White Paper

CEREC Tessera™

Advanced Lithium Disilicate

THE DENTAL SOLUTIONS COMPANY™

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CEREC Tessera™

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Introduction

As a result of the growth of single-visit CAD/CAM dentistry, dental professionals now have a wide offering of indirect, machinable restorative materials to choose from. The myriad of materials available for chairside single-visit dentistry can be categorized according to composition, microstructure, mechanical properties, and esthetic characteristics. Another very important attribute that should not be overlooked is a material's impact on procedural workflow, with careful consideration given to the overall speed and simplicity of working with the material throughout each step.

Background

The application of materials science is unique in dentistry because of the complexity of the oral cavity, which includes bacteria, high masticatory forces, ever-changing pH, and a warm, fluid environment. In addition, when dental materials are placed into the mouth as restorative materials, there are very specific requirements for manipulation of the material.

Knowledge of materials science and biomechanics is necessary when choosing materials for specific dental applications, as well as when determining the best solution for restoration of tooth structure and replacement of teeth. The characteristics of an ideal restorative material are described as fulfilling requirements applying to the:

- Physical and mechanical properties of the material
- Technical features of the material from the perspective of the dental professional
- Patient factors of acceptability
- Other clinical aspects that contribute to the material's effectiveness, such as workflow integration

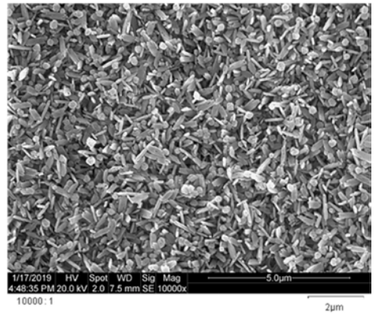
Material overview

CEREC Tessera blocks are a tooth-colored Advanced Lithium Disilicate (ALD) high-strength glass ceramic material designed for chairside CAD/CAM applications. The combination of glass and high crystal content allows the material to be fired at an accelerated speed—4 minutes 30 seconds in the CEREC SpeedFire furnace—with no detriment to material strength or durability. At the time of this publication, CEREC Tessera blocks are indicated for full-contour single-unit anterior and posterior restorations, including crowns, inlays, onlays, and veneers.

Composition: Optimized microstructure

The advanced formulation of CEREC Tessera blocks is comprised of two essential crystals: lithium disilicate ($Li_2Si_2O_5$) and virgilite ($Li_{0.5}Al_{0.5}Si_{2.5}O_6$), which is an LAS (Lithium Aluminium Silicate) type of crystal. Additionally, during the firing process, new virgilite crystals are formed on a nano-growth scale.

These needle-like crystals, measuring approximately 0.5 µm in length, are embedded in a zirconia enriched glass matrix. Together, these material constituents combine to create a robustly reinforced, high-density restorative material. The dense interwoven crystal composition of CEREC Tessera blocks is key to their high strength and serves to virtually eliminate the presence of microcracks and subsequent crack propagation. The principle here is similar to steel reinforced concrete: Within CEREC Tessera blocks, the lithium disilicate provides compression strength, while the newly formed virgilite increases the pre-compression stress.



CEREC Tessera microstructure

Material workflow

Designed to take full advantage of the CEREC single-visit chairside restoration workflow, the advanced formulation of CEREC Tessera facilitates one simplified processing pathway—mill, glaze, fire, and seat—which helps eliminate any risk of variability in material performance. And with CEREC Tessera's unprecedented firing time of 4 minutes 30 seconds in the CEREC SpeedFire, the entire CEREC chairside single-visit workflow can be accomplished as expeditiously as possible.

Material strength

The compressive strength of human enamel (384 MPa) and dentin (297 MPa), and fracture strength of a natural tooth (molar = 305 N; premolar = 248 N), offer excellent mechanical standards to determine the optimal strength for restorative dental materials.[1]

The behavior and performance of CEREC Tessera restorations were evaluated in several standardized in-vitro tests. These tests provide preliminary information about the performance of a material when it is used for the recommended indications. In biaxial strength tests, CEREC Tessera measured >700 MPa. The increased strength value of CEREC Tessera blocks is due in part to matrix-firing (in 4 minutes 30 seconds in the CEREC SpeedFire furnace with spray glaze) and also the material's unique strength-enhancing formulation. CEREC Tessera can also be fired in a traditional porcelain oven, however, doing so requires a longer firing time.

Esthetic properties

The same microcrystal composition (lithium disilicate and virgilite) of CEREC Tessera that is responsible for the material's high biaxial and flexural strength also contributes to its highly esthetic and dynamic light refraction, transmission, and absorptive properties that mimic the visual vitality of natural dentition.

CEREC Tessera material provides a natural opalescence, lifelike fluorescence, and high translucence. Radiopacity of the material is also excellent, and is an important characteristic to diagnose secondary caries, determine the proximal contour of the restoration and its contacts with adjacent teeth, and also to distinguish restorative material from gaps and voids.

Conclusion

When identifying an ideal restorative material, all clinical characteristics must be considered and carefully evaluated. Clinicians who choose Advanced Lithium Disilicate for their specific practice needs can have confidence in its strength, esthetics, speed, and simplicity.

REFERENCE:
1. Willems G, Lambrechts P, Braem M, Vanherle G. Composite resins in the 21st century. *Quintessence Int*. 1993 Sep;24(9):641-68.

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