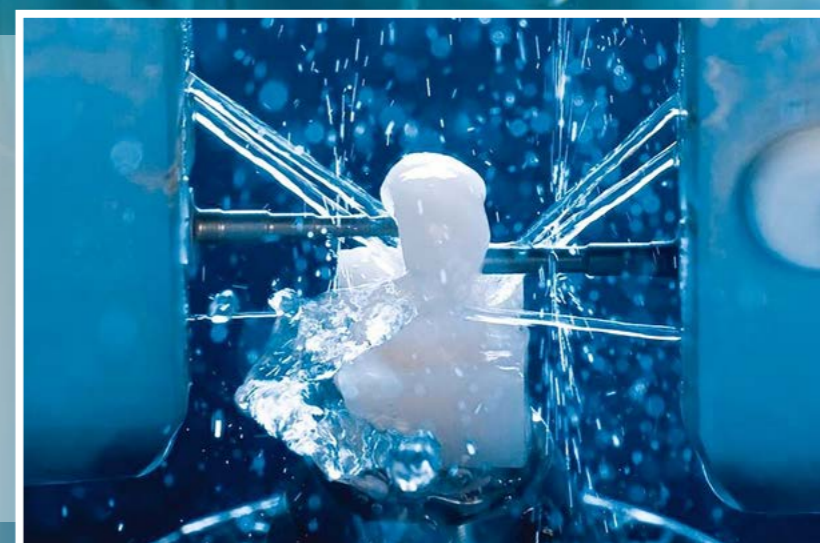


New Material for
**CAD/CAM-based
Restorative Dentistry**



CAD/CAM Materials in Dentistry

Until recently, a clinician's decision was quite simple when selecting CAD/CAM materials as typically, tougher materials were associated with poor esthetics and excellent esthetics were associated with low strength. Today, CAD/CAM restorations can be created with a multitude of materials, including ceramics (esthetic ceramics, high-strength ceramics, and zirconia), hybrid ceramics and CAD/CAM composites, fiber reinforced resins, polymers, and metals. These materials can be used to fabricate anything from single copings, crowns, temporaries, surgical guides, dentures, appliances, and complex full-arch restorations to models and burnout wax patterns for pressing and casting.



Zirconium-silicate nanoceramic CAD/CAM composite, HC Block/Disk (Shofu).



Fiber-reinforced composite, TRINIA CAD/CAM (Bicon/Shofu).

Ceramics are by far the most common materials used to fabricate CAD/CAM restorations.¹ In the pioneering years of CAD/CAM technology, feldspathic porcelain was the restorative material of choice for many clinicians as this material best matched the desired physical properties—excellent translucency and moderate strength. While esthetic, porcelain is brittle with a low fracture toughness and a high proneness to failure in the presence of flaws.



Vintage MP Porcelain (Shofu).

Courtesy of Abel Fernandez, CDT, MDT.

1. Porto T, Roperto R, Akkus A, et al. Mechanical properties and DIC analyses of CAD/CAM materials. *J Clin Exp Dent.* 2016;8(5):512-516.

A New Category

To overcome this problem new materials with greater strength were pursued. First, leucite-reinforced then lithium-disilicate glass ceramics, both of which demonstrate higher flexural strength than porcelain. Tough and esthetic, when these materials are adequately prepped, handled, and bonded they demonstrate a good success rate.²

Porcelain-fused-to-gold (upper) and high-strength ceramics (lower).
Courtesy of Abel Fernandez, CDT, MDT.



However, when the margins are thin, a bond to the underlying tooth deficient, or an adjustment is needed, the failure rate of restorations with high-strength ceramics tends to dramatically increase.³ Consequently, the enhanced toughness of high-strength ceramics requires that these materials be fabricated in a pre-sintered stage. In turn, the resultant firing process can make it difficult to complete the treatment on the same day. Furthermore, the manual nature of the processing can potentially lead to more errors and thus, further reduce the quality of a final restoration.⁴

Although widely utilized by dental laboratory technicians due to its high flexural strength and fracture toughness, zirconia demands significant post-processing work, and therefore is not considered an optimal solution for single-day chairside restorations.



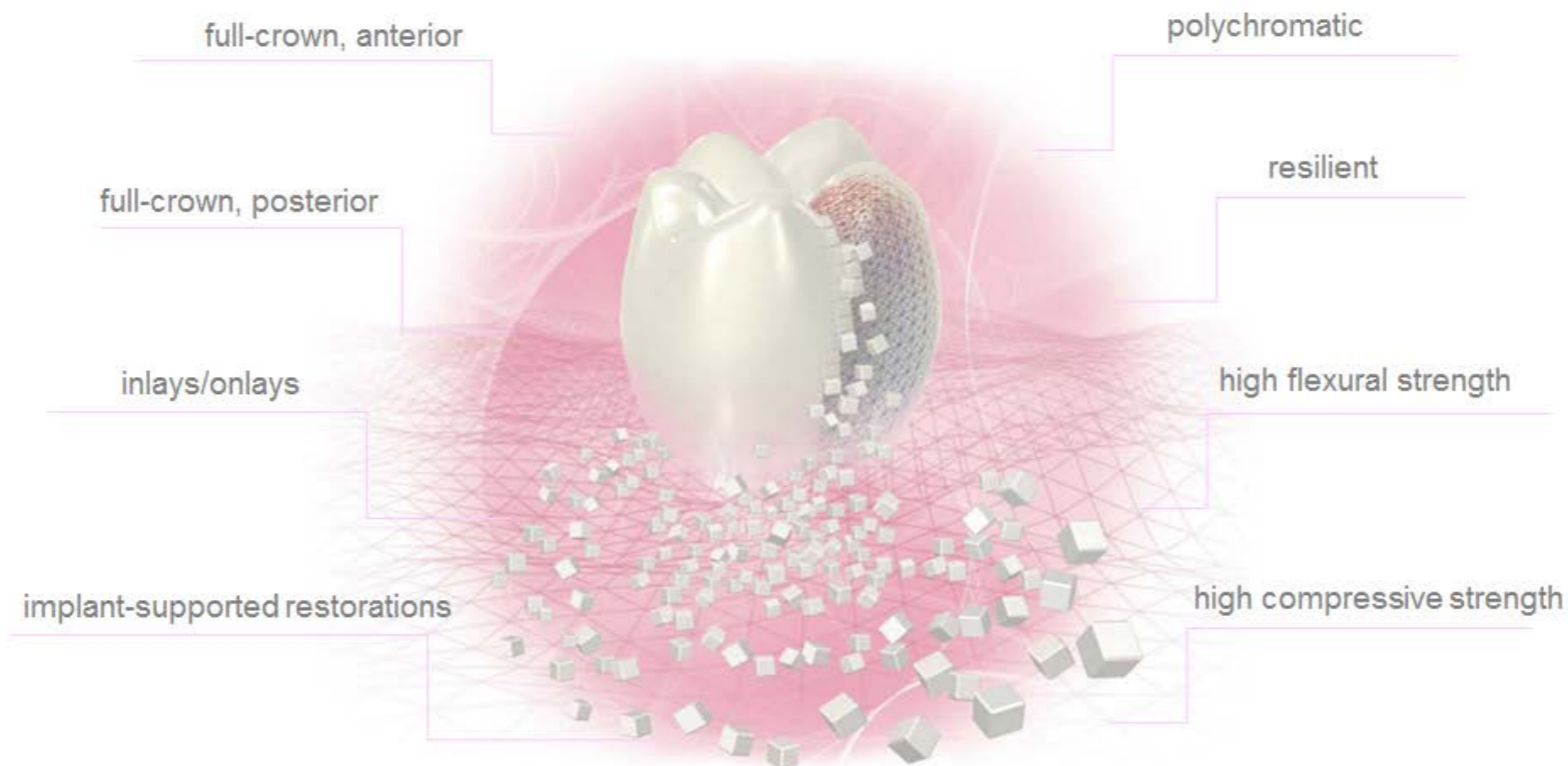
HC Block/Disk (Shofu). *Courtesy of Robert Vasile, MDT.*

In response to the limitations of high-strength ceramics, new polymer-based resin-composite materials such as HC Block/Disk (Shofu) have been developed. This new category of materials, referred to as **CAD/CAM composites** and/or **hybrid ceramics**, represents the synergy of ceramics and composites with their respective beneficial mechanical properties.

2. Fasbinder D. Materials for chairside CAD/CAM restorations. *Compend Contin Educ Dent.* 2010; 31(9):702-709. 3. Koenigsberg A. CAD/CAM materials in dentistry. *Inside Dentistry.* 2015;11(11):78-82. 4. Horvath S. Key Parameters of hybrid materials for CAD/CAM-based restorative dentistry. *Compend Contin Educ Dent.* 2016;37(9):638-643

Novel CAD/CAM Composite for All Indications

Intended to provide clinicians with the capability of restoring teeth in one appointment, **HC Block/Disk represents a generation of new CAD/CAM composites**. It features a unique nanostructure, polymerization mode, matrix composition, augmented filler content, and a highly homogenous formulation designed to minimize flaws attributed to esthetic and high-strength ceramics.



Composed of 61% zirconium silicate embedded in a high-temperature/high-pressure polymer matrix, a densely-packed nanofiller of HC Block/Disk forms a skeleton which **uniformly absorbs masticatory forces** and **promotes resistance to breakdown phenomena**.

The **high flexural strength** of 191 MPa and Vickers hardness of 66 Hv0.2 make the material a good candidate for posterior restorations, implant-supported cases, and long-term provisionals. Additionally, the hardness of HC Block/Disk also demonstrates values closer to dentin (ca. 65 Hv0.2). Thus, no excessive antagonist wear can be observed, which is a concern when using conventional ceramics.

Unique Features

Evidence also indicates that restorations fabricated with HC Block/Disk achieve **better marginal integrity and less avulsion** than those of glass ceramics. This can be attributed to a unique polymer component of the material and it is important for the optimal fit of restorations, including highly esthetic anterior cases and minimally-invasive restorations.

When compared to other CAD/CAM materials, HC Block/Disk manifests **better machinability** in terms of milling time, damage tolerance, wear of CAD/CAM instruments, and the ability to be milled in a very low thickness.

HC BLOCK/DISK: FEATURES & BENEFITS

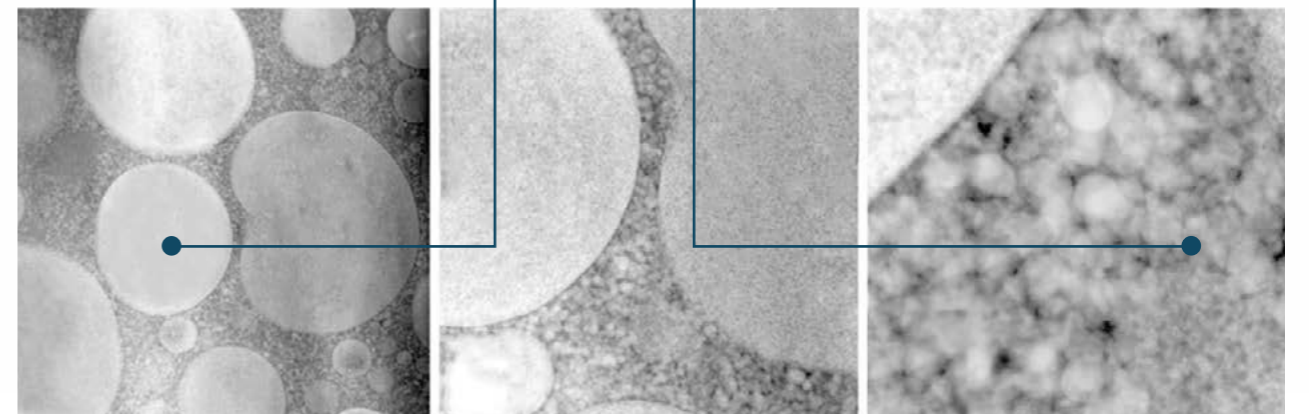
- Combine positive attributes of ceramics and resin composites
- No firing/sintering—simplify the work flow
- Very fast milling—wet or dry
- Improved machinability
- Better marginal integrity
- Higher milling accuracy—ideal reproduction of cups, ridges, and incisal edges
- Can be fabricated in very low film thickness
- Ideal for minimally-invasive restorations
- Tooth-resembling esthetics and functionality

The proprietary microstructure of HC Block/Disk composite with its spherically-shaped high-density filler particles offer greater polishability, and **esthetic results** that mimic natural dentition's optical properties of light diffusion and anisotropy.

HC Block/Disk (Shofu). *Courtesy of Brian Lindke, CDT.*



Spherical particles with “self-polishing” attributes and densely-packed filler with greater strength and durability together facilitate creating restorations that are functional and naturally beautiful



SEM photomicrographs of untreated surface of HC Block/Disk.
Source: Shofu R&D.

Case Presentation

A 42-year-old male patient with a non-restorable tooth No. 30. The proposed treatment includes a placement of a short implant (Bicon) cemented to a full-contour crown (HC Block/Shofu).

Case presented by Muneki Hirayama, DMD, and Robert Vasile, MDT (Bicon).



FIG 1. Making an incision.



FIG 2. Splinting the tissue.



FIG 3. Forming a sulcus for a permanent implant crown.



FIG 4. Placing a scan post.

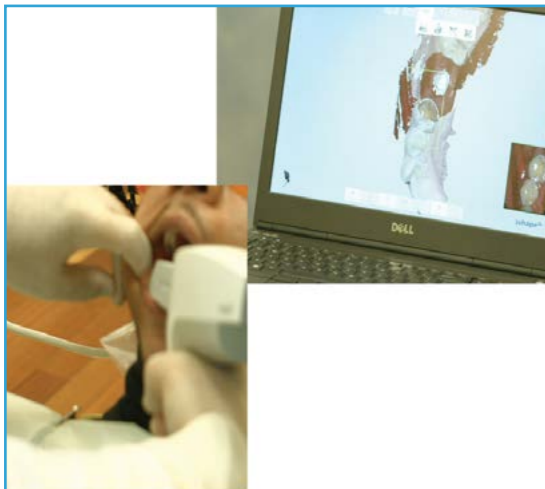


FIG 5. Capturing a direct digital impression in the patient's mouth.



FIG 6. Introducing an abutment.



FIG 7. Placing a healing cap.

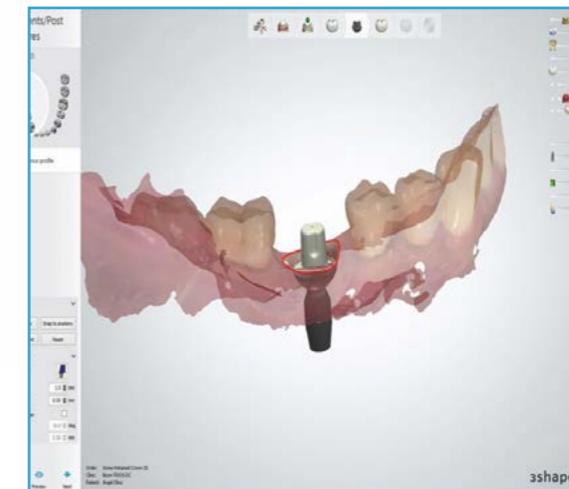


FIG 8. Detecting preparation margins.

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Case Presentation-Continued

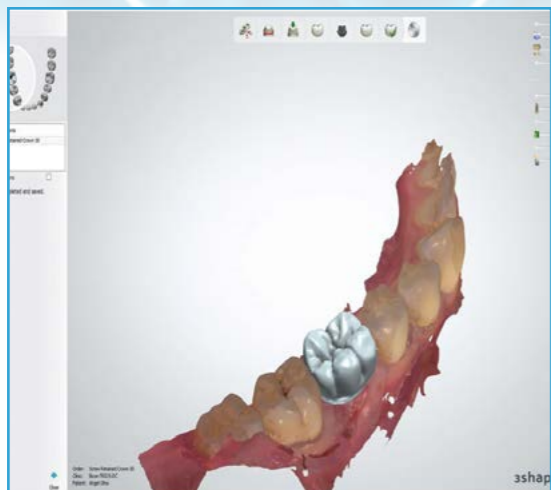


FIG 9. Generating a 3D model and the crown.



FIG 10. Milling the crown (HC Block, A3-LT; Shofu) with Cerec inLab MC XL (Dentsply Sirona).



FIG 11. Removing the healing cap.



FIG 12. Seating the crown.



FIG 13. Adjusting the contacts.



FIG 14. Assuring functionality of the crown.



FIG 15. Final restoration at the appointment time.



FIG 16. Optimal functionality and intact esthetics of the HC Block/Disk crown 2 years after the initial appointment.

Milling Time: **8 minutes**

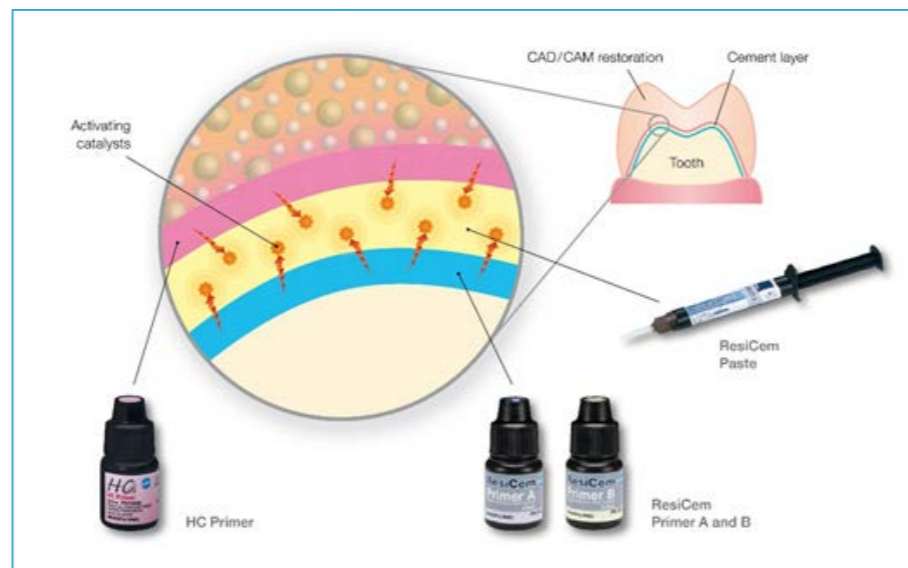
Total Appointment Time: **1 hour 20 minutes**

Adhesive Bonding and Cementation

Predictable and reliable bonding can be accomplished by providing strong mechanical interlocking and chemical adhesion between the tooth and fabricated restoration. An increase of surface roughness and proper surface-activation of indirect restorations through various methods facilitate better mechanical retention and a stronger bond to the cement.

In its guidelines, the International Academy for Adhesive Dentistry (IAAD) indicates that surface-conditioning via air-particle abrasion with either aluminium oxide (50 µm) or silicon oxide (30 µm) at a pressure of 2 bars provides the best choice for pre-treatment of CAD/CAM composite restorations.⁵

This recommendation was corroborated by the researchers from Jena University. In a recent study they concluded that two methods, sandblasting with corundum and roughening with Dura-Green Stones (Shofu), enable equally sufficient surface-conditioning.⁶



HC BLOCK/DISK: CEMENTATION

The scientific evidence from this study also supports the application of a suitable priming agent such as HC Primer (Shofu).

Thanks to its innovative formulation, **HC Primer** thoroughly infiltrates the matrix of hybrid-ceramic materials ensuring strong micromechanical retention between the primer and restoration without the risk of voids and bubbles. It also forms a **reliable bond to any adhesive resin cement**, including ResiCem, MonoCem and BeautiCem (Shofu), which are highly recommended for adhesive luting of CAD/CAM composites.

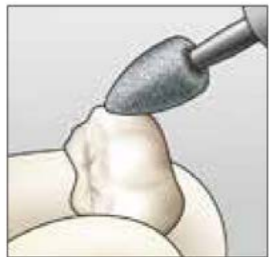
5. Spitznagel F, Vuck A, Giermuehlen P, et al. Adhesive bonding to hybrid materials: an overview of materials and recommendations. *Compend Contin Educ Dent*. 2016;37(10):630-637.

6. Rzanny A, Göbel R. In-Vitro Investigation of the Bond Strengths of "Hybrid-Ceramic" Blocks to Resin Cements. University of Jena, Germany, Department of Dental Prosthetics and Materials Science, Mar. 2017.

Finishing and Polishing

Adequate finishing and polishing of indirect restorations is critical to remove surface defects caused by machining and to establish low surface roughness and high gloss. CAD/CAM composites can be easily finished, polished, and adjusted intraorally⁷ with the same instruments as direct resin composites. Furthermore, they can retain their gloss, shade, and surface anatomy nearly as effectively as traditional ceramics.⁸ This is an important feature of the chairside clinical technique because generally, the occlusal refinement occurs intraorally.

HC BLOCK/DISK: FINISHING & POLISHING



Remove the sprue from the restoration



Try the restoration and check the occlusion



Adjust and contour with appropriate rotary instruments (e.g. Robot Points, Dura-Green, Dura-White Super-Snap)



Smooth the surface with appropriate polishers (e.g. CeraMaster Coarse, CeraMaster, Super-Snap)



Pre-Polish with Al₂O₃ impregnated polishing paste (DURA-POLISH)



Polish high gloss with diamond impregnated polishing paste (DURA-POLISH DIA) and clean with ultrasonic cleaner or with steam cleaner and dry.

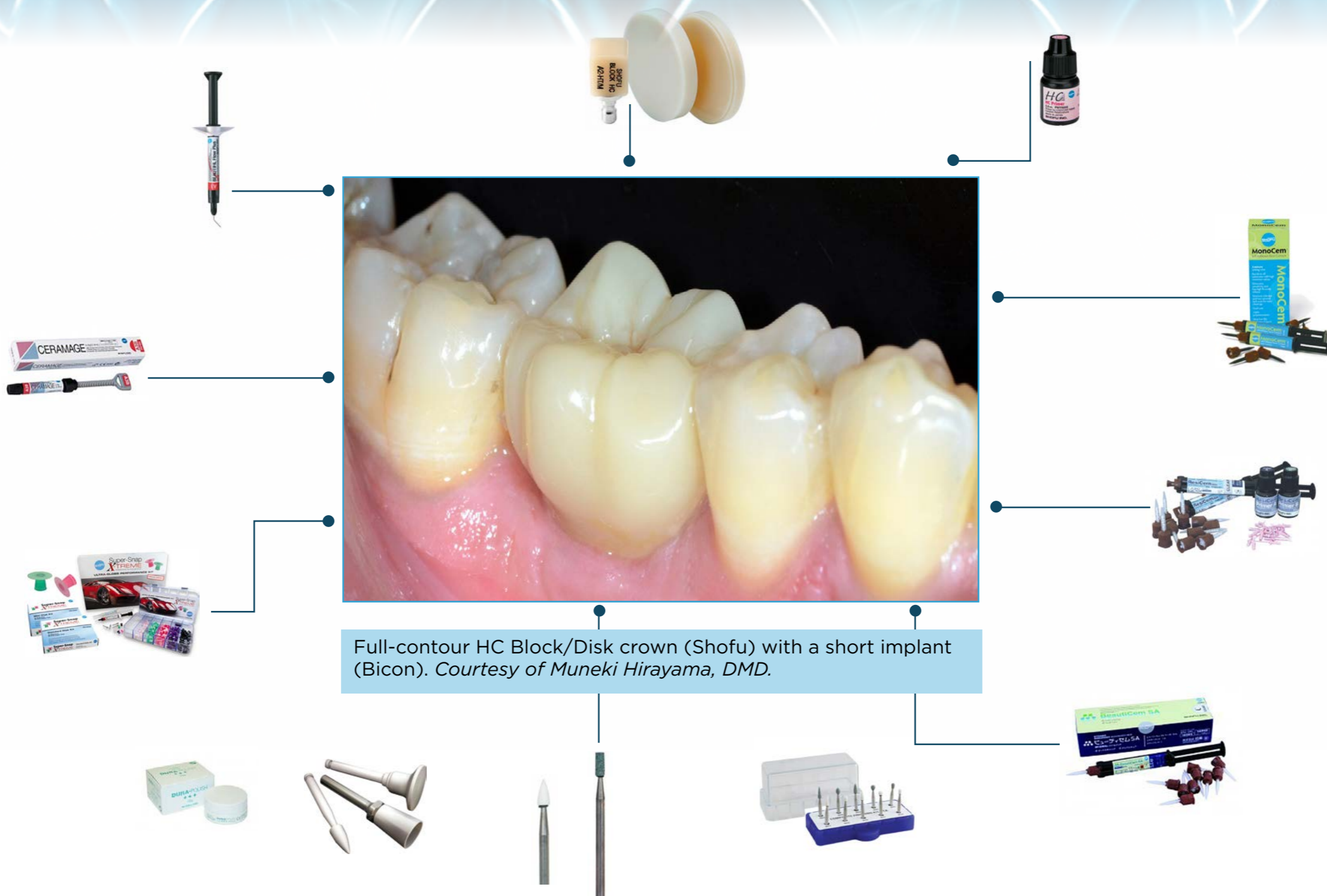
Repairs of porcelain, zirconia, and other ceramic materials have proven to be challenging. However, with **HC Block/Disk**, restorations can **successfully be adjusted chairside** with either a direct resin composite such as Beautiful Flow Plus (Shofu) or an indirect composite such as Ceramage (Shofu).

Because HC Block/Disk is a composite-based ceramic material, a tenacious bond can be achieved between the HC Block/Disk and the tooth, but then the dentist can add composite if necessary.⁸
HC Block/Disk (Shofu) teeth on a denture. *Courtesy of Brian Lindke, CDT.*

7. Fasbinder D, Neiva G. Surface evaluation of polishing techniques for new resilient CAD/CAM restorative materials. *J Esthet Restor Dent.* 2016;28(1):56-66.
8. Diedrichs G. University of Dusseldorf, Klinik für Zahnärztliche Prothetik, UKD der Heinrich-Heine-Universität.



HC Block/Disk Related Products



Full-contour HC Block/Disk crown (Shofu) with a short implant (Bicon). Courtesy of Muneki Hirayama, DMD.

About the Company

Informed and educated patients seek treatments that are not only esthetic but also innocuous, healing, and have a beneficial influence on their overall health. To address the ever-growing needs of the today's patients, Shofu has developed a score of award-winning dental products, including a smart digital dental camera, bioactive direct, indirect and CAD/CAM restorative materials, adhesive systems, and minimally-invasive rotary instruments. Not only are these products clinical problem-solvers; they also have the ability to help clinicians, dental laboratory technicians, and their teams expand the range of treatment techniques in a simple and cost-effective manner, elevating their practice's and laboratory's growth and profitability.

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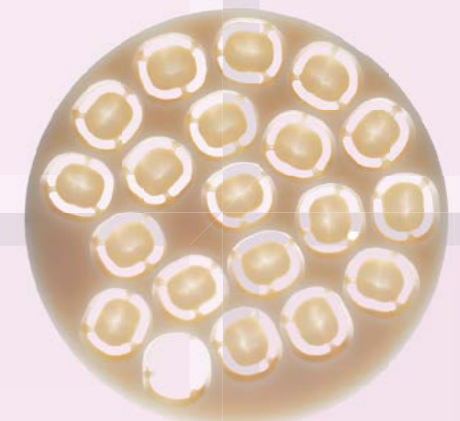
SHOFU BLOCK & DISK



CAD/CAM CERAMIC-BASED RESTORATIVE



10mm x 12mm x 16mm
12mm x 14mm x 18mm



98mm x 14mm

- Force-absorbing hybrid ceramic
- High wear resistance
- Tooth-like light transmission and fluorescence
- Excellent stain resistance
- Precise milling—fast chair time
- Easy high gloss polishing

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