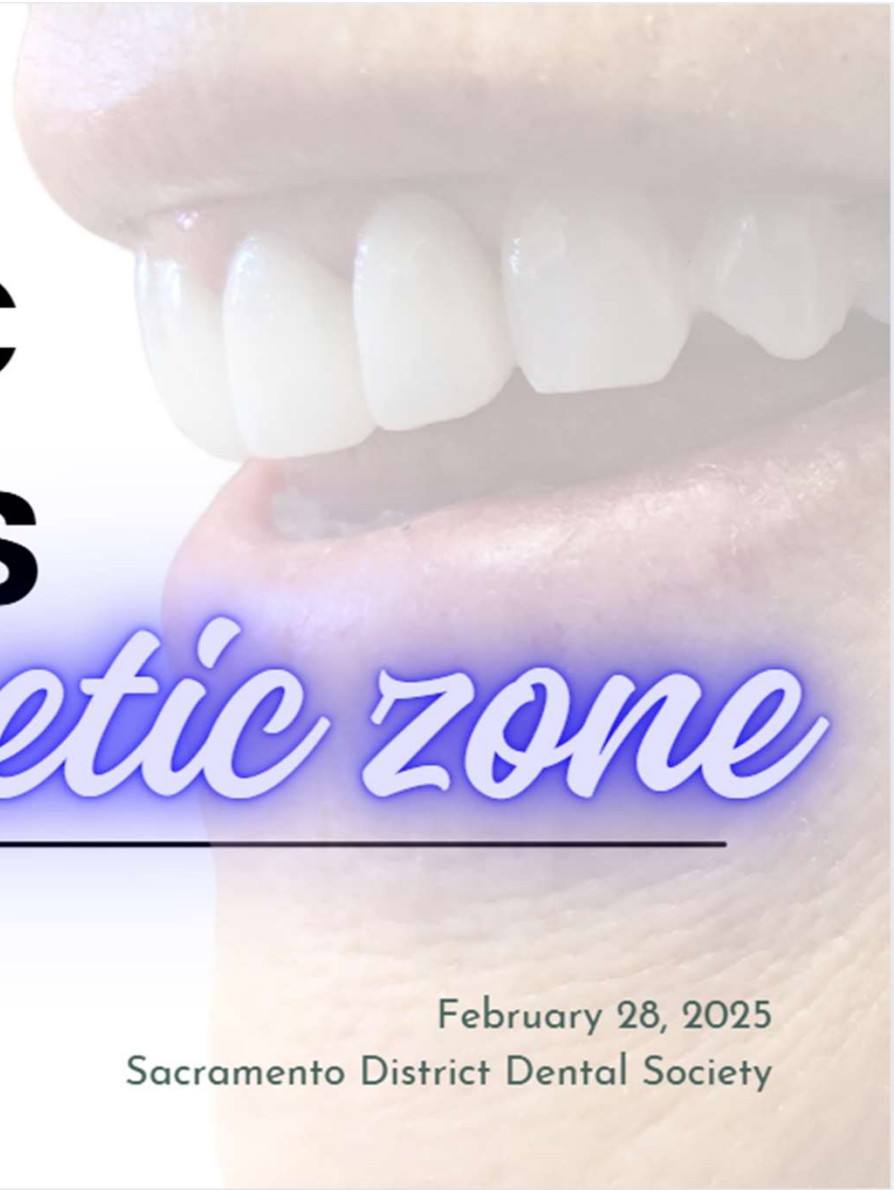
MONOLITHIC COMPOSITES *in the esthetic zone*



LAUREN YASUDA RAINEY, DDS
www.laurenrainey.com
raineydds@gmail.com
@raineydds

February 28, 2025
Sacramento District Dental Society


with gratitude
sacramento
District Dental Society
BISCO®

LAUREN YASUDA RAINEY, DDS

REMEMBER...

this is what the teeth looked like

OBJECTIVES

- Challenges of direct composite
- Loss of tooth structure
- Composite techniques
- Isolation + adhesion

GARY

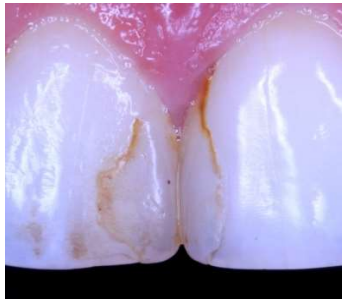
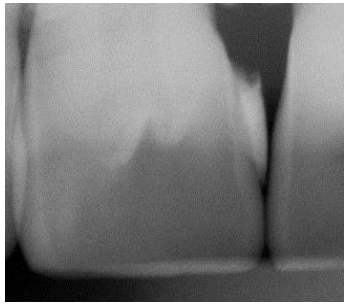
DAVEENA

LINDA

monolithic composites
provide solutions

CHALLENGES with direct composite resins

- Emergence profile
- Staining
- Incisal edges
- Complex layering
- Longevity



- Recurrent decay
- Fracture
- Sensitivity
- Contacts
- Voids

LOSS of TOOTH STRUCTURE

LOSS of TOOTH STRUCTURE

dysfunction

and

disease

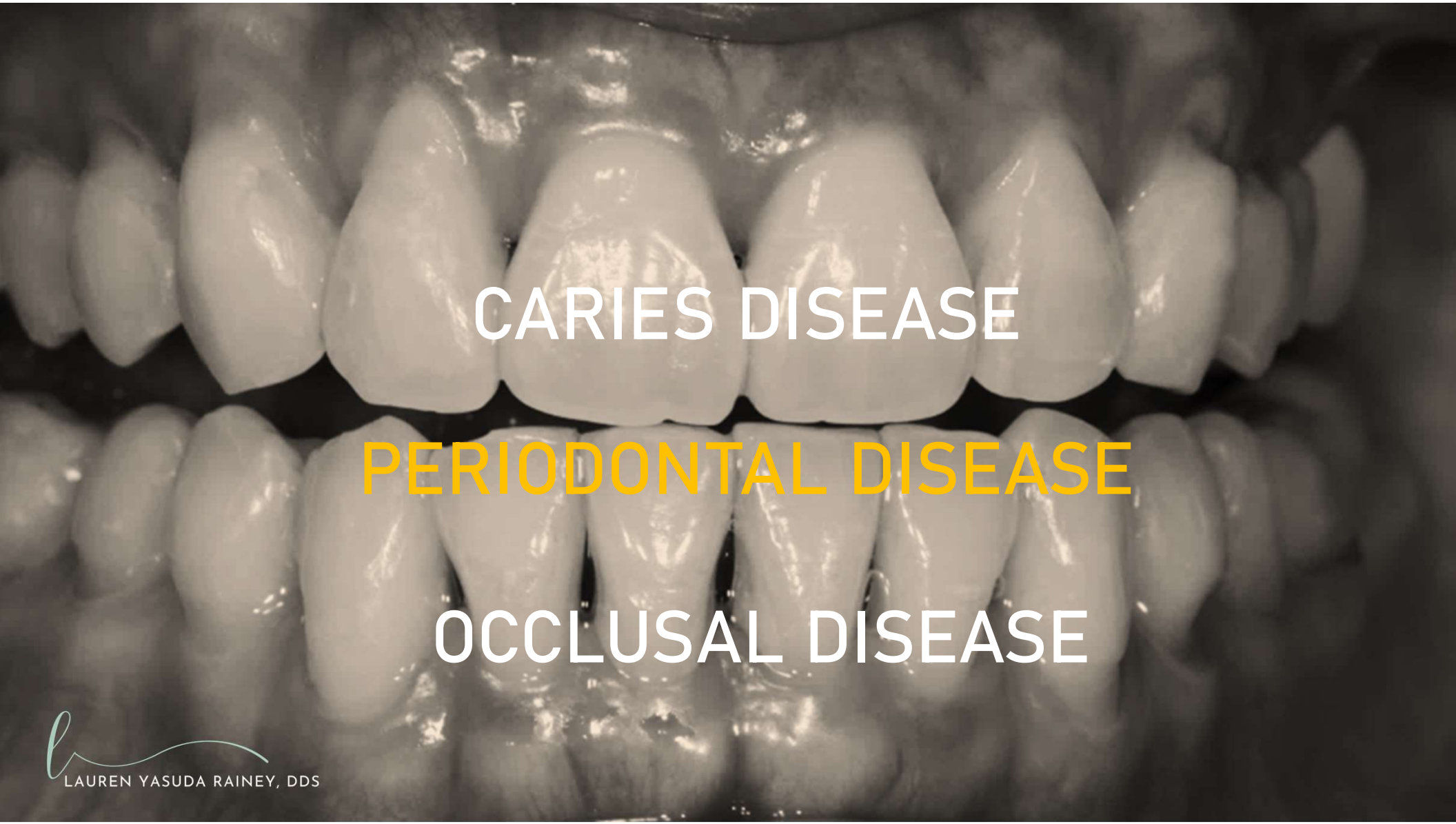
DYSFUNCTION

erosive wear

attrition

loss of support


CARIES DISEASE
PERIODONTAL DISEASE
OCCLUSAL DISEASE


CARIES DISEASE
PERIODONTAL DISEASE
OCCLUSAL DISEASE
LAUREN YASUDA RAINEY, DDS

LAUREN YASUDA RAINEY, DDS

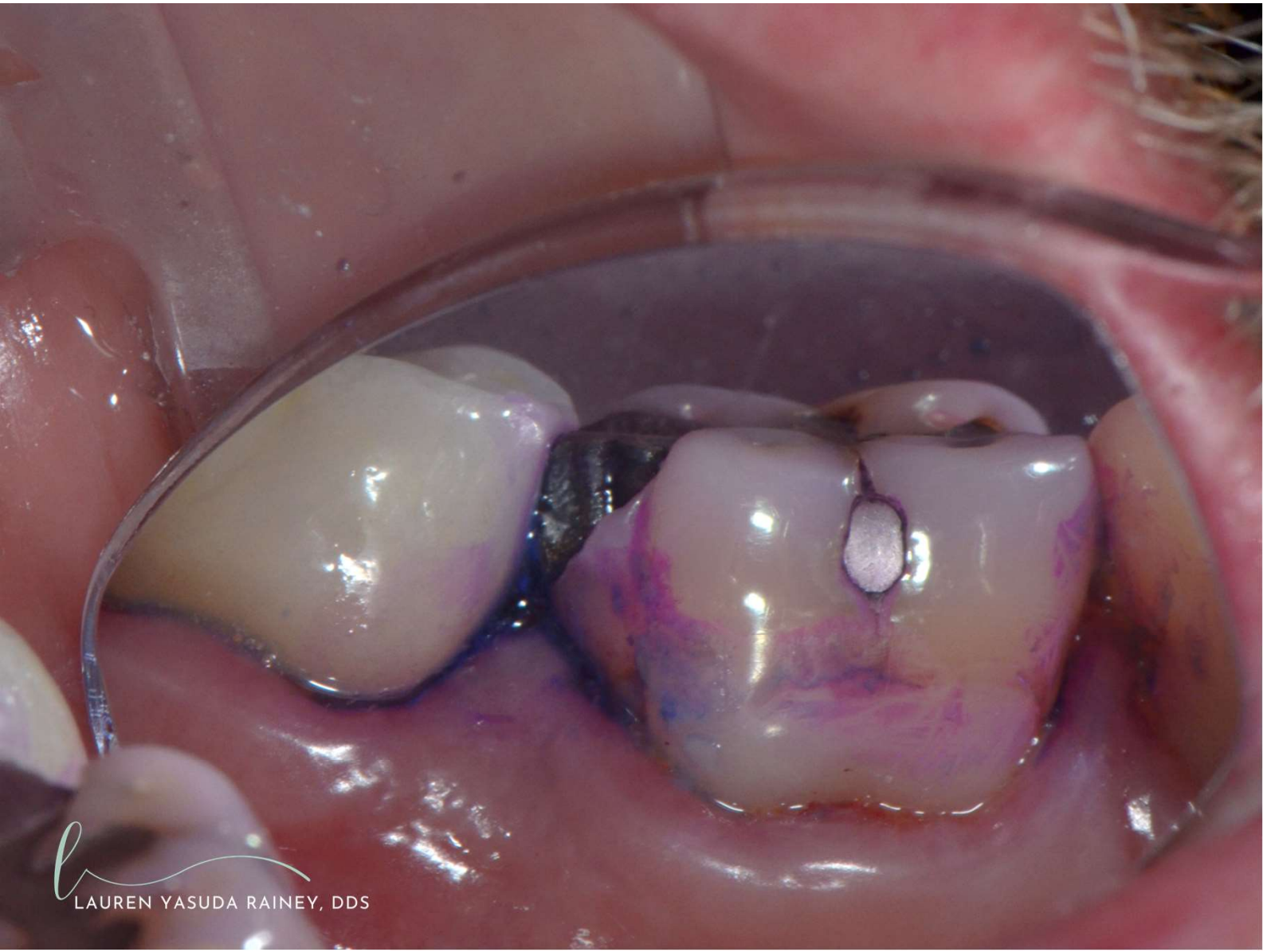
COMPOSITE TECHNIQUES

- Clean substrate
- Matrix plan or guide
- Choose your material

BIOFILM

- organic
- difficult to see
- mechanical means are *necessary* to remove it

BIOFILM REMOVAL



BIOFILM INDICATOR

allows the eye to see what we are missing

PHOSPHORIC ACID ETCH

cleans the
inorganic part of
the tooth structure

LAUREN YASUDA RAINEY, DDS

Absolute Hardness

Talc Mg_3S	1	
		Bio-Blasting $Al(OH)_3$
$Al(OH)_3$	9	Dentin
Apatite	48	Enamel
Al_2O_3	400	Air Abrasion Al_2O_3
Diamond (C)	1600	

Indiana Geological Survey
611 N. Walnut Grove Ave.
Bloomington, IN 47405-2208
(812) 855-7636
IGSinfo@indiana.edu
http://IGS.indiana.edu


PREP START
PRESSURE
Danville

COMPOSITE TECHNIQUES

- Clean substrate
- Matrix plan or guide
- Choose your material

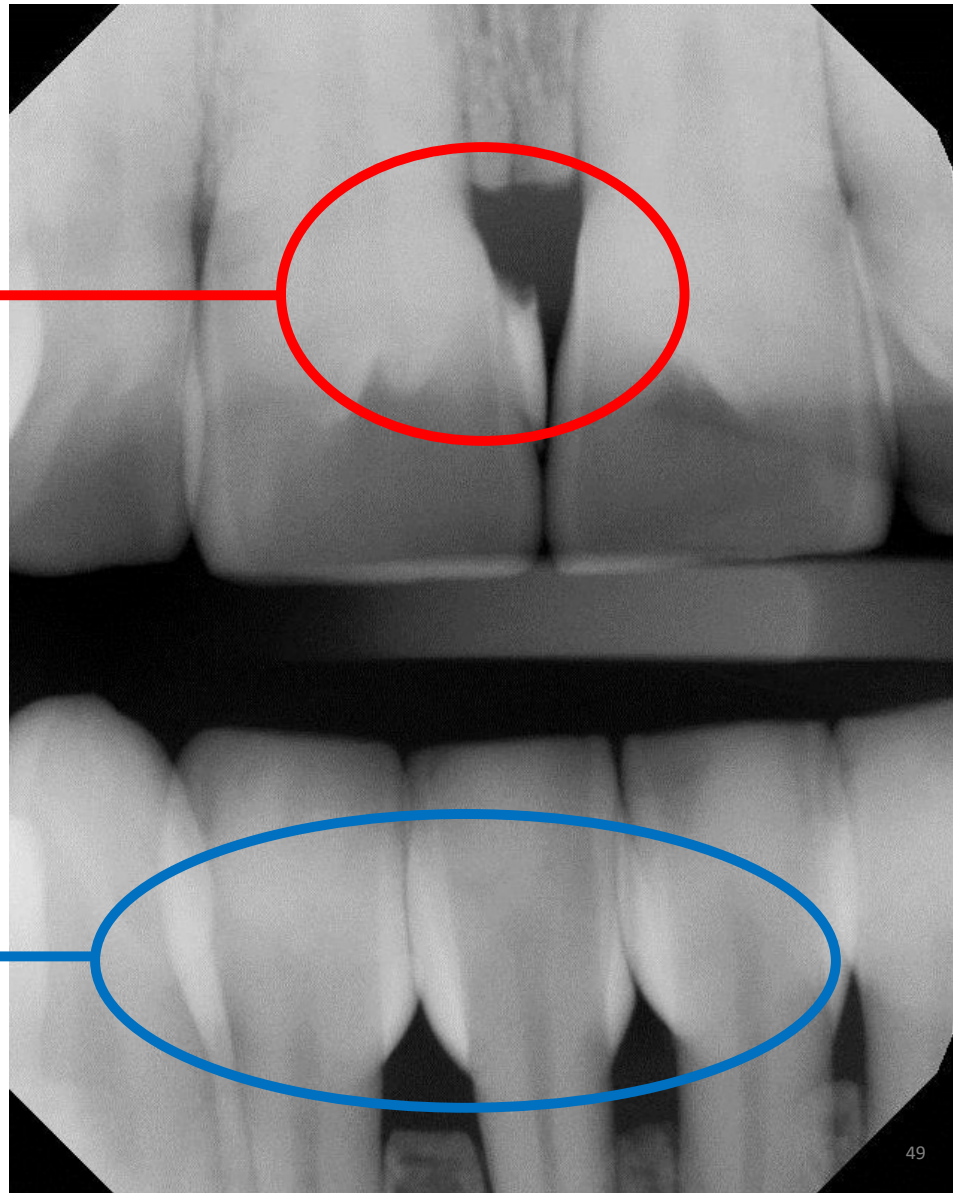
freehand approach

- benefits: relatively fast, no special armamentarium needed

- challenges: emergence profile, unpredictable outcome

Traditional "Bonding"

Injection Molding



predesigned matrix

- **benefits**: custom to patient, some specialized armamentarium, color-in-the-lines approach
- **challenges**: wax-up (or fragment) needed, black triangles are tricky to restore with this method

predesigned matrix

ANATOMIC MYLAR

LAUREN YASUDA RAINEY, DDS

COMPOSITE TECHNIQUES

- Clean substrate
- Matrix plan or guide
- Choose your material

the *decreased viscosity* with heated composite may allow for more predictable placement in challenging preparations

Journal of the Mechanical Behavior of Biomedical Materials
Volume 138, February 2023, 105605

Raising the temperature of the composite can:

- Reduce shrinkage stress
- Improve microhardness
- Improve fracture resistance

Ribeiro, MT; Bragança GF; Oliveira LR, et al. 2023. Effect of pre-heating methods and devices on the mechanical properties, post-gel shrinkage, and shrinkage stress of bulk-fill materials. J Mech Behav Biomed Mat, 105605. https://doi.org/10.1016/j.jmbbm.2022.105605

ELSEVIER

Journal of the Mechanical Behavior of Biomedical Materials

Volume 138, February 2023, 105605

Heated composite DOES cool down quickly

- 50% drop in temp at 2 mins
- 90% drop in temp at 5 mins

Heated composite placement must be *intentional* and *precise*.

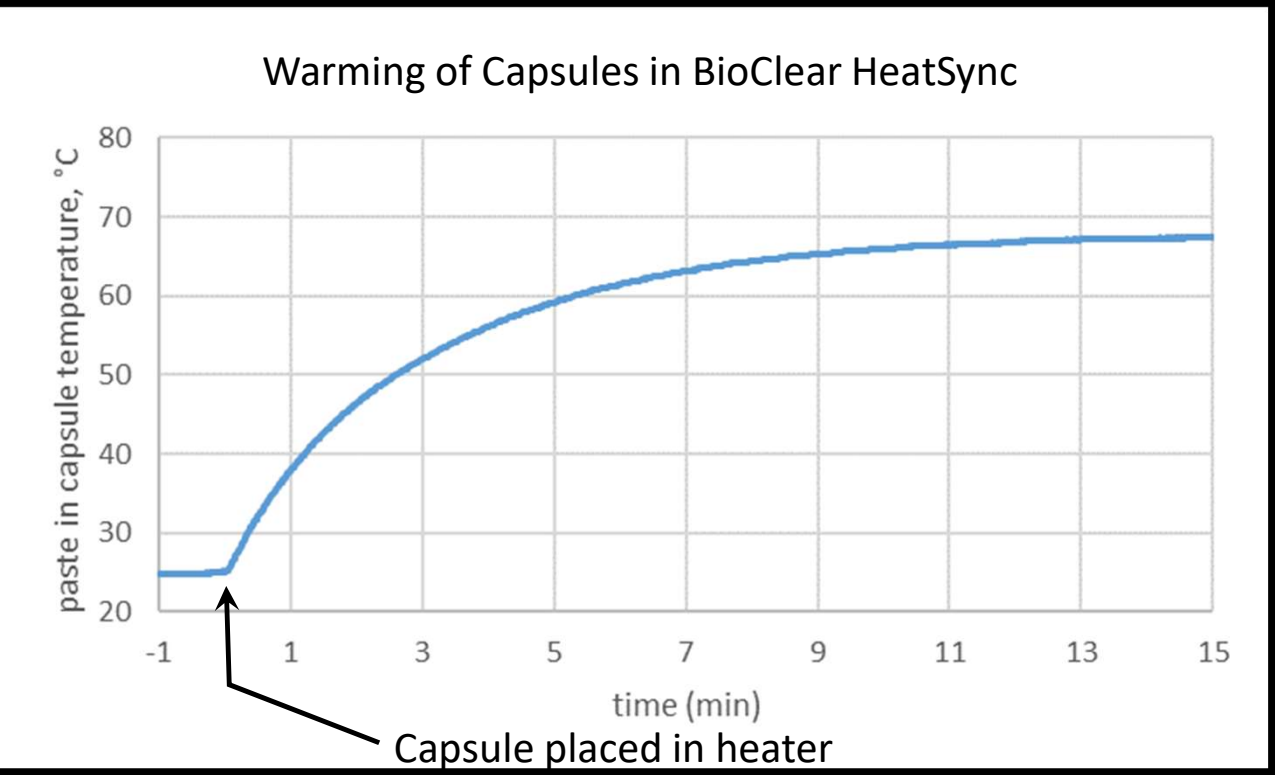
Ribeiro, MT; Bragança GF; Oliveira LR, et al. 2023. Effect of pre-heating methods and devices on the mechanical properties, post-gel shrinkage, and shrinkage stress of bulk-fill materials. J Mech Behav Biomed Mat, 105605. https://doi.org/10.1016/j.jmbbm.2022.105605

Warming & cooling of composite in capsules in HeatSync heaters

- Tim Dunbar
- 3M Oral Care Solutions

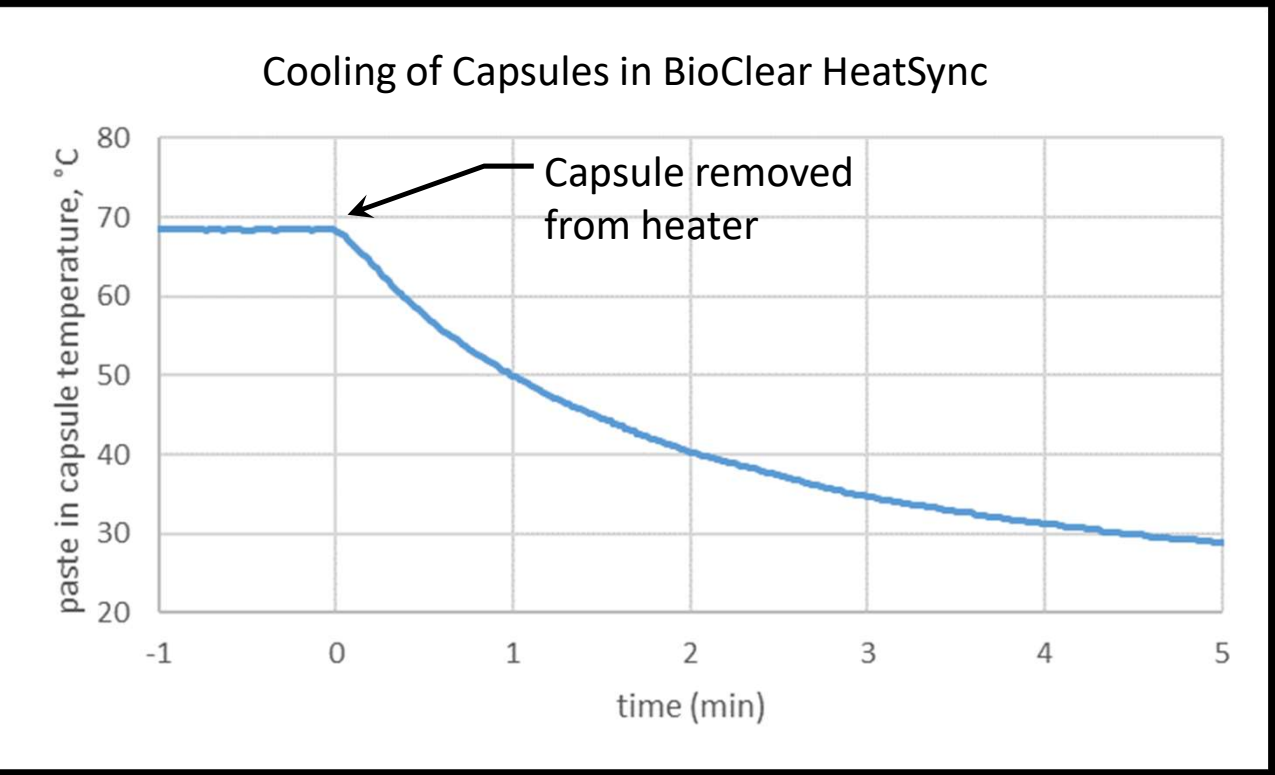
May 24, 2018

WARMING

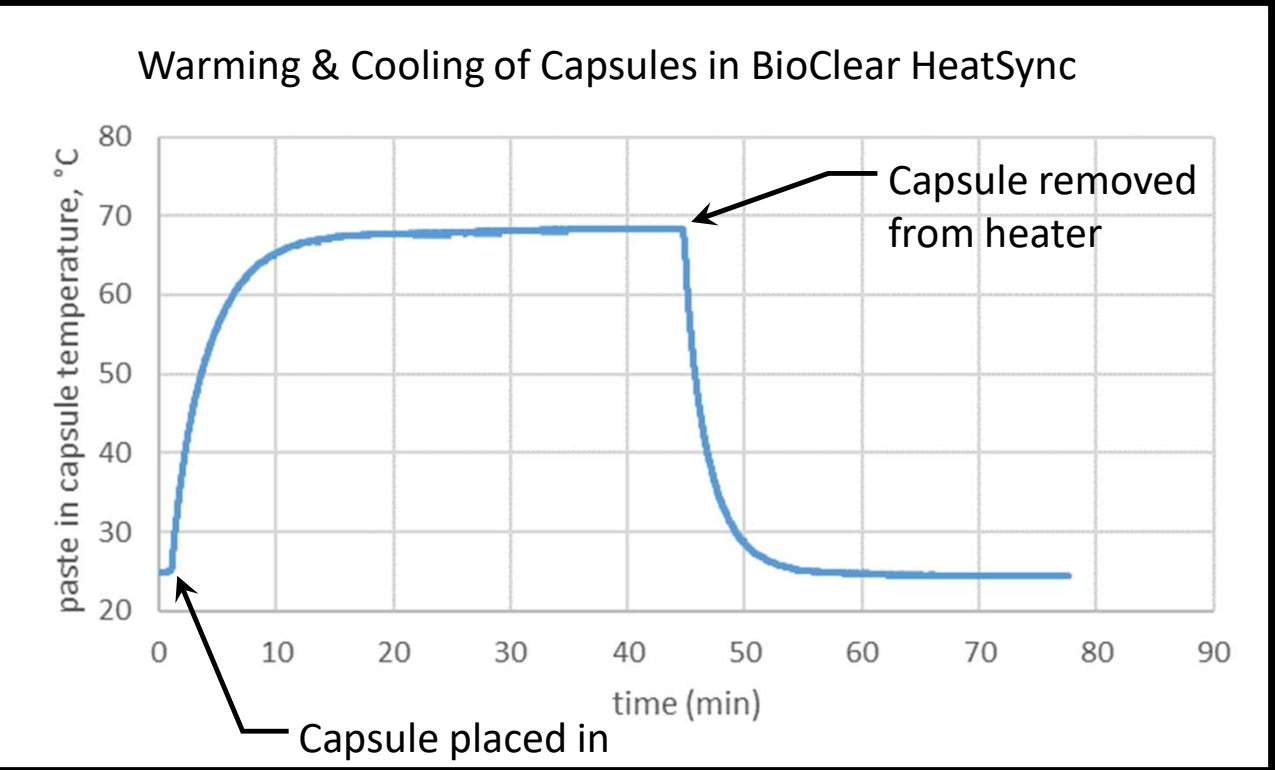


- **Warming started at t = 0 min**
- **Paste in capsule temp rises to 66°C/150.8°F after 10 min**
- **Max temperature obtained 68.4°C/155°F**

COOLING



- Cooling started at t = 0 min
- Capsule & capsule gun removed, placed on block to elevate capsule above bench so good airflow around capsule maintained
- Temperature of paste in capsule:
  - 66.8°C after 5 sec
  - 65.0°C after 10 sec
  - 49.9°C after 1 min
  - 40.3°C after 2 min
  - 37.0°C after 2:34



- **Capsule & gun placed in heater at t = 0 min**
- **Capsule & gun removed from heater at t = 45 min**
- **Allowed to cool in room temperature air**

CONCLUSIONS

- Preheating a syringe of Filtek™ Bulk Fill Posterior to 60 °C for twenty 1 hour increments does

NOT harm mechanical properties such as
- Diametral tensile strength
- Flexural strength

NOT harm cure properties such as
- Depth of cure
- Cusp deflection (polymerization shrinkage stress)

NOT harm esthetic properties such as
- Color and opacity
- Polish retention

Does Preheating a Dental Composite Degrade its Post-Cure Properties?
T.D. Dunbar et al., *J Dent Res* 95 (Spec Iss A):952, 2016 (www.iadr.org).

What is INJECTION MOLDING?

a manufacturing process for producing parts
by injecting molten material into a mold

Materials used can include metal (die casting),
glass, elastomers

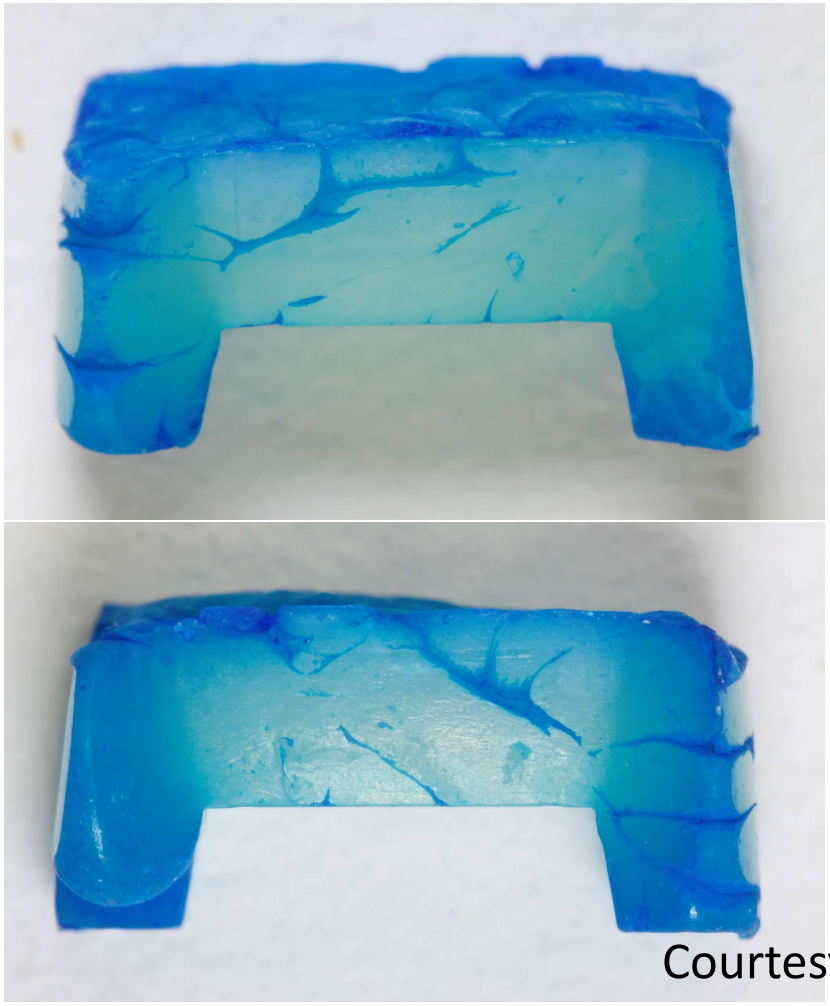
Most common usage is with *thermoplastic* and
thermosetting polymers

How about composite resin??

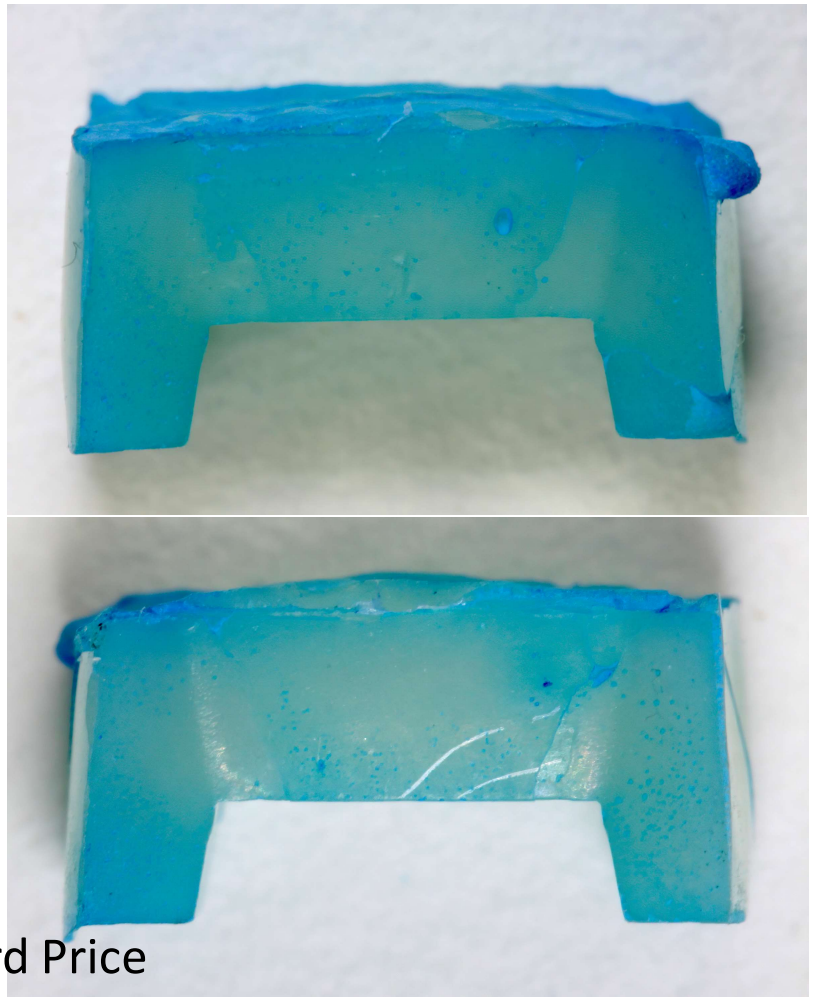
Injection Molding Process

Adhesive as surfactant	Saturate the area then air thin
Heated Flowable	Tip already on, remove from heater, inject
Heated Paste	Remove from heater, uncap and inject
Three Point Cure	Adapt resins, massage matrix and cure

Hand-Packed and Layered



Monolithic and Injection-Molded



Courtesy Dr. Richard Price






LAUREN YASUDA RAINEY, DDS

GOOD ISOLATION GOES HAND IN HAND *with*

SOLID ADHESION PROTOCOLS

ISOLATION


DryShield


ZYRIS
Extra Small Mouthpieces


ZYRIS
Large Mouthpieces


ZYRIS
isolite
Medium Anterior

ISOLATION

ADHESION

systems are composed of monomers with both hydrophilic groups and hydrophobic groups

chemical reaction between multiple substrates

technique *and* material sensitive

Sofan E, Sofan A, Palaia G, Tenore G, Romeo U, Migliau G. Classification review of dental adhesive systems: from the IV generation to the universal type. Ann Stomatol (Roma). 2017 Jul 3;8(1):1-17. doi: 10.11138/ads/2017.8.1.001. PMID: 28736601; PMCID: PMC5507161.

Perdigão J, Araujo E, Ramos RQ, Gomes G, Pizzolotto L. Adhesive dentistry: Current concepts and clinical considerations. J Esthet Restor Dent. 2021 Jan;33(1):51-68. doi: 10.1111/jerd.12692. Epub 2020 Dec 2. PMID: 33264490.

PHOSPHORIC ACID ETCH

Contains BAC

Available with benzalkonium chloride (BAC), an antimicrobial agent. In-vitro research shows it is effective against Streptococcus mutans[1,2].

Ideal for Selective-Etch

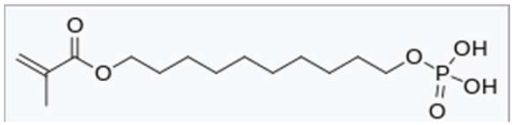
Select HV Etch's high viscosity offers precise placement, making it ideal for the selective-etch technique. However, it can be used for the total-etch and self-etch techniques as well.

High Viscosity

High viscosity, 35% phosphoric acid etchant that is ideal for enamel etching.

MDP & why it matters

10-Methacryloyloxydecyl dihydrogen phosphate



MDP is a monomer in dental adhesives

promotes a chemical reaction with hydroxyapatite crystals

allows for the protection of collagens within the tooth

Sofan E, Sofan A, Palaia G, Tenore G, Romeo U and Migliau G. Classification review of dental adhesive systems: from the IV generation to the universal type. Ann Stomatol (Roma). 2017 Jan-Mar; 8(1): 1–17.

"Adhesion…chemical reaction with dental substrates…is stable over time…a scrubbing technique must be used…"

Materials (Basel). 2019 Mar; 12(5): 790.
Published online 2019 Mar 7. doi: 10.3390/ma12050790
PMCID: PMC6427605
PMID: 30866488

10-MDP Based Dental Adhesives: Adhesive Interface Characterization and Adhesive Stability—A Systematic Review

Eunice Carrilho,[1,2,3,4,†] Miguel Cardoso,[1,2,*†] Manuel Marques Ferreira,[1,2,3,4,5] Carlos Miguel Marto,[1,3,4,6] Anabela Paula,[1,2,3,4] and Ana Sofia Coelho[1,2,3,4]

Abstract

Go to:

The incorporation of functional monomers in dental adhesive systems promotes chemical interaction with dental substrates, resulting in higher adhesion forces when compared to micromechanical adhesion only. The 10-MDP monomer, whose chemical structure allows for a polar behavior which is favorable to adhesion, also promotes the protection of collagen fibers through the formation of MDP-calcium salts. This systematic review aimed to characterize the interface created by 10-MDP containing adhesive systems through an evaluation of the following parameters: Formation of nano-layered structures, capacity to produce an acid-base resistant zone, and adhesion stability. The research was conducted using PubMed, Cochrane Library, Web of Science and Embase, limited to English, Spanish, and Portuguese articles. The research was done according to the PICO strategy. The 10-MDP monomer has the capacity to produce an acid-base resistant zone on the adhesive interface, which increases the response to acid-base challenges. The adhesion established by these systems is stable over time. To have the best of these adhesive solutions, a scrubbing technique must be used to apply the adhesive system on dental substrates, in order to improve monomers infiltration and to create a stable bond. Time must be given for the solution to infiltrate, hybridize and form the MDP-Ca, improving adhesive stability.

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6427605/#:~:text=(%E2%80%9Cmethacryloyloxydecyl%20dihydrogen%20phosphate%E2%80%9D%20OR,OR%20%E2%80%9Cbond*%E2%80%9D)

UNIVERSAL ADHESIVES

containing MDP

act as a mild acid

single bottle efficiency

GARY

DAVEENA

LINDA

monolithic composites
provide solutions

LAUREN YASUDA RAINEY, DDS

POLISH PROTOCOL

coarse diamond

polishing discs

Magic Mix (Bioclear) on prophy cup

RS polisher, dry then wet

Image courtesy of Dr. Richard Young

UNIVERSITY OF THE PACIFIC
Arthur A. Dugoni School of Dentistry

In-Vitro Composite Surface Analysis Using Four Polishing Systems A SEM STUDY

Shreya Nerli,[1] B.D.S., M.P.H., Scott Davis,[2]

Karen A. Schulze,[1] D.D.S., Ph.D.,

Patrick Roetzer, [1] D.D.S.

[1]Department of Preventative and Restorative Dentistry, University of the Pacific, Arthur A. Dugoni School of Dentistry, San Francisco

[2]Department of Endodontology, University of the Pacific, Arthur A. Dugoni School of Dentistry, San Francisco

UNIVERSITY OF THE PACIFIC
Arthur A. Dugoni School of Dentistry

Introduction:

Polishing of a dental composite is *essential* to avoid plaque accumulation and secondary caries. Staining and discoloration correlate to the surface roughness. The goal of each composite filling is a ***glossy surface finish***. Four polishing methods that are commonly used in dental practice were tested in this study.

Objective:

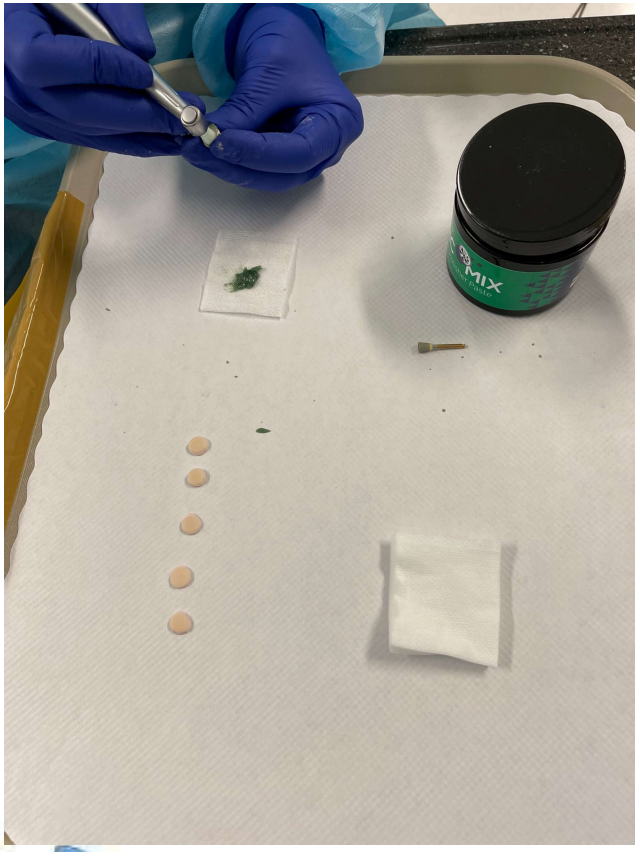
- To evaluate the effect of four polishing methods on the surface gloss of a composite.

Materials and Methods:

- 30 discs of composite Filtek Supreme Ultra shade B1 (3M) were fabricated and light cured for 40s using the light curing unit Elipar S10 (3M).

- Dimensions 10mm diameter x 3mm in height

- sanded to a uniform surface finish using 320 grid SiC paper



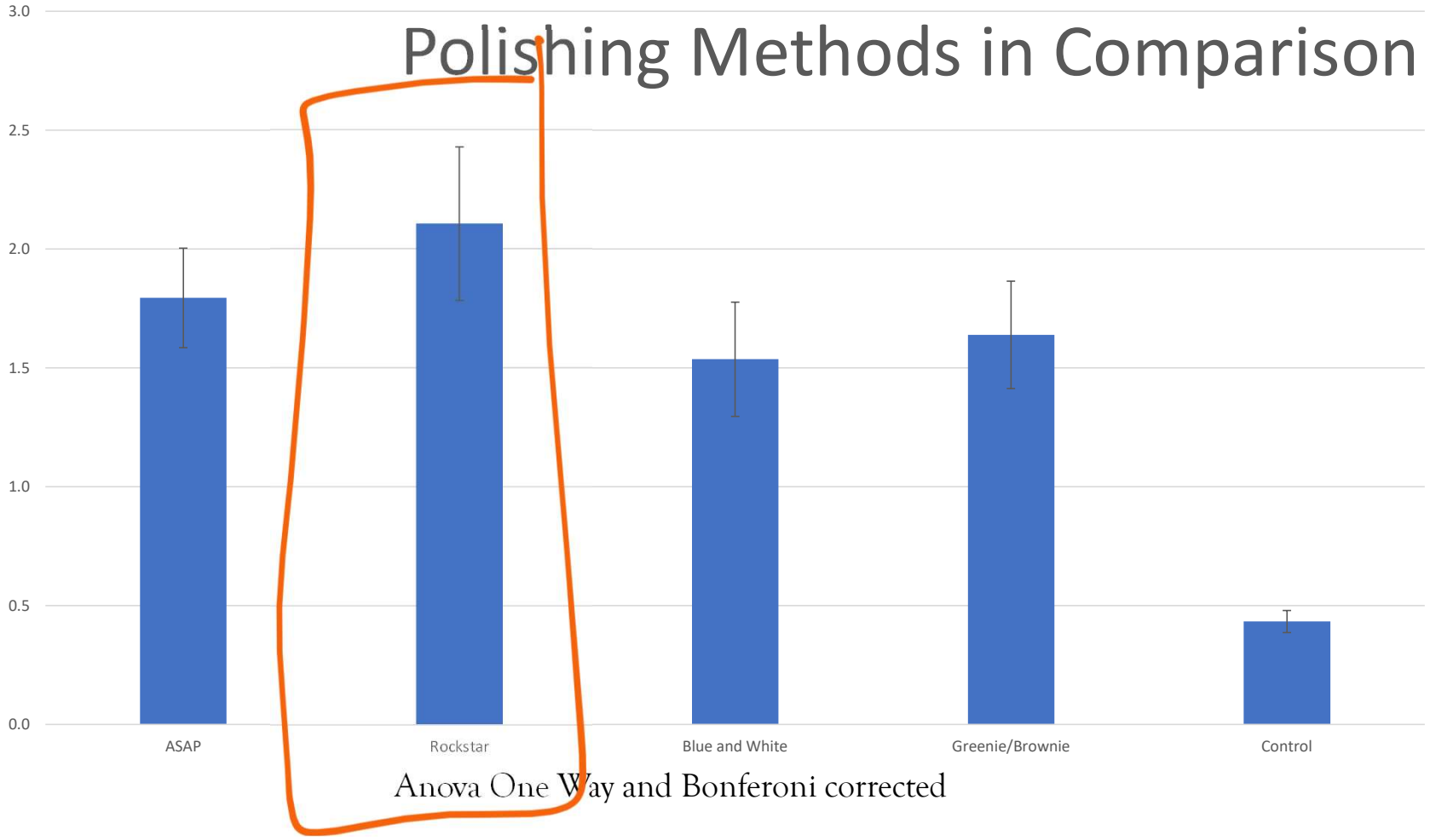
UNIVERSITY OF THE PACIFIC
Arthur A. Dugoni School of Dentistry

Materials and Methods:

- Control group (no treatment),
- Rockstar system (BIOCLEAR),
- Soflex mylar discs (3M) and ASAP Wheels(Clinician's-choice)
- Minnow MCOMP blue and white (Henry-Schein-Dental),
- Brownie/Greenie (Patterson-Dental) followed by bristle brush (Dental-Ventures-of-America) impregnated with CompoDotz medium (Patterson-Dental) followed by linen buff without any material(Dental-Ventures-of-America).

UNIVERSITY OF THE PACIFIC
Arthur A. Dugoni School of Dentistry

Results:



UNIVERSITY OF THE PACIFIC
Arthur A. Dugoni School of Dentistry

Discussion

- In the absence of a Glossmeter a SEM method analyzed surface texture

- Only one type of composite was used in this study. The filler to resin ratio was supposedly the same for all specimens.

UNIVERSITY OF THE PACIFIC
Arthur A. Dugoni School of Dentistry

Rockstar Polishing System (Bioclear) performed best. The special paste in combination with the polishing cups may have a positive impact on the surface gloss of the composite.

https://talk.ac/laurenrainey
CODE: CROWN

LAUREN YASUDA RAINEY, DDS

email raineydds@gmail.com
website www.laurenrainey.com
social @raineydds