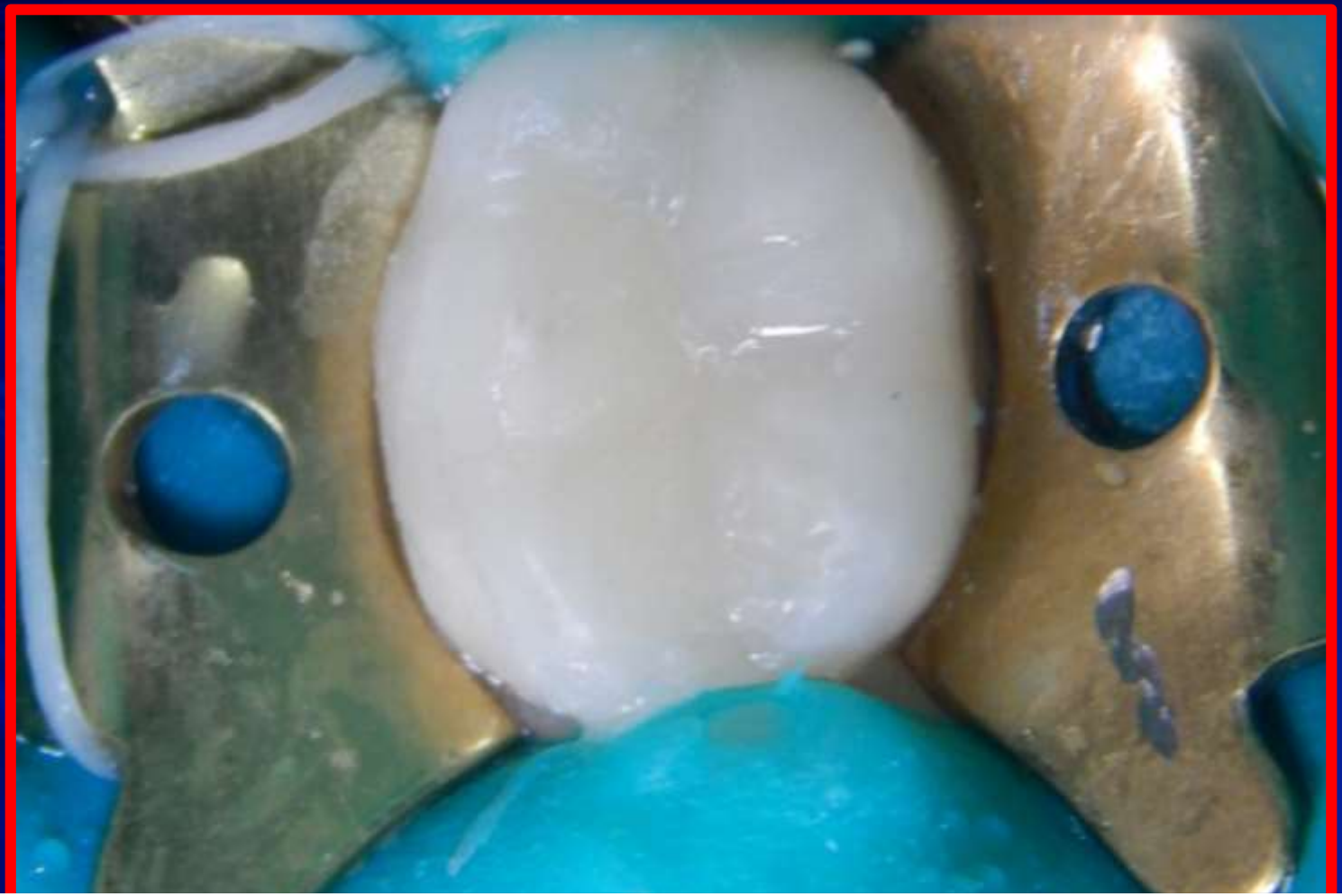
Case 1: Second Primary Molar

- Light curing of Estelite Bulk Fill Flow- becomes opaque

Case 1: Second Primary Molar

- Anatomy created with Raptor bur

Case 1: Second Primary Molar



- Finished restoration! Remove rubber dam and check occlusion

Case 1: Second Primary Molar

- Recare follow up- no microleakage

Advantages

- Estelite Bulk Fill Flow- translucent
- Allows deep curing
- After polymerization- becomes opaque
- Doesn’t have voids/ displays excellent adaptation

Chris- back home…. Yay!!