Technique Guide:

FINISHING & POLISHING OF MODERN DENTAL CERAMICS

Lithium Disilicate & Zirconia

According to John A Sorensen, DMD, PhD

Introducing the New
Dialite LD & Dialite ZR
Polishing Systems for
Increased Clinical
Expediency & Efficiency
Dental zirconium oxide (ZrO\(_2\)) ceramics have a very high polycrystalline content which has a small amount of Yttria added to maintain the ZrO\(_2\) in the tetragonal phase conferring the ability to undergo transformation toughening making it the strongest dental ceramic available. This metastable state can be transformed back to the monoclinic phase if overheated with temperature spikes while adjusting. However, the fusion temperature of ZrO\(_2\) is quite high making the ceramic more abuse resistant than other dental ceramics. Additionally, although ZrO\(_2\) is extremely strong, if traumatized during fabrication and adjustment with a coarse diamond, excessive pressure with a handpiece or heat generation can cause phase shift or induction of flaws which can lead to propagation of cracks and even failure.

A clinical problem associated with ZrO\(_2\) restorations especially in the early years was chipping of the veneering porcelain. A popular new design concept has been to eliminate the veneering porcelain and mill full-contour crowns entirely out of ZrO\(_2\). This eliminates the possibility of chipping and produces a nearly bullet-proof restoration even on second molars in bruxers.

Zirconium oxide restorations have become extremely popular with many major companies like Lava™ (3M ESPE®), e.max® ZirCAD (IvoclarVivadent®), Zenotec® (Wieland Dental), Cercon® (DENTSPLY International), Prettau® (Zirkonzahn®) and a myriad of smaller companies making CAD/CAM fabrication systems. Prevalent trade names of full contour monolithic ZrO\(_2\) restorations include Lava™ Plus (3M ESPE®), BruxZir® (Glidewell Laboratories), Zir-MAX® (Burbank Dental Laboratory), Cercon® ht (DENTSPLY International), Diazin™ (Diadem Precision Technology) just to name a few. While the quality, homogeneity, flaw content and particle size of the ZrO\(_2\) may vary between manufacturers’ systems, they all possess superior polishing qualities.

These SEM pictures show the polycrystalline structure of Lava™ Framework ZrO\(_2\) (mean particle size about 0.6 µm) and the new more translucent Lava™ Plus ZrO\(_2\) (about 0.3 µm particle size). This fine particle size compared to dental porcelains at 3-5 µm mean particle size, make ZrO\(_2\) the most machinable and highly polishable ceramic material available in dentistry. This photo (right) demonstrates how the exposed polished ZrO\(_2\) on the lingual cusp of the second molar is actually smoother than the polished veneering porcelain.

Microscopic surface roughness of a ceramic restoration is the key property in controlling wear of antagonist tooth structure. Therefore, another advantage of highly polished full contour ZrO\(_2\) crowns is the minimal wear of opposing tooth structure.

With new high translucency zirconias like Lava™ Plus and the ability to differentially color a full contour ZrO\(_2\) crown with incisal, body and dentin shades, extremely esthetic restorations can be produced.
THE SCIENCE ON MODERN DENTAL CERAMICS...

Lithium Disilicate Glass Ceramic

Depending on the demands of the clinical situation, the e.max® system from Ivoclar Vivadent® has a variety of fabrication technologies to produce lithium disilicate (LS₂) high strength restorations either at chair-side or in the laboratory. e.max® CAD starts as a semi-sintered block which is easily milled in the CEREC® (Sirona®) or E4D® (D4D®) systems. Once milled, the restoration is fired in an oven to attain maximum strength with no net shape change to produce accurately fitting restorations. The LS₂ form can be used as a substructure for application of veneer porcelain or milled to full contour. The inherent translucency of the ceramic produces a highly esthetic restoration eliminating the need for veneering on most posterior teeth. The e.max® Press system fabricates a crown by waxing to desired contours, investing and then hot pressing the LS₂ into the mold. The e.max® Press form can also be made as a substructure or pressed to full contour. The innovative e.max® CAD-on system utilizes CAD/CAM technology to mill a high strength LS₂ veneer for zirconia substructures.

The e.max® LS₂ system has great durability with a flexural strength of 360-400 MPa. When fabricated to full-contour, the monolithic structure is one of the most robust ceramic systems available. Adding to the clinical applications, even in reduced thickness situations the e.max® LS₂ has been shown to perform well. With the outstanding esthetics conferred by the LS₂ microstructure even as a monolithic crown this system is an excellent option for routine restoration of posterior teeth whether fabricated by chair-side milling or laboratory technician. For most chair-side fabricated restorations no porcelain oven glazing or staining is necessary. By merely using the Dialite LD polishing system an extraordinary quality finish and polish can be rapidly achieved that rivals the polish of any glazed or polished indirect restorative system available in dentistry.

Clinical trials have reported high clinical success rates for molar LS₂ crowns. Additionally, in vitro oral wear simulator studies show wear of antagonist enamel tooth structure from LS₂ to be similar to a gold platinum alloy or an enamel control. If the clinician wished to use this material for second molars in bruxers then longevity can be maximized by making a monolithic crown with no veneering.

Not to be forgotten is the Empress® CAD system. Although the leucite glass ceramic is not as strong as the LS₂ ceramic it is well suited for chair-side CAD/CAM production of crowns that only require polishing with Dialite LD polishing kit. With adhesive cementation these restorations have established a long history of high clinical success rates. Improving further on this concept, Ivoclar Vivadent® developed the Empress® CAD Multi Block which is comprised of four to eight layers of chroma, translucency and transitions that beautifully simulate the different layers of a natural tooth producing an extremely esthetic restoration also requiring only polishing after chair-side milling.

SEM of IPS e.max® CAD lithium disilicate. The high crystalline content (~70%) incorporated in a glass matrix produces a high strength ceramic without compromising translucency.

SEM of IPS Empress® CAD milling block with a leucite crystal content of 35 to 45 vol % with crystalline size of 1-5 μm.
Representation of intra-oral occlusal adjustment of LD2 with new red-band fine Dialite finishing diamond 8369DF.

Representation of intra-oral occlusal adjustment of LD2 with new yellow-band extra-fine Dialite finishing diamond 369DEF.

Completely polished LD2 crown with no stain or glaze.

Devested IPS e.max® Press LD crown. Because occlusion can be precisely waxed there is no need to grind-in anatomy. Only polishing is necessary.

Grinding off positioning sprue with LD Grinder LD13M, which minimizes heat generation.

LITHIUM DISILICATE POLISHING

Dialite LD red medium thin polishing disc L20MLD for polishing grooves.

Dialite LD red medium polishing point H2MLD for crafting a shine in the occlusal grooves.

Dialite LD red medium polishing point H2MLD for creating a shine in the occlusal grooves.

Completed lithium disilicate crown only polished with Dialite LD kit and no stain or glaze.

Comparison of LD stain and glazed premolar crowns, Dialite LD kit polished LD 1st molar crown and Dialite ZR polished ZrO₂ 2nd molar crown (lingual view).

Comparison of 1st premolar stained and glazed, 2nd premolar and 1st molar polished only. Dialite ZR polished ZrO₂ 2nd molar crown (buccal view).

Dialite LD yellow fine polishing point R17FLD for establishing high shine and luster on lithium disilicate (note right side with finish polish).

Dialite LD yellow fine polishing point H2FLD for creating a shine in the occlusal grooves.

Dialite LD yellow fine thin polishing disc L20FLD for polishing grooves.

Dialite LD yellow fine polishing wheel R17FLD for establishing shine on lithium disilicate (note right side with finish polish).

Dialite LD red medium polishing point H2MLD for creating a shine in the occlusal grooves.

Dialite LD yellow thin polishing disc L20FLD for polishing grooves.

Dialite LD yellow fine polishing wheel R17MLD for establishing high shine and luster on lithium disilicate (note right side with finish polish).

Dialite LD red medium thin polishing disc L20MLD for polishing grooves.

Dialite LD yellow fine polishing point H2FLD for creating a shine in the occlusal grooves.
Adjustment of occlusion on full contour ZrO₂ crown using football-shaped red-band Dialite finishing diamond 8369DF.

Primary and secondary anatomy ground in full contour ZrO₂ crown.

Gross contouring of full ZrO₂ crown with green coarse LD Grinder LD13C.

Dialite ZR green medium polishing wheel R17MZR for establishing shine on ZrO₂ (note right side with high polish even with Medium Fine polishing only).

Dialite ZR orange fine polishing point H2FZR for high shine in the occlusal grooves.

Dialite ZR orange fine thin polishing disc L20FZR for high shine in grooves.

Completed polished full contour ZrO₂ crown.

Completed full contour ZrO₂ crown #18 and lithium disilicate crowns #19 and #20 with durable high shine and luster (buccal view).

Completed full contour ZrO₂ crown #18 and lithium disilicate crowns #19 and #20 with durable high shine and luster (occlusal view).

The new Lava™ Plus All-Zirconia Monolithic system achieves esthetic results that match the VITA™ Shade Guide.

Dialite ZR green medium polishing point H2MZR for crafting a shine in the occlusal grooves.

Dialite ZR green medium polishing point H2MZR for high shine in the occlusal grooves.

Lava™ Plus monolithic translucent ZrO₂ crown differentially colored with incisal and dentin internally, then polished with Dialite ZR system (buccal view).

Lava™ Plus monolithic translucent ZrO₂ crown polished with Dialite ZR system (palatal view).

Photos and content courtesy of Dr. John A. Sorensen, DMD, PhD
Help your zirconia and lithium disilicate restorations reach their full potential with Brasseler USA’s extensive line of diamond, grinding and polishing instruments. Available in comprehensive procedure systems and individual instruments, we have solutions for any adjustment, finishing and polishing situation. Contact your Brasseler USA representative to order today!

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Lithium Disilicate Polishing Kit

K0240
Dialite® LD Extra-Oral Lithium
Disilicate Polishing System

K0262
Dialite® ZR Adjustment
Finishing & Polishing System

K0239
Dialite® ZR Intra-Oral
Zirconia Polishing System

K0238
Dialite® ZR Extra-Oral
Zirconia Polishing System

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