Ensuring Optimal Clinical Outcomes with Celtra Duo (ZLS) Blocks for CEREC®

Dennis J. Fasbinder, D.D.S., and Markus Vollmann

Celtra Duo is a zirconia-reinforced lithium silicate (ZLS) material developed specifically for use with CEREC®. Comprised of a high glass content and ultrafine microstructure, Celtra Duo provides several unique benefits; the first is that after milling, it can either be fired or polished based on the clinical needs of the case. Second, the final strength of the material is dependent on the method of finishing the milled restoration. And finally, the material composition is one that most closely resembles that of lithium silicate glass ceramic, although in this case with the inclusion of zirconia for added strength and fracture toughness. With a 50% glass content by volume, Celtra Duo (ZLS) is unlike any other CEREC block available today.

Clinical Performance

Manufactured by Dentsply Sirona and introduced to the U.S. dental market in early 2015, Celtra Duo is a relatively new material for CAD/CAM restorations. Despite the material's new-to-market status, Celtra Duo has a sizable compendium of in-vivo clinical performance data as well as a considerable number of in vitro flexural strength, wear, fracture toughness, and bond strength tests.

One study evaluated the performance of chairside Celtra Duo restorations after two years of clinical service. The authors reported a 98.9% success rate for 18 premolar and 68 molar restorations. There were no cases of chipping or fracture, with one restoration requiring endodontic treatment. A second study evaluated Celtra Duo inlays and onlays all adhesively bonded with a total etch and dual-cured resin cement after one year of clinical service. There were 33 onlays and 27 inlays. A total of 32 restorations were hand-polished and 28 were glaze-fired. There were two fractured restorations, one molar that was polished and one molar that was glaze-fired, with a success rate of 96.7%. Of course a longer clinical evaluation period is necessary to draw further conclusions, but the initial results of such a new material are very good.

Handling Celtra Duo

Experienced CEREC clinicians are comfortable hand-polishing or firing chairside CAD/CAM restorations, so the natural tendency is to use what has worked in the past. However, this can lead to problems with newer materials as they do not always respond the same to previous techniques. It’s not that Celtra Duo requires unorthodox handling procedures—on the contrary, there are no new techniques to learn; rather, it’s how those well-known processing steps need to be carried out to ensure success with this material.

Microfractures: Why They Happen and Their Effect on Clinical Outcomes

Celtra Duo provides the clinician a choice of workflows: mill and polish, or mill and fire. If the clinician simply polishes the material, the flexural strength of the milled Celtra Duo restoration is 210 MPa. Firing the material in the CEREC SpeedFire oven results in a flexural strength of 370 MPa. When choosing the mill and fire pathway, it is important not to rush the cool-down period, as doing so can cause undue thermal stress. This is true for all Celtra Duo restorations, no matter the indication, but is even more critical for posterior crowns, as these restorations are typically thicker.

Due to the natural way heat dissipates, the outer surface cools more quickly than the internal or intaglio surface. As a result of this cooling time should not be rushed. The act of polishing Celtra Duo actually doing much more than creating a natural gloss to the restoration—it’s imparting physical strength to the material as well.

A second critical item to ensure clinical success is to respect the recommended thickness of Celtra Duo to maximize the potential strength of the material. Different types of ceramic materials require varying thickness dimensions to ensure the potential physical strength of a material is achieved. Manufacturer-recommended dimensions may be encroached on by clinicians based on clinical limitations of a particular case. But this also creates an inherent risk to the longevity of the restoration.

Celtra Duo has a significant glass component that is responsible for the good translucency of the material. It is also the reason that encroaching on the 1.5-mm recommended thickness can significantly compromise the desired strength of the restoration.

Microfractures: Why They Happen and Their Effect on Clinical Outcomes

Celtra Duo requires unorthodox handling procedures—on the contrary, there are no new techniques to learn; rather, it’s how those well-known processing steps need to be carried out to ensure success with this material.

Handling Celtra Duo

Experienced CEREC clinicians are comfortable hand-polishing or firing chairside CAD/CAM restorations, so the natural tendency is to use what has worked in the past. However, this can lead to problems with newer materials as they do not always respond the same to previous techniques. It’s not that Celtra Duo requires unorthodox handling procedures—on the contrary, there are no new techniques to learn; rather, it’s how those well-known processing steps need to be carried out to ensure success with this material.

Microfractures: Why They Happen and Their Effect on Clinical Outcomes

Celtra Duo provides the clinician a choice of workflows: mill and polish, or mill and fire. If the clinician simply polishes the material, the flexural strength of the milled Celtra Duo restoration is 210 MPa. Firing the material in the CEREC SpeedFire oven results in a flexural strength of 370 MPa. When choosing the mill and fire pathway, it is important not to rush the cool-down period, as doing so can cause undue thermal stress. This is true for all Celtra Duo restorations, no matter the indication, but is even more critical for posterior crowns, as these restorations are typically thicker.

Due to the natural way heat dissipates, the outer surface cools more quickly than the internal or intaglio surface. As a result of this cooling time should not be rushed. The act of polishing Celtra Duo actually doing much more than creating a natural gloss to the restoration—it’s imparting physical strength to the material as well.

A second critical item to ensure clinical success is to respect the recommended thickness of Celtra Duo to maximize the potential strength of the material. Different types of ceramic materials require varying thickness dimensions to ensure the potential physical strength of a material is achieved. Manufacturer-recommended dimensions may be encroached on by clinicians based on clinical limitations of a particular case. But this also creates an inherent risk to the longevity of the restoration.

Celtra Duo has a significant glass component that is responsible for the good translucency of the material. It is also the reason that encroaching on the 1.5-mm recommended thickness can significantly compromise the desired strength of the restoration.
on the ceramic. Because ceramic partially consists of glass, this is an unavoidable phenomenon that happens no matter what type of burs or what type of milling unit is used, no matter what speed the burs are turning, or altering any of the other variables of the milling process. The act of simply cutting into the ceramic with diamond burs results in the introduction of microscopic surface flaws. These flaws weaken the ceramic restoration and may cause premature failure if not addressed properly. The propagation of the microfractures into larger fractures may lead to bulk fracture and failure of the ceramic restoration. Initially, the surface flaws that are created by milling the ceramic are microscopic in nature. With repeated function and wear of the ceramic, the flaws can increase in size, eventually causing the ceramic to fracture completely through fatigue failure.

The Importance of the Celtra Duo Polishing Protocol

When choosing the mill and polish processing pathway for Celtra Duo, clinicians will notice that the restoration quickly becomes very shiny, and the tendency is to stop polishing too soon. However, underpolishing the material will not fully heal the surface of the material and will not result in maximum restoration strength. It is not the shiny or gloss surface that gives the Celtra Duo its strength; rather, it’s the surface-healing effect of the polishing removing the roughness that increases the strength of the material (Figs. 1 and 2).

At a high enough magnification, all smooth surfaces appear as a continuous line of peaks and valleys rather than a mirror-like surface. The process of milling accentuates the height of the peaks and depth of the valleys, increasing the surface roughness of the material. In order to smooth the surface, heal the fractures, and create the desired gloss finish, the first step is to reduce the height of the peaks with a relatively coarse grit of polishing wheel; failure to remove these peaks and valleys by using fine grit polishers will only round them over rather than completely removing them, which is the first goal of polishing.

Upon recovery from the milling unit, the first step in polishing a Celtra Duo restoration is to use a fine diamond (40 micron grit) to remove the sprue and do any minor contouring that may be required. Use a lab hand motor with a speed between 8,000 and 12,000 RPMs with light to medium pressure; it is important not to overheat the material. Dentsply Sirona does not recommend using a stone wheel for the removal of the sprue due to the damage it can cause, thus the recommendation to use a fine diamond bur with water spray.

One recommended polishing kit is the Meisinger CAD/CAM Luster Kit because it contains the range of polishers required to smooth and polish the surface. After initial contouring, a coarse rubber wheel is used to remove any remaining bur marks and begin the smoothing process. The recommended speed for the rubber wheel is between 10,000 and 12,000 RPM. The blue twist polisher is then used to prepare the surface for polishing. The blue twist polisher is a coarse grit and will continue to remove the peaks and valleys to create a more uniform surface. The green polisher is not necessary for use with Celtra Duo as it is too aggressive for this contouring protocol. After using the blue twist polisher, the pink twist polisher is used, and finally the yellow twist polisher. All of the polishers are run at approximately 10,000 to 12,000 RPM, using a firm but light touch. The general tendency in polishing ceramic materials is to use the relative gloss of the material as a judge of smoothness; however, this results in underpolishing Celtra Duo as the gloss surface is generally achieved more rapidly than complete smoothing of the material. Figs. 3A/B, 4A/B, and 5A/B illustrate the significant change in surface roughness that is achieved with careful polishing of Celtra Duo following milling.

As an optional last step, the restoration can be refined with fine diamond paste using a stiff Robinson brush. With each of these polishing steps, it’s important to avoid overheating the material. To do so, use a “pressure and release” technique; that is, apply a bit of pressure for a second or two, then release, then repeat. This will prevent the material from overheating from the friction that prolonged contact of the polishing wheel can cause.

A logical question is, if the polishing sequence is required to remove the surface microfractures and improve the physical strength of Celtra Duo, does not the inner or intaglio surface of the restoration remain rough and potentially lead to bulk fracture?
This is one of the reasons that an adhesive bonding protocol is required for delivery of Celtra Duo restorations. The etching, silanation, and adhesive bonding process not only provides retention of the restoration to the tooth, but also seals the inner or intaglio surface of the restoration from crack propagation. The adhesive bonding protocol is another important sequence that can contribute to clinical longevity and success.

**Taking the “Mill and Fire” Pathway**

Optionally, Celtra Duo can be milled and then fired. Choosing this processing pathway instead of taking the mill and polish route is up to the clinician, as the final strength of Celtra Duo is above clinically accepted standards when processed either way. Firing alone results in a final restoration strength of 370 MPa, and any microfractures that may have occurred during the milling step are healed when the restoration is fired. This healing happens automatically due to the heat that the material is subject to during the firing. The high temperature effectively fuses together any microscopic fractures in the material, thereby resulting in a solid, unified, high-strength and fracture-free structure. Once glaze-fired, the surface of the Celtra Duo restoration takes on a smooth, natural luster allowing the restoration to be seated immediately after cool-down without the need for an additional polishing step.

To achieve consistent, repeatable clinical success with Celtra Duo when choosing either the mill and polish or mill and fire processing pathways, it’s imperative to use all the protocols as described herein. For the polish-only option, don’t skip a step as soon as you see the restoration getting shiny, because that’s not enough to correctly heal Celtra Duo. The final steps are where the healing takes place. This is critical with Celtra Duo because the material polishes quickly, but if the proper steps are not followed, the surface may appear shiny but is not properly healed and surface roughness remains. With regard to the fire option, it’s important not to rush cool-down, and for both options, adhere to the material thickness guidelines.

By having a material that is flexible in its use, that can either be polished or fired, Celtra Duo offers CEREC dentists a versatile and dynamic block that’s indicated for virtually any clinical situation.

For questions and more information, contact Dr. Fasbinder at dfas@umich.edu.
References


Fig. 4A: SEM polished dialite wheel

Fig. 4B: Celtra Duo surface after polishing with Dialite Wheels (Brasseler). Average roughness (Sa = 0.021 + 0.003 microns) representing a very smooth surface on par with other glass ceramics.

Fig. 5A: SEM polished twist polishers

Fig. 5B: Celtra Duo surface after polishing with spiral rubber polishers (Meisinger Luster polishers). Average roughness (Sa = 0.023 + 0.006 microns) representing a very smooth surface on par with other glass ceramics.