

“The esthetics of the first 15 years of CAD/CAM restorations is characterized by the attribute, *tooth-colored*.”



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CAD/CAM—A Tool for Cosmetic Dentistry

In 1973, Dr. Bruce Altschuler described an experimental setup for the holographic 3-D scanning of teeth.¹ He anticipated that an advanced version of this appliance would be able to machine gold crowns. When François Duret presented his CAD/CAM system in 1985, he used a fiber-reinforced polymer for the machining of a crown.² I myself had Vita Mark I blocks of monochromatic feldspathic ceramic available for generating the first CAD/CAM inlay in restorative dentistry in 1985.³

The esthetics of the first 15 years of CAD/CAM restorations is characterized by the attribute, *tooth-colored*. I performed the first chairside CAD/CAM CEREC 1 veneer on a discolored central incisor in 1986. Though the scope for design was limited at that time, the ceramic veneer blended well with the surrounding dentition and hinted at high cosmetic potential. By now, CAD/CAM technology has triggered the development of a multitude of high- and low-translucency monochromatic as well as multicolored and 3-D structured blocks, extending the choice of esthetic ceramics. The design software then allows positioning of the restoration design relative to layered multicolored blocks or relative to dentin and enamel block structure in such a way that optimum blending in of shades and structure in crowns or veneers is obtained. The milled restoration thus lays an optimal foundation for customization. Some restorations just need surface texturing and polishing; others are characterized with stain and glaze or with cutback and layering.⁴

In a recent study,⁵ our group found that all tested, permanent esthetic CAD/CAM block materials—whether zirconia, lithium disilicate, feldspathic, hybrid ceramics, or resin-based nanocomposites—behave similarly or better than natural enamel with respect to two-body and tooth brushing wear, which was not true for provisional acrylic polymer-block materials. Ceramics showed the best gloss retention compared to hybrid ceramics, nanocomposites, and acrylic polymers. Scanning electron microscopic inspection showed that CAD/CAM materials are to the core homogeneous; whereas light-cured, direct-filled resin-based composite throughout exhibited pores.⁵

Dentists and dental technicians today can choose from a variety of CAD/CAM systems and 3-D scanners. Intraoral 3-D scanners with true color information present natural-looking virtual 3-D models. Together with the virtual articulator (a work in progress), digital registration of jaw movements and muscle activity, 3-D radiographs, and cone beam computed tomography data and those from 3-D face scanners (smile) form a comprehensive set of data representing the “virtual dental patient.”⁶ This offers the potential to analyze, plan, design, and fabricate single as well as multiple restorations in form, function, and esthetics completely from digital data.

CAD/CAM has introduced unprecedented highly esthetic and high-strength ceramics, and through that it has become an essential tool for cosmetic dentistry.

References

1. Altschuler BR. *Holodontography: an introduction to dental laser holography*. Springfield (VA): National Technical Information Service; 1973.
2. Duret F. CAD/CAM in dentistry. *J Am Dent Assoc*. 1988;117:715-20.
3. Mörmann WH. The evolution of the CEREC system. *J Am Dent Assoc*. 2006 Sep;137 Suppl:7S-13S.
4. Masek R. Ultimate CEREC creations—comprehensive single visit esthetic dentistry. In: Mörmann WH, editor. *State of the art of CAD/CAM restorations, 20 years of CEREC*. Berlin: Quintessence Int; 2006. p. 131-8.
5. Mörmann WH, Stawarczyk B, Ender A, Sener B, Attin T, Mehl A. Wear characteristics of current aesthetic dental restorative CAD/CAM materials: two-body wear, gloss retention, roughness and Martens hardness. *J Mech Behav Biomed Mater*. 2013 Apr;20:113-25.
6. Mehl A. The “virtual patient” in medicine and dentistry. *Int J Comput Dent*. 2013;16:7-8.



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