CEREC Materials Overview

Different Selections for Milling Restorations

CAD/CAM DENTISTRY HAS EVOLVED FROM its rudimentary beginnings to a viable chairside technology that allows clinicians to restore virtually any tooth in a single visit. With almost 40,000 users worldwide, the CEREC system has lead the way with regard to innovation and increased range of uses. As the number of CEREC users has grown, material manufacturers have noticed the potential for profit. This spurred an incredible amount of research and development into new blocks both for chairside and laboratory use. This article will attempt to summarize the main materials that are currently available for clinicians to use with their CEREC systems chairside, and the authors' recommendations for the optimal use of each material.

The original block for the CEREC system was created as collaboration between Dr. Werner Mörmann and the Vita Corporation. Dr. Mörmann was looking for a material that could be used in his new CAD/CAM system for the fabrication of inlays and onlays. The first blocks were created out of feldspathic porcelain and called the Vita Mark I blocks. These eventually evolved into the current generation of blocks (Vita Mark II).

Available since 1991, the Vita Mark II blocks are considered one of the most abrasion-resistant dental ceramics. Clinical studies have shown a survival rate of approximately 95 percent after 10 years.[1] The blocks are fabricated from feldspar porcelain particles

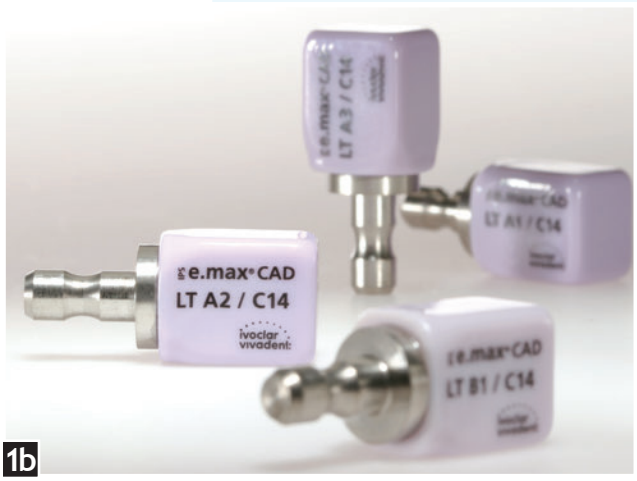

Figure 1a: Empress blocks are available in multiple shades and translucencies. The LT (low translucency) blocks are used for large onlays and crowns; the HT (high translucency) blocks are used for partial-coverage restorations that allow the blocks to blend in with the surrounding tooth structure. The Multi blocks have both high- and low-translucency components in the blocks.

Figure 1b: The e.max blocks are available in both low- and high-translucency variations. The blocks are milled in the "blue" state to allow for ease of milling.

Figure 2: The Vita blocks are the oldest blocks. Made from a feldspathic-type porcelain, the blocks are suitable for many uses intraorally.

Figure 3: Vita Enamic: The most recent block from the Vita corporation is a hybrid made from a matrix of ceramic infiltrated with a polymer. The combination allows the block to have the best properties of both enamel and dentin.

embedded in a glass matrix and have a flexural strength of approximately 150 MPa. Due to the small particle size in the material, the potential for wear on the opposing dentition is minimized. Ideal for inlays, onlays, crowns and veneers, the material can be glazed in a standard oven using low-fusing porcelain.

While the strength of the material has shown to be sufficient for single-unit restorations, it's not a strong enough block for multi-unit fixed bridges.

Its small particle size, excellent esthetics and availability in polychromatic blocks means that the material is ideal for use in esthetic areas. However, due to its relatively low strength as compared to other millable blocks such as e.max, the authors' recommendation is to limit the use of this material in the premolar and anterior areas. The blocks have been successfully used in molar areas for years; but other stronger, more resilient materials are available today for use in the molar region. The premolar and anterior areas, where there are fewer occlusal stress issues, are the ideal indications for use with the Vita Mark II blocks.

To prepare the blocks for cementation, the porcelain is etched via hydrofluoric acid for approximately 60 seconds with 4.5 percent HF acid. Silane is applied, followed by an application of bonding resin, after which the restoration is bonded to the tooth structure.

The most recent material to be introduced from Vita is the Vita Enamic block. In this block, the dominant ceramic network is infiltrated with a reinforcing polymer network structure that is fully merged with one another. Thanks to the dual ceramic-polymer network, the new material exhibits the benefits of ceramic and resin in one material.

While the compressive strength of the blocks is similar to Vita Mark II, the flexural strength is much higher, allowing the material to perform at high strength. Ideal for inlays, onlays and crowns, the material is prepared for bonding via a HF acid etch and silane similar to its cousin, the Vita Mark II.

According to the Vita Corporation, the color stability of the material is high due to the ceramic component. But due to the resin infiltration of the ceramic, until long-term in-vivo performance data is available, it is the authors' recommendation that the material be used with caution in the esthetic zone.

Not that the material cannot be polished well; it can. However, because the esthetics of the material is determined by polish and not a fired glaze, there is limited predictability in how the polished appearance will hold up over time in the mouth.

The Ivoclar Corporation creates two different materials for use in the CEREC system: Empress CAD and e.max. IPS Empress CAD is a Lucite-based glass ceramic. The composition is similar to the Empress ceramic that has been available from commercial laboratories for more than 20 years. By reinforcing the glass matrix with Lucite crystals, the intent by the manufacturer is to slow or deflect the propagation of the cracks that form naturally in porcelain.

The Empress CAD blocks exhibit a flexural strength of approximately 160 MPa, which his similar to the Vita Mark II blocks. Able to be polished as well as glazed in an oven, the recommended indications are anterior crowns and veneers, and inlays, onlays and crowns in the posterior. However similar to Mark II, the authors' recommendation is that the material be limited in use in esthetic anterior areas with low occlusal stress, such as veneers and crowns in the premolar and anterior region. Preparing the surface for bonding is similar to Mark II as well – etch with 4.5 percent HF acid for 60 seconds and apply silane and bonding agent. The etch dissolves the crystalline structure and allows for additional retention of the blocks with silane and resin cement.

The other material that is created by Ivoclar is IPS e.max CAD. e.max has fast become one of the most popular materials to be used by CEREC users simply because of its success in the clinical world. The e.max material is milled in a softer, pre-crystallized ("blue") state due to the ease of milling that occurs in that state. In the "blue" state, the material exhibits a strength of 130-150 MPa and is thus comparable to other glass-ceramic blocks available for the CEREC. Once milled, the blocks are crystallized in a furnace, which increases the strength of the material to between 360-400 MPa. Not only is the strength increased, but the final color of the restorations is changed from the blue color to the final esthetic shade.

During crystallization, which occurs at a temperature of approximately 840 degrees Celsius, the material shrinks 0.2 percent, which has been already taken into account by the CEREC software.

While the material can certainly be used for inlays, because it needs to be

MATERIALS AVAILABLE TO USE WITH CEREC CHAIRSIDE

MATERIAL	COMPANY	COMPOSITION	BLOCKS	POLYCHROMATIC VENEERS	CROWNS	INLAYS	ONLAYS	BRIDGES
Mark II	Vita	Feldspathic Porcelain	Yes	Ideal	Yes	Yes	Yes	No
Enamic	Vita	Ceramic Resin Hybrid	No	Not recommended	Yes	Ideal	Yes	No
Empress CAD	Ivoclar	Leucite Reinforced Porcelain	Yes	Yes/Ideal	Yes	Yes	Yes	No
e.max	Ivovlar	Lithium Disilicate	No (planned for 2013)	Yes	Ideal	Yes	Yes	Limited
LAVA Ultimate	3M	Nano Ceramic/Resin	No (planned for 2013)	Not recommended	Yes	Ideal	Ideal	Limited

fired in an oven to fully crystallize (which takes approximately 15 minutes in a furnace) the authors' recommendation is to use the material for more "extensive" restorations such as onlays and crowns. The blocks come in a low translucency and high translucency variation. The LT blocks are intended more for full-coverage restorations, while the HT blocks are meant more for partial-coverage restorations where the operator needs the restorations to blend with the surrounding tooth structure.

The other indication for e.max is full-contour bridges. Recent studies have shown that the survival rates for posterior bridges with e.max rival those of traditional porcelain fused to metal bridges.[2] Although not recommended by the authors, laboratories have successfully used e.max for anterior bridges, and more and more clinicians are using e.max for posterior bridges. More testing needs to be completed prior to the outright recommendation of e.max for full-contour bridges.

The main limitation of e.max as a bridge material is the connector size. If you can get the connector size of appropriate thickness, then the success of the material is greatly increased. The downside of this is obviously esthetics. With a large connector size, can the material be made to fulfill the esthetic needs of the patient? Smaller connector equals better esthetics but also leads to premature failure.

The final material we will discuss is LAVA Ultimate from 3M. Fabricated with resin nano particles combined with zirconia particles, the LAVA blocks are available in a HT and LT translucencies. The same indications that are applicable for e.max HT and LT blocks apply to LAVA Ultimate. The material is strong enough to be used in virtually all indications such as crowns, onlays and veneers. But, because this is a resin-based material, similar to the Enamic blocks, the authors' preference is to use the blocks in areas of low esthetic importance. Not that the material is not esthetic; polished properly, the material can be polished to a high luster. The only concern that remains is that because this is a polished, but not a glazed, restoration, how will the luster hold up over time?

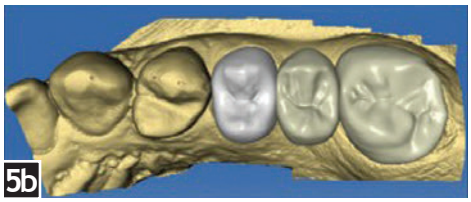

Figure 4a: The e.max blocks are milled in the "blue," softer state. This allows the milling unit to mill this material without too much effort.

Figure 4b: After placing the restoration in the oven for approximately 15 minutes, the final shade is shown. The crystallization process gives the material its strength of approximately 400 mpa.

Figure 5a: Recent research has shown that e.max full-contour bridges might be a viable treatment option.[3]

Figure 5b: This article showed that the failure rate of bridges fabricated with full-contour e.max was similar to laboratory-fabricated ceramometal bridges.

Figure 6: The LAVA Ultimate material is a nano-ceramic resin block that shows excellent physical properties. This block can be used for inlays, onlays and crowns. Some clinicians find the softer material preferable to use on implant abutments.

CONCLUSION

In evaluating all the available materials, there is no such thing as a perfect material. CEREC users have an array of different materials available to them that will best help them to restore their patients' dentition. From blocks suited for anterior restorations to blocks that have the strength to withstand posterior bite forces, CEREC blocks are now suited for virtually all intraoral clinical situations.

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3 Kern M, Sasse M, Wolfart S. *Ten-Year Outcome Of Three-Unit Fixed Dental Prostheses Made From Monolithic Lithium Disilicate Ceramic.* JAm Dent Assoc. 2012 Mar;143(3):234-40.