TRICONia Full Zirconia
The New Crown & Bridge Standard

All-Ceramic Restorations
Impact Your Patients and Your Practice
John Jameson, DDS & Brad Guyton, DDS

Superior Strength & Natural Aesthetics
Using Precision-Milled Zirconia Restorations
Gene Shapiro, DDS

Zirconia Restorations
Their History and Future Trends
Gordon J. Christensen, DDS, MSD, PhD

TRIDENT DENTAL LABORATORIES

Gordon J. Christensen, DDS, MSD, PhD
Dear Doctor:

It is with great pleasure that we present to you this first 2011 issue of Perspectives. Through this publication, we will continue to provide our readers with valuable insights on innovative products and emerging technologies that help to optimize practice profitability and keep your practice up to date in today’s dynamic marketplace.

This issue features practice-building strategies utilizing zirconia restorations. Restorations fabricated of this material combine the strength you demand with the aesthetics your patients expect. Zirconia restorations have already proven to be enormously successful as alternatives to PFM s and full-gold restorations. All of us at Trident are excited about the current and potential future uses of zirconia for crown, bridge, and implant-supported restorations.

We are very thankful to Doctors Christensen, Jameson, and Shapiro for their outstanding contributions to this issue. Each clinician will provide you with a different perspective on zirconia restorations, and explain how they can be used to improve aesthetics and achieve predictable results for your patients. Dr. Christensen will introduce the subject, Dr. Jameson will provide the reader with answers to frequently asked questions, and Dr. Shapiro will demonstrate the clinical application of zirconia restorations.

Trident Dental Lab remains committed to sharing information with the dental community as part of our ongoing effort to improve patient care and practice profitability. As always, we encourage your comments and feedback. Please feel free to contact us via e-mail at perspectives@tridentlab.com

Sincerely,

Laurence K. Fishman
Owner, President
Trident Dental Laboratories
Judging from my conversations with dental laboratory owners, there is a growing trend for dentists to prescribe zirconia restorations instead of porcelain-fused-to-metal (PFM) restorations. That significant change is directly related to patient demand for tooth-colored, highly esthetic restorations that do not contain metal. Clearly, patients want tooth-colored restorations. Until relatively recently, the strength of all-ceramic restorations was questionable--especially for fixed prostheses. That challenge is now being overcome.

Nearly a decade ago, I was presenting a course at the University of Zurich during which time I had the pleasure of talking to my long-time friend Dr. Peter Scherer, a world-renowned prosthodontist and materials researcher. Peter was excited as he told me that he thought he had discovered a material to either replace PFM restorations or at least provide a major alternative to them. The material he described was zirconia, and the late Peter Scherer was entirely right in his suggestion.

Since that time, zirconia-based restorations (e.g., Lava, 3M ESPE; Cercon, Dentsply Prosthetics; Everest, Kavo) have captured a significant part of the international fixed prosthodontic market. Initially, these restorations had milled zirconia substructures with either layered or pressed ceramic on the surface. The first generation of these crowns and fixed prostheses had a few technical challenges that are being overcome as dental technicians, ceramic scientists, and clinicians share their research and clinical observations.

Zirconia-based all-ceramic restorations, fabricated properly using the correct materials and techniques, can be beautiful and strong restorations. They have the ability to serve as crowns and fixed prostheses. Because of their strength, properly made zirconia restorations are viable alternatives to the venerable PFM restorations when used as fixed prostheses. For those patients desiring or requiring all-ceramic restorations, they are an alternative that should be considered. Patients rapidly accept the zirconia concept when thoroughly educated about it. Such restorations are an excellent practice builder and provide good return on your investment.

Ongoing developments continue to shape the present and future use of zirconia restorations. They are now being fabricated without layered or pressed ceramic on the exterior surfaces. The extremely high strength of these all-zirconia restorations has made them one of the fastest-growing new concepts in the profession. It appears that dentists prefer to have the high strength and moderate esthetic results that these restorations provide. Ongoing basic and clinical research will provide the needed validation of such restorations.

The “bottom line” is that zirconia-based restorations and all-zirconia restorations are making a significant impact in dentistry and should be considered as alternatives to Full Gold and PFMs for some clinical situations.

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In today’s economically challenged environment, dentists face the demand of having to provide high-quality crown and bridge solutions at a reasonable cost. The skyrocketing prices of high-noble metals often limit the PFM option for some patients. There are acceptable alternatives to PFMs that include the all-zirconia materials, zirconia copings that are then layered with veneering porcelains, and lithium disilicate solutions. Often, these quality restorations offer strength, esthetics, and fracture resistance comparable to porcelain-fused-to-metal restorations (PFMs); they also provide a better “cost of goods sold” than their PFM counterparts. As dentists strive to improve their case acceptance ratio and expand their treatment mix, they may ask:

When is a zirconia coping restoration an appropriate choice?

These alternatives to PFMs are appropriate when natural esthetics, combined with strength, are a priority for you and your patient. Zirconia offers greater strength than do all-ceramic materials such as glass-ceramics. Zirconia single and multiple units provide an ideal balance of desired translucency and opacity. When metal sensitivity is a concern for a patient, zirconia frameworks serve as an excellent alternative. Zirconia is also appropriate when the patient requests it! Patients are increasingly aware of all-ceramic options through the growing media attention and public awareness initiatives. When patients place a high value on esthetics, zirconia gives you a treatment option that enhances case acceptance.

Concerning precision-milled zirconia restorations, what are the advantages to consider?

Since zirconia is CAD/CAM processed, the variances that exist between technician and technique with hand-crafted metal restorations are eliminated. You achieve a predictable, reproducible CAD/CAM fit and contacts that are often superior to those produced through other laboratory techniques.

Zirconia is a price-stable material, unlike precious metals. That is important to more accurately manage your lab expenses when compared to the “cost plus” arrangement you may currently have with your dental laboratory.

Zirconia substructures also demonstrate excellent durability in clinical studies. Technical complications (e.g., loss of retention) and biological complications (e.g., caries and loss of pulp vitality) were similar for zirconia-based and PFM restorations over a five-year observation period. In summary, zirconia survival is superior to glass-containing all-ceramics and equivalent to PFM restorations.

What are the parameters for working with zirconia frameworks?

Single-unit crowns and multiple-unit bridge frameworks with a maximum of two or three consecutive pontics work well with zirconia. A cantilevered bridge that has less than a 10mm distal extension has also shown to be successful. Furthermore, zirconia copings have proven indications for both the anterior and posterior regions of the mouth.

For optimal results, adhere to conservative preparation guidelines and ensure retentive preparation height. It is also beneficial to collaborate with your laboratory to ensure that a reputable
brand of zirconia is used and that the substructure is designed for adequate porcelain support.

If a need for an adjustment arises, use water cooling liberally and ensure that gross abrasion to the ceramic is polished out adequately. You may want to consider re-glazing the surface.

Conclusion

The new generation of ceramic restoratives creates excitement with patients and allows clinicians to provide high-quality, esthetic crown and bridge options at a reasonable cost. Now is the time to consider some of these options and see how they positively impact your patients and your practice!

The authors mention their gratitude to Dr V. Sundar, Dentsply Prosthetics, York, PA, for his assistance in verifying some of the technical aspects of this article.

References


*Chairman of the Board for Jameson Management, Inc, a dental practice management consulting firm in Davis, OK.

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The advent of all-ceramic restorations has exponentially increased patient demand for natural-looking prostheses that eliminate the need for amalgam or metal-ceramic protocols. Zirconia’s low susceptibility to stress fatigue, high initial strength, and fracture toughness makes it a predictable, durable, and biocompatible alternative for aesthetic restoration. Using modern CAD/CAM systems, zirconia crowns can be precision-milled to deliver an ideal marginal fit, while eliminating marginal discoloration. These restorations can then be used to provide strength, translucency, and aesthetics both in the posterior and anterior regions.

Case Presentation
A female patient presented with mild to moderate pain upon biting and a large pre-existing amalgam restoration in the posterior region (Fig. 1). Standard hot/cold sensitivity tests demonstrated variations within normal limits; a bite stick test, however, resulted in a positive response and confirmed the presence of a coronal fracture. The pre-existing amalgam restoration was removed and revealed moderate recurrent decay without pulpal involvement. Once the decay was removed, using a resin-based glass ionomer cement (Fuji II LC, GC America, Alsip, IL) a full-contour build up was indicated and performed (Fig. 2).

A precision-milled zirconia system (TRICONia FZ, Trident Dental Laboratories, Hawthorne, CA) was selected for the definitive restoration, and a supragingival shoulder crown preparation design was implemented to enhance long-term maintenance, restorative longevity, and overall patient satisfaction (Fig. 3). Digital impressions (iTero, Cadent Inc, Carlstadt, NJ) were obtained and relevant data was transmitted to the laboratory.

Design and Fabrication
Following digital impression-scanning, the case file was received at the laboratory ready to be designed and fabricated utilizing CAD/CAM (Computer Aided Design / Computer Aided Manufacturing) technology (Fig. 4 and 5). The completed monolithic zirconia crown was returned for try-in and cementation.
Seating and Cementation

Upon receipt from the laboratory, the CAD/CAM zirconia crown was tried in and cemented using a dual-cure resin cement (Cement-it Universal C&B material, Pentron Clinical Technologies, Wallingford, CT) to ensure high-strength bonding and reduce postoperative sensitivity. Using standard bite records, occlusion was verified and additional adjustments were not necessary. One week postoperative, the patient confirmed comfort and satisfaction with the improved aesthetics (Fig. 6).

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SYNOPSIS

Discussion

Zirconia is polymorphic and has no glass component. As a polycrystalline ceramic, there are three forms of zirconia: monoclinic, cubic, and tetragonal. The addition of stabilizing oxides (e.g., calcium oxide, magnesium oxide, cerium oxide, yttrium oxide) to pure zirconia permits the generation of multiphase materials (i.e., partially stabilized zirconia) with superior mechanical properties. As outlined in this Perspectives, the physical property of transformation toughening is often utilized to prevent crack propagation in these materials. Furthermore, in vitro studies of Y-TZP specimens have shown flexural strength values of 900 MPa to 1,200 MPa and fracture toughness of 9 MPa/m\(^{1/2}\) to 10 MPa/m\(^{1/2}\) (almost double that of alumina-based materials and nearly three times more than lithium disilicate-based materials).

Summary

Given the increased patient demand for aesthetics and durability, zirconia restorations have enabled clinicians to deliver predictable alternatives to conventional porcelain-fused-to-metal (PFM) crowns. Furthermore, computer-guided CAD/CAM restorations have enabled the clinician to provide optimal marginal fit and integrity. Because the handling and seating procedures for zirconia restorations are essential consistent with traditional PFM protocols, the learning curve associated with seating precision-milled restorations is also eliminated. It is, therefore, safe to conclude that precision-milled zirconia restorations can be used to deliver optimal aesthetics using novel restorative materials and traditional protocols for predictable results.
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