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OPTIMIZING

Monolithic Translucent Zirconia

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INTERNAL AND EXTERNAL COLOR MODIFICATION AND CUSTOM TEXTURIZING TECHNIQUES

This eBook demonstrates very specific techniques to optimize monolithic cubic zirconia (CUZR)—also referred to as super translucent multilayer—in form, texture, and color.

Achieve Natural Texture Using Analog Techniques

The CAD/CAM system should give the basic contours to CUZR, but it does not achieve natural texture (Figure 1). To achieve natural texture, texturizing must be done by analog techniques. Texturizing the surface of the ST/cubic zirconia with different coarseness of carbides and laboratory diamonds gives very different results (Figure 2). Fine diamonds used in an electric handpiece at approximately 1,000-2,000 RPM give the most natural looking texture (Figure 3). After multiple experimentations, it was found that the same diamonds used to texturize composites intraorally do the best job on ST Zirconia/CUZR. They can either be used in an electric friction grip high speed at slow speeds, or in a high speed/low speed bur converter to place the burs in a lab straight nose cone handpiece.

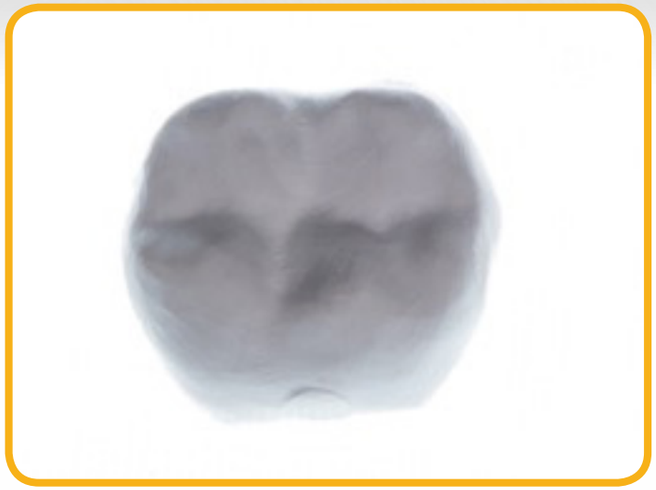


Fig 1. ST Zirconia (CUZR) out of CAD-CAM: note finished contour but lacking nature surface texture.

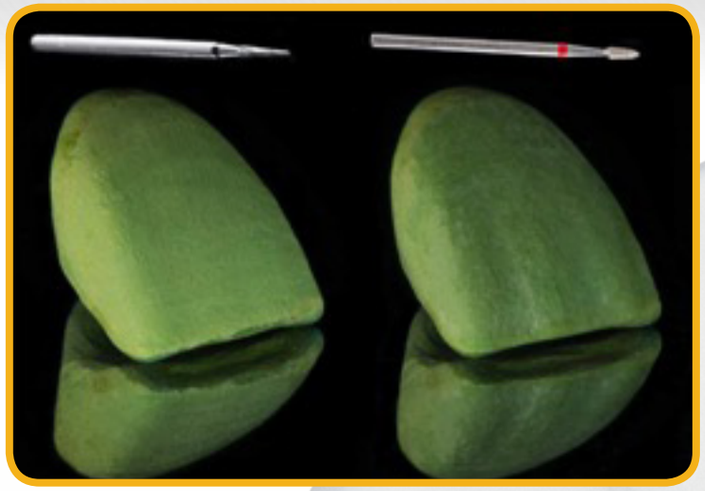


Fig 2. Very different surface texture effects are obtained on CUZR with fine carbide vs. fine diamond burs.

Fig 3. Sintered but unglazed CUZR crown done by technique demonstrated by author.

ACHIEVING GOOD TEXTURE USING THE RIGHT INSTRUMENTS

The secret to getting good texture, other than using the right instruments at the right speeds, is to use two diamonds of different size in each groove with the same motion for each bur (Figure 4 and Figure 5). This approach will automatically give you subtly changing contours.

Another trick is to work each groove from three directions: first the main direction of the groove, then from the height of the ridge to the depth of the groove on one side, and then from the height of the ridge to the depth of the groove on the other side.

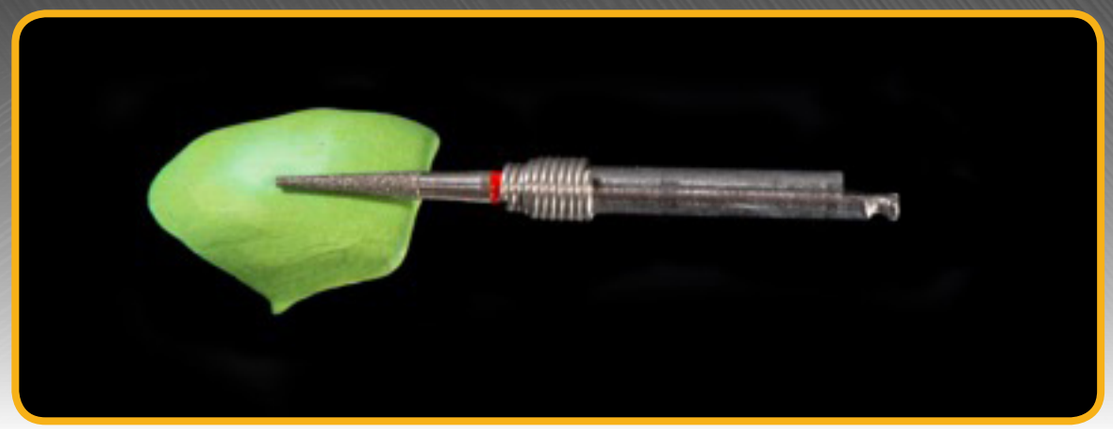


Fig 4. Demonstrating surface texture creating a groove working first the main direction of the desired groove.

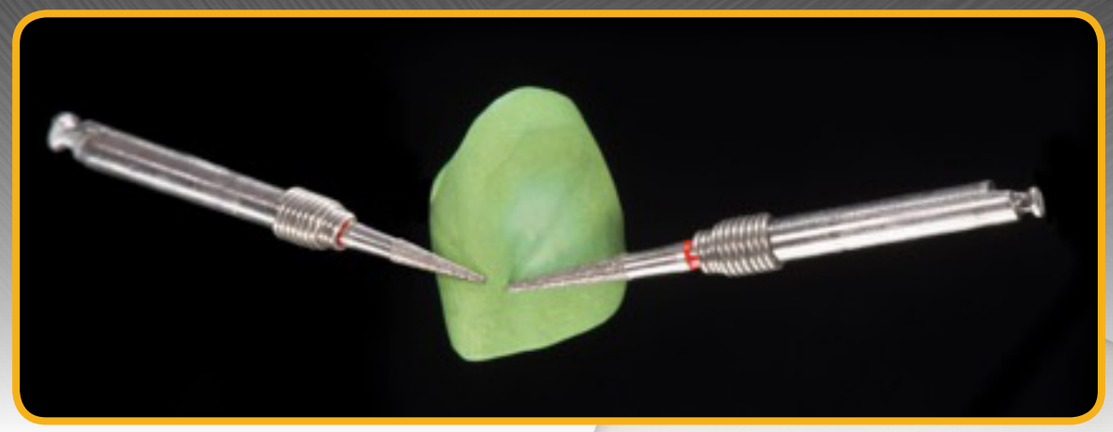


Fig 5. Demonstrating working from the height of contour (ridge) to the depth of the groove from both sides of the groove.

Note: Avoid Applying Texture Post-Sintering

There was also an attempt to put texture in post-sintered cubic zirconia and then re-polish. The result was either:

1. Impossible to maintain natural looking surface texture, or

2. The surface was micro-rough after polishing, which could potentially create an increased chance of abrasion against the opposing tooth. Thus, it is highly recommended to put all of the form surface texture and pre-polish into the restoration prior to sintering.

USING A NEEDLE POINT CARBIDE

To create realistic anatomy in posterior teeth, dress a used high-speed carbide to a point (Figure 6). The diamond disc and the carbide must be turning, which means you need two handpieces. Then, using the new needle point carbide at a high speed, carefully carve the grooves as desired (Figure 7). After placing grooves with the carbide, use a small tapered fine diamond with a rounded end to blend the ridges with the groove (Figure 8).

Fig 6. Creating a needle point with a carbide bur and diamond disc in two separate handpieces.

Fig 7. Using the needle point carbide to create fine grooves that are typical in posterior teeth.

Fig 8. Using a small tapered rounded end composite diamond to blend ridges into the grooves in posterior teeth.

POLISHING AND CLEANING

After using the diamonds, two different impregnated rubber polishers were tested. Brasseler Dialites cone shape and the “single” feather lite (both pink coarseness) used at approximately 8,000 RPM gave the most natural finish (Figure 9 and Figure 10).

Avoiding Contaminants

Contaminants in zirconia must be avoided. Contaminants from finishing could present as grey spots. Rubber from polishers could get impregnated into the surface. In addition, there should be no moisture in zirconia when it goes in the oven to sinter. One way to clean contaminants is to steam clean; however, it is very difficult to get the moisture from the steam out of the CUZR. An effective alternative is to use ultrasonics with 90% isopropyl alcohol, a technique Kyle Kuhns (Owner, Ceramica Dental Design) uses.

Fig 9. Using a pink Dialite point to blend the micro anatomy.

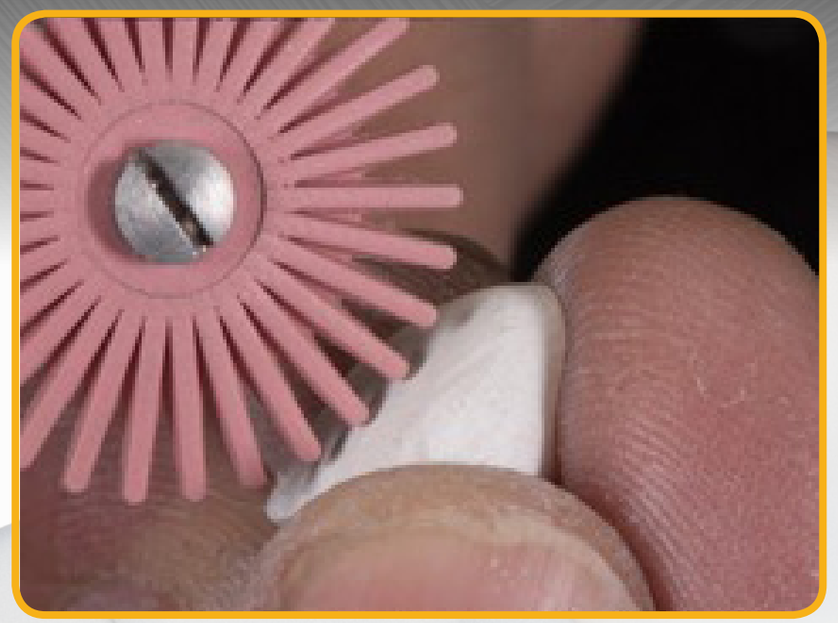


Fig 10. Using a pink Feather lite to slightly polish the deep grooves.

CUSTOM COLORIZATION

A combination of two pigment systems was used for optimization of colorizing ST Zirconia (CUZR). Argen pigments are very shade accurate. Argen Modifier pigments could be used for some special characterization (Figure 11).

Typically, a gradient block is used. If extra chroma is needed, for example a shade A2.5, this could be achieved by a mix of Argen's A2 and A3 shades and then paint in the gingival 1/3 of the crown (Figure 12). To help see the color of the addition, you can add food coloring to the pigments to add visual contrast (Figure 13). Kroger food colors will burn out cleanly, other brands may not.

Fig 11. Argen shading liquids.

Fig 12. Custom colorizing a CUZR prior to sintering.

Fig 13. Adding Kroger food colors to increase visual contrast to CUZR colorants.

IDEAL ESTHETICS, REALISTIC FINISH

To enhance the illusion of incisal enamel, consider alternating Argen Incisal Effect 1 and Argen Violet (Figure 14). For occlusal characterization, a mixture of the Argen base shade (say A2) 90% and Argen Orange modifier (10%) could be used and painted in the central fossa of molars (Figure 15).

An important observation regarding obtaining ideal esthetics related to glaze and polish. During this test, glazing alone did not achieve a realistic looking surface as it might with normal porcelain. Using a glaze powder, then mechanical polishing with Brasseler Dialites, followed by diamond polishing paste, gave a much more realistic finish to the surface (Figure 16).

Fig 14. Custom colored ST Zirconia (CUZR) using alternating Argen Incisal Effect 1 and Argen Color Modifier Violet.

Fig 15. Custom colorizing the occlusal.

Fig 16. Demonstrating the effect of glaze and polish on CUZR.

FINAL THOUGHTS

One elusive goal of all-ceramics is to be able to fabricate restorations with minimal or no application of a secondary phase of a material while maintaining esthetics. In other words, the goal is to develop a monolithic material that has optical properties close enough to the tooth to be used without layering of porcelain.

A recent strategy to increase the translucency of zirconia is to stabilize the zirconia with a significant cubic crystalline phase interspersed with the tetragonal phase. The cubic phase of zirconia is isotropic in different crystallographic directions, which decreases light scattering that occurs at grain boundaries. As a result, the cubic zirconia appears more translucent.

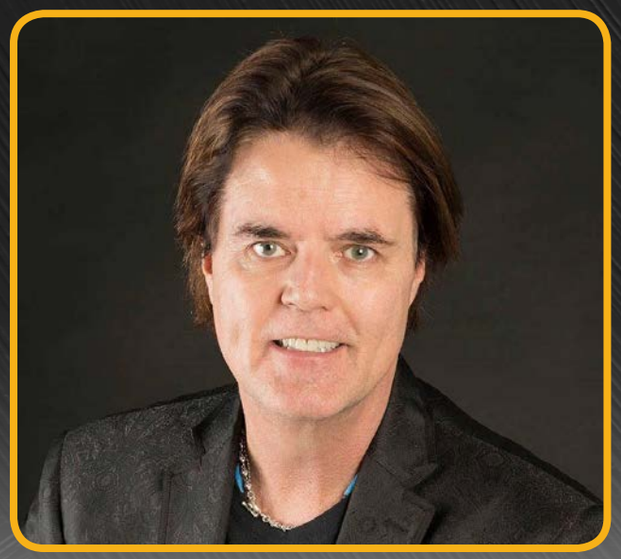
Figure 17 and Figure 18 are a monolithic maxillary first molar using ArgenZ ST A2 gradient / Multilayer. In Figure 19, ArgenZ ST A1 gradient / Multilayer was used.

Fig 17. Occlusal view of ArgenZ ST molar.

Fig 18. Buccal view of ArgenZ ST molar.

Fig 19. Single anterior crown of ArgenZ ST.

ABOUT THE AUTHOR



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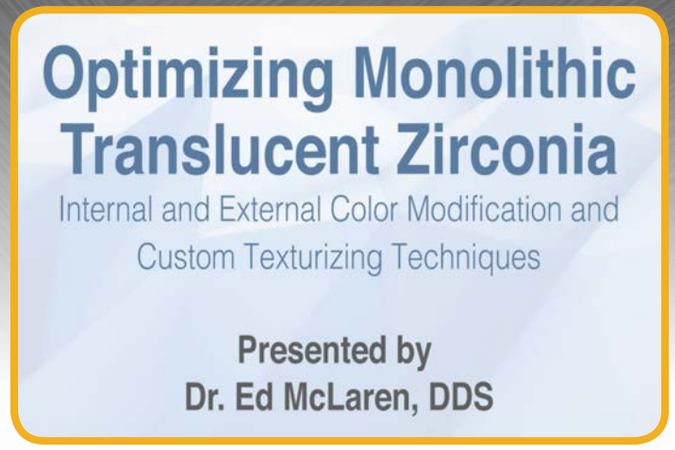
Additional Resources

Zirconia Tips and Tricks - Biting Force and Occlusal Thickness

Get Started with ArgenZ Zirconia



Optimizing Monolithic Translucent Zirconia (video)