BruxZir® Solid Zirconia is a monolithic solid zirconia restoration with no porcelain overlay. More brawn than beauty, you'll be impressed by the esthetics of BruxZir crowns & bridges when prescribed instead of metal occlusal PFMs and full-cast metal restorations. BruxZir restorations are virtually chip proof, making them ideal for bruxers, implant restorations and areas with limited occlusal space.

BruxZir Solid Zirconia crowns & bridges are made from the highest quality zirconia powder from Japan. We chemically and physically reprocess the powder to further reduce the zirconia particle sizes. BruxZir milling blanks are then created through a unique patent-pending process. Unlike conventional high-pressure milling blank manufacture, our processing gives BruxZir restorations improved light transmission, which provides a lower, more natural shade value.

Designed and milled using CAD/CAM technology, BruxZir restorations are sintered for 6.5 hours at 1,530 degrees Celsius. The final BruxZir crown or bridge emerges nearly chip proof and is glazed to a smooth surface.

**Indications**

BruxZir Solid Zirconia is indicated for crowns, bridges, implant restorations, inlays and onlays. It is an esthetic alternative to PFM metal occlusal/lingual or full-cast restorations. The chip-proof durability of BruxZir restorations make them ideal for bruxers who have broken natural teeth or previous PFM restorations. BruxZir restorations are also ideal when the patient lacks the preparation space for a PFM.

**Patient Benefits**

- Chip-resistant because it is made of solid zirconia with no porcelain overlay
- Glazed to a smooth surface to reduce plaque accumulation

**Preparation Requirements**

- Shoulder preparation not needed, feather edge is OK. It is a conservative preparation similar to full-cast gold, so any preparation with at least 0.5 mm of occlusal space is accepted.
- Minimum occlusal reduction of 0.5 mm; 1 mm is ideal.

**Cementation Recommendations**

- Ceramir® Crown & Bridge (Doxa Dental; Newport Beach, Calif.) or a resin-reinforced glass ionomer cement such as RelyX™ Luting Cement (3M ESPE; St. Paul, Minn.) or GC Fuji Plus™ (GC America; Alsip; Ill.)
- For short or over-tapered preparations, use a resin cement such as RelyX™ Unicem (3M ESPE) or Panavia™ F2.0 (Kuray; New York, N.Y.)
BruxZir and Milled IPS e.maxCAD: Very Promising 1-Year Results

Gordon’s Clinical Bottom Line: An unprecedented paradigm shift has occurred in the last few months relative to use of tooth-colored crowns! Some major dental laboratories report the percentage of use of full-ceramic crowns is now higher than porcelain-fused-to-metal (PFM). TRAC Research is conducting the following ongoing controlled clinical study on full-zirconia (BruxZir) and milled lithium disilicate (e.maxCAD) restorations in “real-world” dental practices. You will be impressed with the short-term positive results.

BruxZir (Gladewell Laboratories) and milled e.maxCAD (Ivoclar Vivadent) attracted attention of TRAC Research scientists because they are the first of over 100 posterior tooth-colored restoratives tested here clinically over the past 35 years that showed NO cracks, chips, break, wear, or staining after their first year of service. Practice-based controlled clinical tests of tooth-colored restoratives began in this lab in 1976, when the demise of metal in dentistry began to be discussed seriously. The goal was to indentify the most promising alternatives. The same test protocol has been used throughout, allowing comparative analyses as restorations age in service. At one year, BruxZir and milled e.maxCAD show superior performance.

Example clinical and scanning electron microscope (SEM) images of the same restorations at initial placement and one year later show no negative changes in BruxZir and milled e.maxCAD after one year of clinical service.
ADVANTAGES

**BruxZir:**
- Very strong at +1000 MPa
- Strength allows more shallow tooth preparation and feather edge margins
- Can serve well in heavy occlusion cases where other materials fail
- Reasonable cost *(from some labs about $100)*

**Milled e.maxCAD:**
- Can match surrounding dentition very well
- Strength at +/-350 MPa shows no failures at one year in molar full-crown restorations
- Reasonable cost *(from some labs $100)*

DISADVANTAGES

- More long-term clinical data are needed to establish indications, contra-indications, longevity and failure modes. This is the first controlled clinical study comparing performance of e.maxCAD and BruxZir.
- Currently, BruxZir is less esthetic and e.maxCAD has less strength, but both look acceptable in molars and are serving well without problems.

Three Ways These Restorations Are Available to Dentists

1. **Conventional impression is mailed to the lab.** The lab scans the impression and mills the restoration.
2. **Digital impression is emailed to the lab.** The lab mills the restoration.
3. **The dentist makes the digital impression and mills the restoration in-office.** The dentist must have CEREC or E4D equipment.

Study Protocol Summary

- 20 dentists experienced with in-office milling and digital impressions
- 66 patients
- 81 full crowns on molars
- Clinical and SEM images made on all restorations and opposing dentitions at initial placement and each yearly recall
- 11 characteristics graded clinically and 9 in the lab
- 2 test materials, 1 control material *(BruxZir; e.maxCAD with 1/2 made by lab using Ivoclar method and 1/2 milled by dentists using CEREC with a fast mill-fast fire method (12.5 minutes) developed by Paul Child DDS; Control = zirconia substructure with PressCeram veneer ceramic)*
- Cements: RelyX Luting RMGI for BruxZir and Control; Multilink resin for e.maxCAD

Results and Observations

1. **Overall esthetics:** e.maxCAD best with 69% rated excellent for matching color and translucency and 47% excellent for BruxZir.

2. **Wear of opposing dentition by crowns:** All 3 crown materials wore small facets (see image below) in over half the opposing dentitions. Facets by BruxZir were more numerous and larger. More time is needed to see if the facets progress beyond first year “wearing in.”

Images A and B show wear facets on dentition opposing BruxZir and milled e.maxCAD full crowns. All the materials in this study, including the Control, produced similar facets in enamel, gold castings, composite resin and some ceramics.
3. Wear of crowns by opposing dentition: Surprisingly, opposing dentition of all types produced wear facets on all the crown materials. Most aggressive was opposing ceramics, followed by enamel. Cast gold alloy and composite resin also produced wear facets.

![Image A](image1.png) ![Image B](image2.png)

*Image A shows a BruxZir crown with wear facets produced by composite resin and enamel (yellow circles) and ceramic (orange circle) opposing dentition. Image B shows a milled e.maxCAD crown with a wear facet made by cast gold opposing dentition. Small wear facets on both the crowns and their opposing dentition is a positive finding indicating near equal wear potential of the materials clinically.*

4. Surface smoothness: BruxZir and e.maxCAD ceramics retained smoothness, but surface glazes in some patients roughened and/or wore away at occlusal contacts or were removed by occlusal adjustment. The question arises — is it necessary to glaze these materials?

![Image A](image3.png) ![Image B](image4.png) ![Image C](image5.png)

*It is apparent that glazes used on all the crowns in this study will not be long lasting. Image A shows glaze disruption to e.maxCAD by a ceramic onlay; Image B shows glaze worn off a BruxZir cusp tip by opposing cast gold; Image C shows where occlusal adjustment stripped away the glaze and left the zirconia underneath untouched.*

5. Cracks, chips, breaks, wear, staining: None of these problems were present on BruxZir and milled e.maxCAD, but the Control (zirconia substructure plus veneer ceramic) had cracks, chips and breaks typical of veneering ceramics designed for use on zirconia.

6. Occlusal adjustment: The homogeneously dense BruxZir and milled e.maxCAD both tolerate occlusal adjustment well, but the rotary instruments roughen and remove the surface glazes. Fine diamonds followed by diamond-impregnated rubber cups are indicated for smoothing of occlusal adjustments. Example products: Axis and Komet have special kits (product numbers LS7579 and LD0707, respectively).

7. e.maxCAD recommended protocol vs. faster fabrication protocol: A fast mill-fast fine protocol to reduce fabrication time to 12.5 minutes was used by dentists chairside in this research. Although Ivoclar states this protocol is “not recommended by the manufacturer,” so far, no differences have been seen in any of the 20 graded characteristics between the slower and faster processing protocols.

8. No differences: So far, there have been no problems with endo, caries, changes in perio health, unusual plaque retention on the crowns, need for re-cementation, margin fit or interproximal contact. Patient ratings for both crown materials have been very high. Overall ratings of crown “feel” and esthetics are 89% excellent and 11% good.

CR Conclusions: Milled e.maxCAD processed two ways and BruxZir full crowns on molars have served well after one year in this practice-based controlled clinical trial, showing no cracks, chips, breaks, wear or staining. Wear of opposing dentition, glaze degradation, effects of occlusal adjustment and long-term durability of e.maxCAD crowns fabricated with the fast mill-fast fire method remain as questions to be answered as more time passes in this ongoing study. Readers can expect a yearly status report on the progress of the pertinent new materials as they age in service.
BruxZir Restorations Deliver More Lifelike Results

Note the differences in these photomicrographs of solid zirconia brands. The high-resolution photomicrographs capture cross-sectioned samples of BruxZir Solid Zirconia and two generic competitors. The visible white spots in the competitor samples reveal agglomerates that remain after the sintering process, which decrease translucency and flexural strength. BruxZir Solid Zirconia has a smaller grain size and is nearly free of agglomerates. Unique, patented colloidal zirconia processing gives BruxZir Solid Zirconia higher flexural strength and provides more natural-looking restorations.

Scanning Electron Microscope Images

SEM of sintered, colloidal BruxZir vs. sintered, isostatically pressed zirconia

Transmission vs. Wavelength Graph

BruxZir zirconia exhibits higher translucency in the warm color spectral wavelength (>550 nanometers), allowing for more natural-looking restorations.
Before & After Cases

Case 1

As you can see in this non-retracted “before” photo, the patient had two pre-existing high-value PFMs over what appeared to be base metal copings on tooth #8 and #9. The condition of the gingiva suggested a possible base metal allergy, which contributed to my decision to go with BruxZir all-ceramic (solid zirconia) crowns.

In the retracted view, you can see the full extent of the gingival tissues. As I placed the topical on tooth #9 with a cotton swab, it started to bleed. You can see that the midline on the existing crown is off, as are the axial inclinations of the two crowns. The unhealthy gingival tissue was removed with a diode laser and BioTemps were placed. I’ve found that the smooth glazed surface of BioTemps helps gingiva heal faster in these types of cases.

As you view the crowns in the lateral smile view, you will notice the flat facial profiles of these crowns.
This is much more difficult to achieve with bilayered restorations such as porcelain-fused-to-metal or porcelain-fused-to-zirconia. Since a BruxZir zirconia restoration is monolithic (one layer), it is much easier to achieve desirable contours.

Case 2

This patient had a number of existing PFM restorations in the anterior, but tooth #8 and #9 had a previous root canal and a lingual fracture next to the access openings. It was decided that the best option was a full-coverage anterior BruxZir crown.

Case 3

As you can see in the “after” photos, the BruxZir bridge has acceptable esthetics, although it won’t be mistaken for IPS Empress® anytime soon. Because BruxZir restorations are virtually unbreakable and the patient had already broken two PFM bridges in the past, this was the most appealing solution.

IPS Empress is a registered trademark of Ivoclar Vivadent.
A broken composite inlay was replaced with a high-strength BruxZir inlay. BruxZir can be used for inlay and onlays, as well as for crowns & bridges.

Case 4

The patient presented with a fractured Maryland bridge. He ruled out implants because it would require a large bone graft. Instead, a digital impression was taken to fabricate a conventional BruxZir bridge.

Case 5

A broken composite inlay was replaced with a high-strength BruxZir inlay. BruxZir can be used for inlay and onlays, as well as for crowns & bridges.

Case 6

When this patient required an onlay to replace a broken cusp, cast gold was suggested but the patient declined. A BruxZir crown was used instead due to its impressive strength.
BruxZir® vs. IPS e.max® Enamel Wear Test

Some dentists are concerned about the wear of enamel when opposing BruxZir full-contour zirconia crowns & bridges. In a recent study to measure the volumetric loss of enamel, glazed BruxZir zirconia was found to wear compatible with enamel and virtually identical to glazed IPS e.max.


IPS e.max is a registered trademark of Ivoclar Vivadent.

BruxZir® vs. IPS e.max® Enamel Wear Test

<table>
<thead>
<tr>
<th></th>
<th>Natural Enamel</th>
<th>Glazed BruxZir® zirconia</th>
<th>Glazed IPS e.max®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (mm³)</td>
<td>0.29±0.12</td>
<td>0.37±0.23</td>
<td>0.41±0.15</td>
</tr>
</tbody>
</table>

High Flexural Strength

Lithium disilicate ceramics have 400 MPa and typical zirconia materials have a flexural strength of more than 1200 MPa. However, because of post-powder processing, BruxZir Solid Zirconia restorations are able to exceed that strength threshold, with flexural strengths up to 1465 MPa.

Antagonist Wear Study

The antagonistic (Steatite balls) wear shows BruxZir zirconia only with 72±21 micron, which is significantly lower than Ceramco®3, with 110±48 micron. The University of Tübingen study was run using an eight-chamber Willytec Chewing Simulator at 1.2 million cycles.

Ceramco is a registered trademark of DENTSPLY Ceramco.
The patient had always disliked the metal occlusal on this PFM. When it became necessary to replace it, a tooth-colored BruxZir crown was chosen.

Case 7

This female patient presented with a predominately cast metal bridge, which her dentist prescribed after she fractured the porcelain on each of the abutment teeth on the previous restoration. The patient always disliked how it looked and desired a more esthetic, long-term option. Because her PFM restorations had fractured previously, a high-strength BruxZir bridge was prescribed, providing the patient with the best combination of strength and esthetics.

Case 8

This patient factured a porcelain all-ceramic crown on the second molar and chipped the first molar. Both crowns were replaced with BruxZir crowns.

Case 9

The patient had always disliked the metal occlusal on this PFM. When it became necessary to replace it, a tooth-colored BruxZir crown was chosen.
BruxZir® vs. Ceramco®3 — A Comparative Wear Study

BruxZir® Solid Zirconia and Ceramco®3 were recently tested in a comparative wear study led by Dr. Jürgen Geis-Gerstorfer, professor and head of the Department of Medical Materials and Technology at University Hospital Tübingen in Germany. In the University of Tübingen study, each material was tested using an eight-chamber Willytech Chewing Simulator, which simulated the clinical performance of the material over a period of 5 years. After 1.2 million wear cycles under a load of 5 kg, BruxZir compared favorably to Ceramco3 with barely detectable wear. To view the full report, visit www.bruxzir.com.

Ceramco is a registered trademark of DENTSPLY Ceramco.
This endodontically treated molar had a large amalgam and several fractures, necessitating a full-coverage BruxZir crown.

Case 11

This PFM crown had undergone chipping on multiple cusps and the mesial marginal ridge, resulting in an open contact. To prevent this from happening again, high-strength BruxZir Solid Zirconia was prescribed as a replacement restoration.

Case 12

The patient had chipped the distal surface of this PFM. It was replaced with a high-strength BruxZir crown.
Case 13

This patient fractured off the distolingual cusp. A monolithic BruxZir zirconia crown was placed.

Case 14

When a patient generates enough occlusal force to break a PFM, a BruxZir crown is a great choice as a replacement.

Case 15

An endodontically treated tooth had a fractured mesial marginal ridge and multiple fractures. A monolithic BruxZir zirconia crown was placed.
Instructions for Seating BruxZir and Other Zirconia-Based Crowns & Bridges

BruxZir restorations are fabricated from solid zirconia oxide material, much like the zirconia oxide coping found in restorations such as Prismatik Clinical Zirconia™, Lava™ Zirconia (3M ESPE; St. Paul, Minn.) and NobelProcera™ (Nobel Biocare; Yorba Linda, Calif.). Like most metals, zirconia exhibits a strong affinity for phosphate groups, and zirconia oxide is no different. We can take advantage of this fact with phosphate-containing primers, such as Monobond Plus (Ivoclar Vivadent; Amherst, N.Y.) and Z-Prime™ Plus (Bisco; Schaumburg, Ill.), or cements such as Ceramir® Crown & Bridge (Doxa Dental). Unfortunately, saliva also contains phosphates in the form of phospholipids, so when a BruxZir crown or bridge is tried in the patient’s mouth and comes in contact with saliva, the phosphate groups in the saliva bind to the zirconia oxide and cannot be rinsed out with water. Attempting to use phosphoric acid (which is full of phosphate groups) to “clean out” the saliva only makes the problem worse.

The only way we have found to successfully remove these phosphate groups from the interior of a BruxZir restoration is with the use of Ivoclean (Ivoclar Vivadent). This zirconia oxide solution is placed inside the restoration for 20 seconds and then rinsed out. Due to the large concentration of free zirconia oxide in the Ivoclean, it acts as a sponge and binds to the phosphate groups that were previously bonded to the BruxZir restoration. Once the Ivoclean is rinsed out, you will have a fresh bonding surface for the Monobond Plus, Z-Prime Plus or Ceramir to bond to.

The protocol would be:
1. Try-in BruxZir or zirconia-based restoration.
2. Rinse saliva out of restoration.
3. Place Ivoclean in restoration for 20 seconds and rinse.

Instructions for Adjusting and Polishing BruxZir Crowns & Bridges

• Adjust BruxZir Solid Zirconia restorations using a fine-grit diamond with light pressure to avoid potential microfractures. The specially designed Axis Dental BruxZir Adjustment & Polishing Set (LS-7579) may be purchased through your dental dealer or by calling 800-355-5063.

A football-shaped bur is most effective for adjusting occlusion on the occlusal surfaces of posterior teeth and lingual surfaces of anterior teeth.

A tapered bur is most effective for adjusting cusps or proximal contacts.

A round bur is used to adjust a cusp or fossa and for creating endodontic access.

Using light pressure and no water, begin pre-polishing with the brown cup to remove abrasions left by the diamonds.

Continue pre-polishing with the green cup until a more glossy look starts to appear on the adjustment areas.

Finally, use the white cup with light to medium pressure to achieve a “wet” high shine.
Prescribe BruxZir Solid Zirconia restorations instead of metal occlusals and cast gold

- Ideal for bruxers who have destroyed natural teeth or previous dental restorations
- An esthetic alternative to metal occlusal PFM and cast gold crowns & bridges
- Conservatively prepare as thin as 0.5 mm with feather edge margins, much like you would cast gold

View this side-by-side comparison of high-strength crown options and conduct your own analysis of how BruxZir restorations compare visually to traditional PFM and full-cast restorations. While some patients may favor the esthetics of precious or non-precious metals, BruxZir restorations present a more lifelike tooth shade, making the final restoration nearly indistinguishable from natural dentition.

BEFORE: This PFM crown had undergone chipping on multiple cusps and the mesial marginal ridge, resulting in an open contact.

AFTER: To prevent this from happening again, high-strength BruxZir Solid Zirconia was prescribed as a replacement restoration.

AFTER: Full-cast gold restoration in the same mouth. Which crown do you think the patient will choose when given a choice?

AFTER: Metal occlusal PFM in the same mouth. While this may get the job done, the esthetics do not compare to those of BruxZir Solid Zirconia.

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