david@hornbrook.com

#drdavidhornbrook

Ceramic materials

Powder-liquid Ceramics

(Feldspathic ceramic)

Pressed/Milled Ceramic

(Lithium disilicate and leucite reinforced glass ceramic)

Zirconium dioxide

(Full contour and core supported)

Powder-Liquid Ceramics

- Refractory technique
- Foil technique

Advantages of Powder-liquid

- *Ability to modify translucencies and opacities within the same restoration*
- *Quick turn-around time*

Disadvantages of Powder-liquid

- *Strength of the ceramics*
- *Higher predictability for long term success if prep is primarily in enamel*
- *Wear compatibility*

Pressed/Milled Ceramic

(Lithium disilicate and leucite reinforced glass ceramic)

- IPS Empress (Ivoclar)
- E.Max (Ivoclar)
- LiSi Pressed (GC)
- Ambria (Vita)

Fabrication techniques

(IPS Empress , LiSi Press, and e.Max)

- *Pressed: "Lost wax" technique*
- *Milled: CAD/CAM in- office or in-laboratory*

Strengths of the pressed/milled Ceramics

- *Powder Liquid: 100 mPa*
- *IPS Empress: 200 mPa*
- *E.Max: 400 - 600 mPa*
- *LiSi: 400 – 600 mPa*

Empress

- *95 % of my anterior cases*
- *All cases where patient has "ruddy" complexions*
- *Red or strawberry blonde haircolor*

DISCONTINUED

E.Max

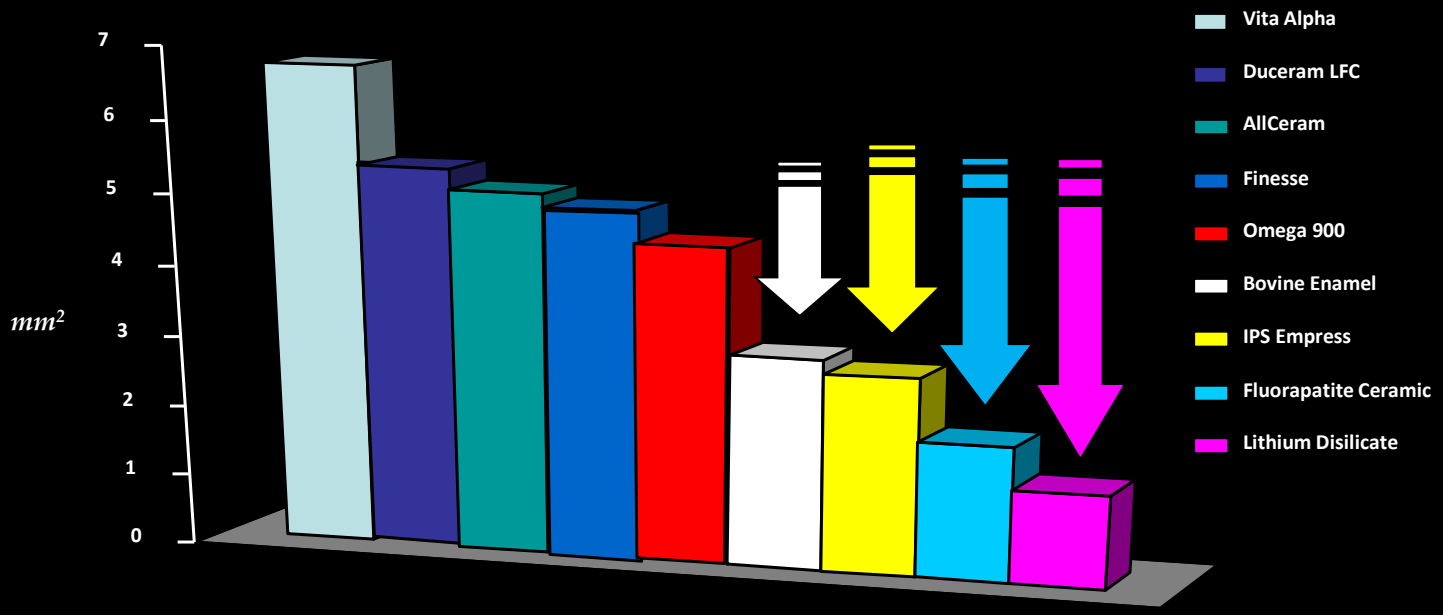
- *Single anterior units or when matching existing dentition*
- *Posterior full crown with minimal retention preps*
- *Inlays/onlays*

LiSi Press

- *100 % of current anterior smile designs Cases*
- *Doesn't gray out and interacts with light similar to Empress*

Total wear (Loss of both materials)

J. Sorensen, OHSU 5-year simulation



Full Contour Zirconium-oxide

Traditional ZrO2

HT ZrO2

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ZrO2

Production of **zirconium dioxide**

Zirconium ceramic is obtained through a reductive clorination (Kroll process). At the end of this process, one can obtain **zirconium oxide** powder (which is a **ceramic** and no longer a **metal**).

Zirconia (ZrO2) = zirconium ceramic

ZrO2 Uses in Dentistry

- *Single Crowns (posterior)*
- *Multiple unit Bridges*
- *All on "x's"*
- *Implants*
- *Implant abutments*

Is all ZrO2 the same?

- Tetragonal
  - High Strength
  - Opaque
- Cubic
  - Low strength
  - Translucent


Single crowns and
Anterior 3-unit bridges
850 mPa
LAVA ESTHETIC DISC GRADIENT SHADED
98S-22MM
BLEACH
Single crowns
900 mPa
KATANA Zirconia STML
125-5232 KA
DPVAJ
2021-11-30
D98.5mm T14mm
A4
w/Collar
1PC
Bridge frameworks
1200-1500 mPa
KATANA Zirconia ML
125-2233 KA
DXNLX
2023-09-30
D98.5mm T18mm
B Light
w/Collar
1PC.
Single crowns and
Anterior 3-unit bridges
750 mPa
IPS e.max ZirCAD
CE 0123
ivoclar digital

3 mm Enamel Shade

3 mm Transition Zone

8, 12, or 16 mm Body Shade

Available Heights:

14 mm

18 mm

22 mm


MiYO (Jensen)
www.uvdl.com

ZrO2

- *Posterior full coverage crowns with adequate retention*
- *All- bridges*
  - *HT ZrO2 with anterior pontic widths <11.0 mm and posterior pontic widths <9.0 mm*
  - *Core for bridges greater than above*

Finishing Techniques

- Shaded or stained
- Cutback and layered

Why so popular?

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Flexural Strength

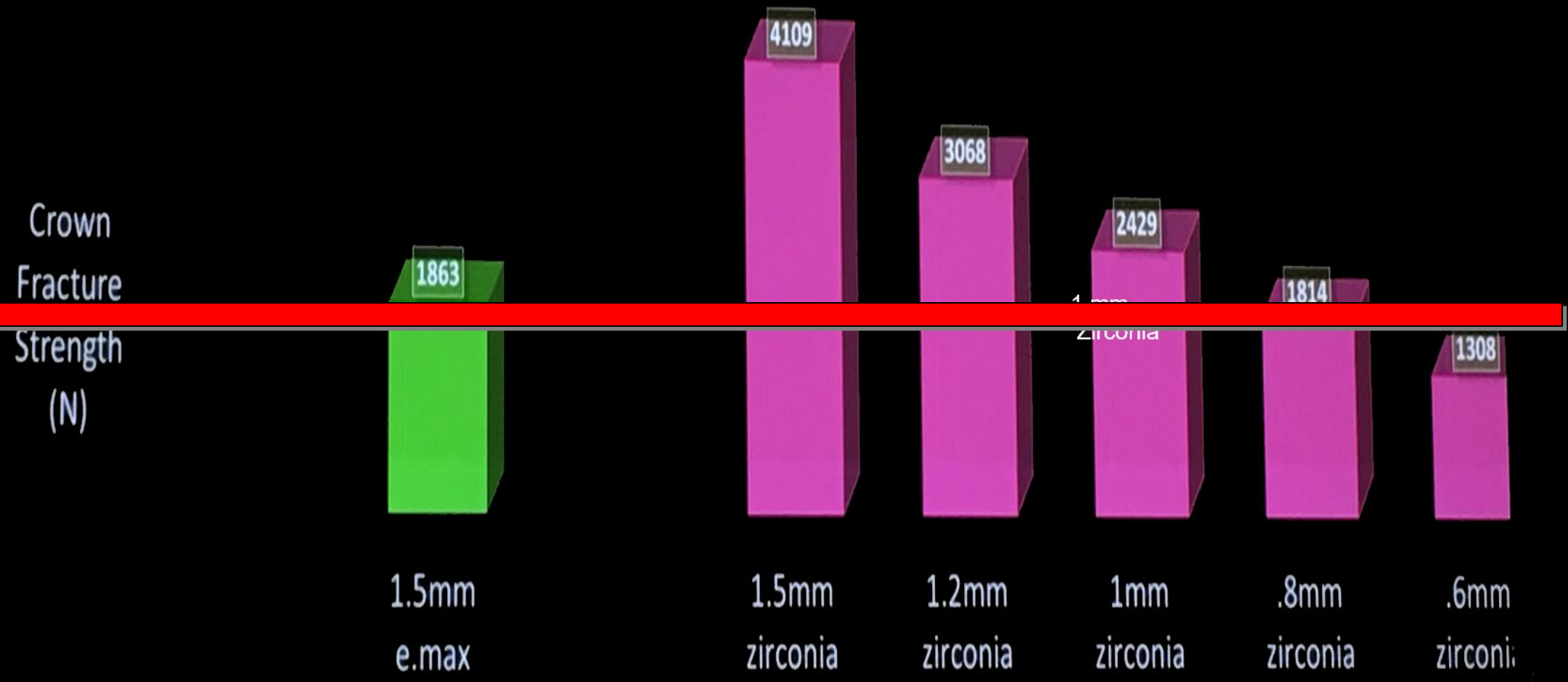
- *Powder/liquid ceramic: 100 mPa*
- *IPS Empress: 200 mPa*
- *E.Max/LiSi: 400 mPa*
- *ZrO2: 550-1500 mPa (Yttrium %)*

Fracture Toughness

In materials science, fracture toughness is a property which describes the ability of a material containing a crack to resist fracture, and is one of the most important properties of any material for many design applications

Fracture Toughness

- IPS Empress: 1 K1c
- Composites/Hybrid ceramics: 1.5 K1c
- E.Max/Celtra Duo: 2.0-3.0 K1c
- HT ZrO2: 3.5-5.0 K1c
- Tetragonal ZrO2: 5.0+ K1c (Lava Plus, Katana STML, Bruxzir, etc)



Data source: Dr. Burgess (UAB)

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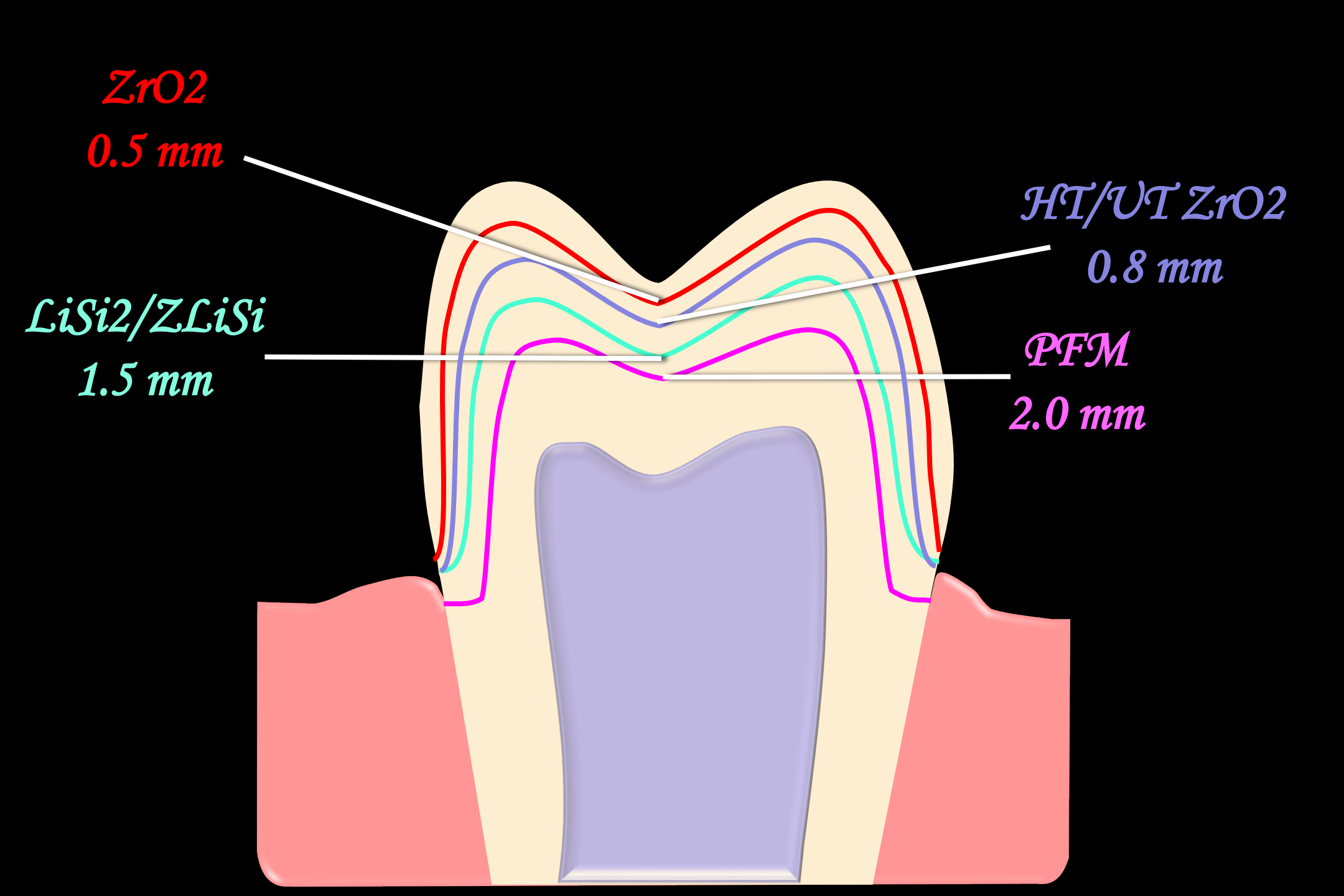
ZrO2
0.5 mm
HT/UT ZrO2
0.8 mm
LiSi2/ZLiSi
1.5 mm
PFM
2.0 mm

Never less than 1.0 mm occlusal thickness

Wear Compatibility?

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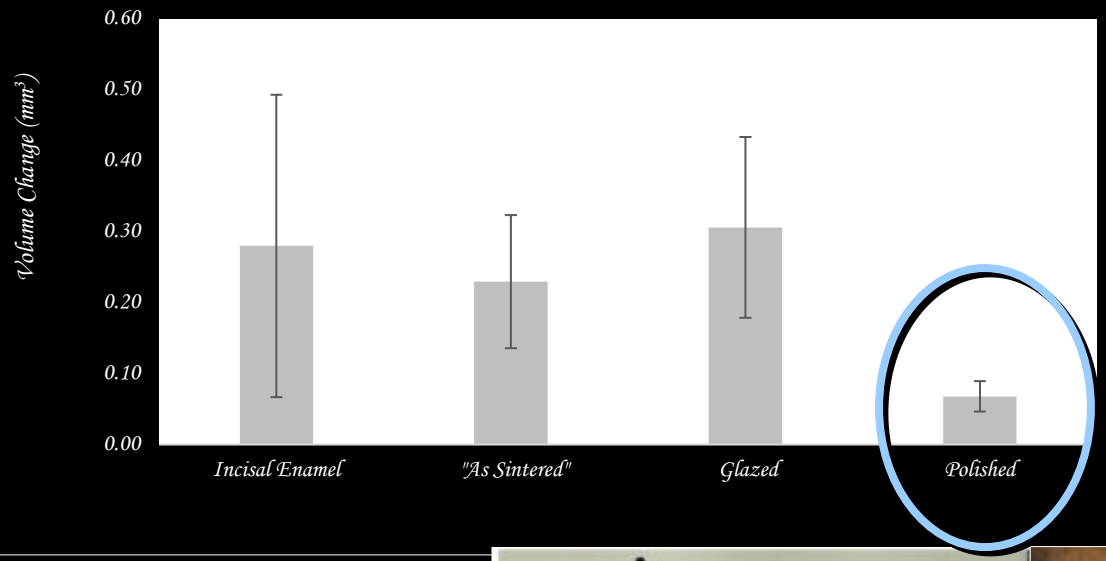
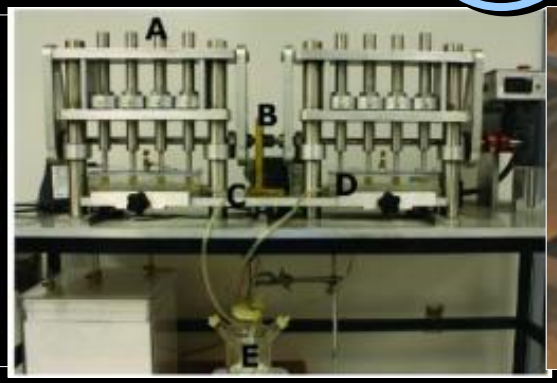
Wear of Enamel Against Antagonist Incisal Enamel with Lava Full Contour



"The results of these studies indicate that Lava Esthetic is wear-friendly to opposing enamel."

Dr. John O. Burgess and
Dr. Nate Lawson
University of Alabama at Birmingham School of Dentistry
Source: Internal Report to 3M Oral Care

From Left to Right, "As Sintered", Glazed, Polished



Alabama Wear Tester

Sample Being Tested

Sample Being Measured

beneficial for effective bonding to the glaze layer.[19]

The authors suspect that stress abrasion may be further aggravated by chemical reactions, besides vertical load and friction cycle frequencies and time. Therefore, further studies are required to investigate the long-term survival rate and wear mechanisms of glazed zirconia under fatigue stress and the effects of acid medium.

CONCLUSIONS

Within the limitations of this in vitro study, the findings suggest that monolithic zirconia polished with the Robinson brush and paste shows the least wear depth and smallest antagonist wear area. Furthermore, glazed zirconia can be more abrasive than polished zirconia. Finally, the wear properties of internally and externally stained zirconia are similar.

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www.diashinepolish.com

What do we cement these with?

Simplify!!!

Minimize # of materials

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- *Anterior Bonded Restorations*
- *Posterior Bonded Restorations*
- *Luted Restorations*

Veneers and anterior crowns

- Etch enamel followed by dentin

Select HV Etch (Bisco)

MMPs

Matrix Metalloproteinases

HORNBROOK
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- 0.2 % Chlorahexadine
- Benzalkonium Chloride

Inhibits degradation of Hybrid layer by MMPs

Veneers and anterior crowns

- *Etch enamel followed by dentin*
- *Rinse, lightly air dry*
- *Apply glutaraldehyde/water/HEMA (Gluma-like)*

Veneers and anterior crowns

- *Etch enamel followed by dentin*
- *Rinse, lightly air dry*
- *Apply glutaraldehyde/water/HEMA (Gluma-like)*
- *Blot dry*
- *Apply multiple coats of primer*

Veneers and anterior crowns

- *Etch enamel followed by dentin*
- *Rinse, lightly air dry*
- *Apply glutaraldehyde/water/HEMA (Gluma-like)*
- *Blot dry*
- *Apply multiple coats of primer*
- *Air dry*
- *Light cure*
- *On the restoration*
  - *Clean with phosphoric acid, rinse, and dry*

Veneers and anterior crowns

- Etch enamel followed by dentin
- Rinse, lightly air dry
- Apply glutaraldehyde/water/HEMA (Gluma-like)
- Blot dry
- Apply multiple coats of primer
- Air dry
- Light cure
- On the restoration
  - Clean with phosphoric acid and rinse
  - Apply a Silane Coupling agent

Veneers and anterior crowns

- Etch enamel followed by dentin
- Rinse, lightly air dry
- Apply glutaraldehyde/water/HEMA (Gluma-like)
- Blot dry
- Apply multiple coats of primer
- Air dry
- Apply unfilled resin (if 4^{th} or 6^{th} generation)
- Light cure
- On the restoration
  - Clean with phosphoric acid and rinse
  - Apply Silane coupling agent for 1 minute
- Use light-cure only cement

Light cure resin cements

- *Variolink Esthetic (Ivoclar)*
- *NX 3 (Kerr)*
- *Choice 2 (Bisco)*
- *Relyx Veneer Cement (3M)*

Indirect Posterior bonded restoration

(LiSi Press, E.Max ≤ 1.5 mm, ZrO2 with low retention, Tooth-supporting restorations)

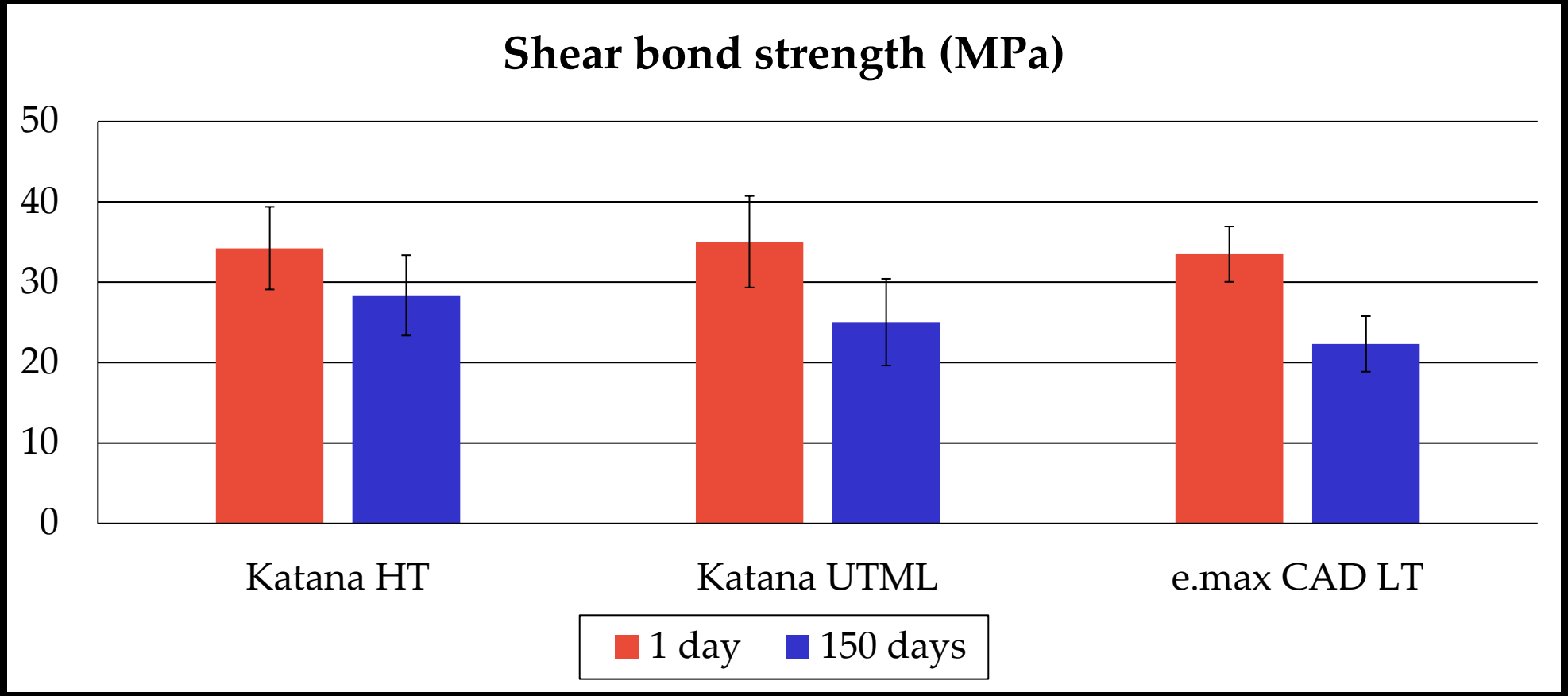
- *Etch enamel followed by dentin*
- *Rinse, lightly air dry*
- *Apply glutaraldehyde/water/HEMA (Gluma-like)*
- *Blot dry*
- *Apply multiple coats of primer*
- *Air dry*
- *Light cure*
- *On the restoration*
  - *Clean with phosphoric acid and silane*
  - *Alkaline-based cleanser and rinse/dry*

Alkaline-based Cleaners

Indirect Posterior bonded restoration

(IPS Empress, E.Max ≤ 1.5 mm, ZrO2 with low retention, Tooth-supporting restorations)

- Etch enamel followed by dentin
- Rinse, lightly air dry
- Apply glutaraldehyde/water/HEMA (Gluma-like)
- Blot dry
- Apply multiple coats of primer
- Air dry
- Light cure
- On the restoration
  - Clean with phosphoric acid and silane
  - Alkaline-based cleanser and rinse/dry
    - Apply ZrO2 primer


Shear bond strength (MPa)
50
40
30
20
10
0
Katana HT
Katana UTML
e.max CAD LT
1 day
150 days

Indirect Posterior bonded restoration

(LiSi Press, E.Max ≤ 1.5 mm, ZrO2 with low retention, Tooth-supporting restorations)

- Etch enamel followed by dentin
- Rinse, lightly air dry
- Apply glutaraldehyde/water/HEMA (Gluma-like)
- Blot dry
- Apply multiple coats of primer
- Air dry
- Light cure
- On the restoration
  - Clean with phosphoric acid and silane
  - Alkaline-based cleanser and rinse/dry
    - Apply ZrO2 primer
- Use a dual-cure resin cement

Dual Cure resin cements

- *Duolink Universal (Bisco)*
- *Relyx Ultimate (3M)*
- *Variolink Esthetic DC (Ivoclar)*
- *NX 3 (Kerr)*


SELECT HV ETCH


Variolink® Esthetic LC
System Kit
ivoclar vivadent


Ivoclean
Cleaning paste
Reinigungspaste


G5


Z-PRIME


BISCO
ALL-BOND
UNIVERSAL
Light-Cured Dental Adhesive


DUO-LINK
UNIVERSAL
Resin Luting Cement


Bisco
PORCELAIN
Pre-Hydrolyzed
REF B-2221
BISCO, Inc.
847-534-6000

Non-bonded posterior crown

(E.Max > than 1.5 mm and adequate retention, ZrO2 , Gold, PFM)

- Clean tooth with Chlorahexadine Pumice (Consepsis Scrub; Ultradent)
- Restoration
  - H3PO4 or Alkaline-based cleanser
  - Silane or ZrO2 Primer
- Use self-etching/alkaline/BioActive resin cement
  - TheraCem (Bisco)
  - Active Cement (Pulpdent)

Properties	TheraCem	Self-Adhesive Resin Cements	(RM) Glass Ionomers
Dual Cure	✓	✓	✓
Self-Adhesive	✓	✓	✓
High Physical Strength	✓	✓	
Fluoride release	✓		✓
Easy Clean-up	✓		✓
Calcium Release	✓		
Alkaline pH	✓		
High bond to Zirconia/Metal	✓		
High Degree of Conversion	✓		


SELECTHV ETCH


Variolink® Esthetic LC
System Kit
ivoclar vivadent


Ivoclean
Cleaning paste
Reinigungspaste


G5


L-PRIME


Bisco
PORCELAIN
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Light-Cured Dental Adhesive


BISCO
TheraCem
Self-Adhesive Resin Cement
Dual-Cure


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Thank You

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