



## BruxZir and e.maxCAD: Superior Clinical Performance at 3+ Years

**Gordon's Clinical Bottom Line:** The TRAC research section of CR has been conducting a controlled clinical study of monolithic restorations for 3-1/2 years. These restorations are serving far better than anticipated. *This report contains an update on the well-documented positive TRAC Research results.*



Scanning electron microscope (SEM), clinical, and laboratory examinations are showing *equally excellent service for BruxZir and e.maxCAD* milled full-contour crowns on molars at 41 months of service in a practice-based controlled clinical study. *This service record exceeds that of over 100 other tooth-colored materials studied by TRAC over the past 39 years using the same methods.* The superior performance of these two products has commanded our close attention. Literally millions of these two products have now been placed by U.S. dentists over the past five years—tipping dominance away from the time-honored PFM. Yet clinical research has lagged far behind clinical use, leaving important questions unanswered.

This report provides follow-up on the one-year data published in the June 2012 *Clinicians Report* to update clinicians as answers begin to develop to the following critical clinical questions.



### Critical Clinical Questions and Answers Beginning to Develop after 3+ Years of Service

#### 1. Does BruxZir zirconia severely wear opposing dentition?

NO, see chart below. Concern that zirconia would severely wear opposing dentition dictated our locating and measuring all facets on test crowns and all types of opposing dentition. Three-year data below show **BruxZir zirconia crowns caused 23% less wear of opposing dentition than the pressed ceramic-over-zirconia Control (PressCeram by Swiss NF over zirconia by Metoxit) and about the same wear as e.maxCAD lithium disilicate processed with an experimental 12.5-minute post-mill procedure. BruxZir received more wear than it caused.**

**Table 1: Percent area worn by the Test Crowns and the Opposing Dentition**

Brands names of materials studied	% area worn by Test Crowns on Opposing Dentition			% area worn by Opposing Dentition on Test Crowns		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
BruxZir	5.5 *	10.3 *	12.8 *	8.2 *	14.5 *	29.6 *
e.maxCAD (27 min. post-mill processing)	6.7	10.8	17.9	4.6	7.3	11.1
e.maxCAD (12.5 min. post-mill processing)	4.7	7.9	11.3	6.1	9.4	13.4
Pressed ceramic-over-zirconia (Control)	10.9	14.2	16.6	8.2	11.1	16.4

\* Data apply only to BruxZir zirconia. Other zirconia formulations may perform differently.

#### 2. Does BruxZir zirconia lack of flexibility adversely affect the occlusal system?

Some people predicted tooth mobility, mastication muscle strain, and joint dysfunction. None of the predicted problems have been noted to date in this study. If you have experienced any of these problems with BruxZir, please contact by email [rella@tracresearch.org](mailto:rella@tracresearch.org).

#### 3. Do full-zirconia dental restorations undergo phase change in the 100% humidity of the oral cavity?

To date, phase change problems such as surface cratering and microcracks have not been noted by SEM, nor have particles released into soft tissues with resulting inflammatory changes been seen in this study. However, more time is needed to eliminate this question. In 2001, some zirconia hip joint implants showed these changes occurring within months to beyond five years of clinical use. BruxZir was released commercially in summer 2009, so these are critical years regarding this question. Other more recently released dental zirconias will require similar long-term monitoring.

#### 4. If e.max lithium disilicate is performing so well, why consider use of BruxZir full-zirconia?

There are no data to indicate BruxZir and e.maxCAD could not serve equally well in all *single-unit* situations. Empirically, both dentists and lab technicians have preferred to take advantage of e.max lithium disilicate's beauty for anterior teeth and BruxZir's high strength for the following:

- When minimal tooth preparation can be used.  
*This study shows BruxZir meeting its claims by serving well with less than 1.0 mm occlusal reduction and near-feather edge margins on molars, even in patients with bruxing/clenching habits. e.maxCAD was not tested with minimal reduction preparations because these claims were not made for this product.*
- In areas that force shallow preps due to limited space.
- For labs, anytime the preps are too shallow to allow predictable positive clinical results with other materials.

# BruxZir and e.maxCAD: Superior Clinical Performance at 3+ Years *(continued from page 1)*

## 4. If e.max lithium disilicate is performing so well, why consider use of BruxZir full-zirconia? *(continued)*

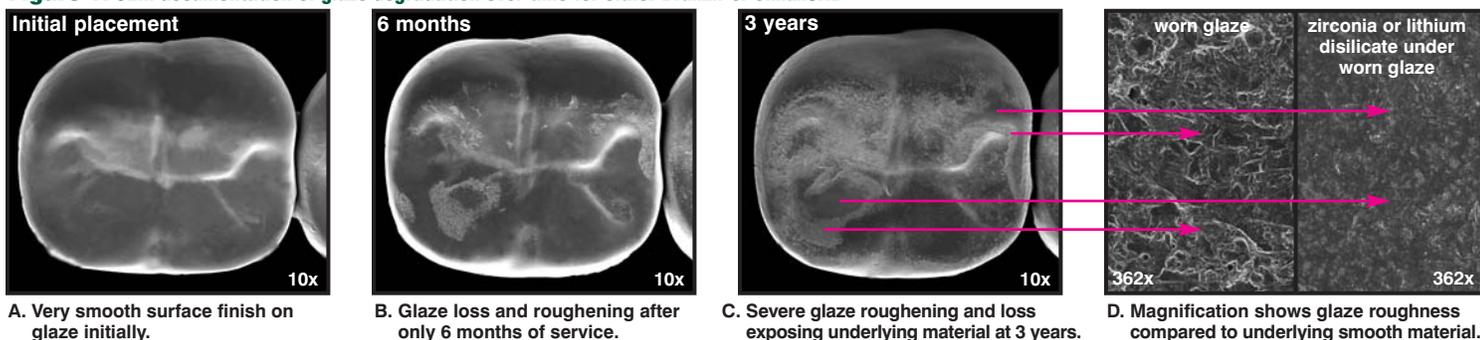
**Table 2: BruxZir and e.maxCAD are the antithesis of one another in many characteristics.**

Differences		Similarities	
BruxZir	e.maxCAD	BOTH BruxZir and e.maxCAD	
• Very high flexural strength (1000+ MPa)	• Lower flexural strength (about 350 MPa)	• Time consuming to remove, and removal risks prep gouging	
• Adequate and improving esthetics	• Excellent esthetics	• Glaze degrades at occlusal contacts, but the unglazed materials function well in occlusion	
• Minimal prep permissible	• Deeper prep preferable	• Currently, more time consuming for labs to polish than to glaze	
• Moderately worn by opposing dentition	• Moderately wears opposing dentition		
• Very long post-mill processing (8.5 hours)	• Shorter post-mill processing (12.5 to 27 min)		
• Mills smoothly at margins	• Milling causes many small chips at margins		
• Cannot acid etch, can sandblast gently	• Acid etches well, must not sandblast		

## 5. Should BruxZir and e.maxCAD be final polished or glazed?

*After only six months, it was evident the glazes would not last long.* By three years, 54% of the glaze applied on occlusal surfaces in this study was no longer present (31% removed by dentists for occlusal adjustment and 23% removed by use). Glaze is used because it is faster than polishing, leaves surfaces very smooth, and preserves characterization stains. However, the clinical degradation and resulting gross surface roughness negates all these points. Options are to improve the glazes or develop easy polishing techniques and internal characterization of blocks.

**Figure 1: SEM documentation of glaze degradation over time for either BruxZir or e.maxCAD**



## Critical Clinical Questions and Answers Beginning to Develop after 3+ Years of Service *(continued)*

### 6. What are the best instruments for occlusal adjustment?

February 2013 *Clinicians Report* gave detailed analyses of 16 products, naming Luster (*Meisinger*) and OptraFine (*Ivoclar Vivadent*) as CR Choices.

### 7. Is TRAC's experimental 12.5-min. post-mill processing procedure for e.max the same, better, or worse than the original 27-min. procedure?

The two procedures were statistically the same in 18 variables monitored, but crowns treated using the experimental 12.5 minute method showed numerically less wear of opposing dentition.

### 8. Does endo entry access compromise BruxZir and e.maxCAD restorations?

YES. October 2012 *Clinicians Report* gave detailed information on best instruments and techniques, and concluded with the necessity to *use new diamonds, light pressure, and copious water coolant with 1mm or more of occlusal material thickness.*

### 9. What are the best products and techniques for removal of BruxZir and e.maxCAD crowns?

*New fine-grit, round-ended taper diamonds used with water coolant, light touch, and frequent examination to avoid gouging underlying dentin works best.* Additionally, Polaris Crown Cutting Wheel (*Pollard Dental Products*) is preferred by some clinicians, but requires attention during use to avoid unintended cutting.

### 10. What is the best cementation technique for BruxZir and e.maxCAD?

See below and page 4. Steps and best products are different for zirconia vs. lithium disilicate.

### 11. Can zirconia have the translucency and colors available now with lithium disilicate?

Translucency and colors of zirconia are improving, but currently lithium disilicate is superior in these characteristics. However, BruxZir esthetics can be adequate (see Figure 2, 30 full-crown BruxZir case at right).

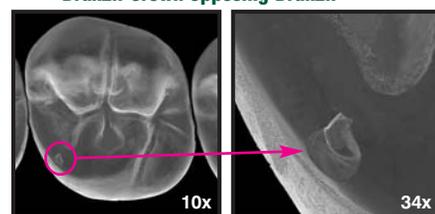
### 12. What is the expected service life and failure mode of BruxZir and e.maxCAD?

No one knows. The first and only chip in this study occurred on BruxZir at one year and has not progressed (see Figure 3 at right). More time is needed to answer this question. **Current exceptional service justifies hope for exceptional longevity.**

**Figure 2: Full-mouth restoration with BruxZir in a heavy bruxing male**



**Figure 3: Small, non-progressing chip in a BruxZir crown opposing BruxZir**



## TRAC Conclusions:

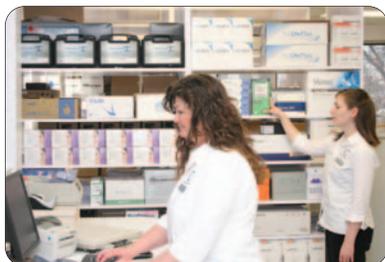
**BruxZir and e.maxCAD** full-contour crowns on molars have demonstrated clinical service superior to all other tooth-colored materials studied clinically by TRAC over 39 years. To date, their service record resembles that of cast metal. Clinical service over three plus years has begun to answer many critical clinical questions, but important questions remain on possibility of phase change of zirconia in 100% humidity of the oral cavity, glaze use, service life, and failure mode. Status reports will be forthcoming as answers to these and other pertinent questions emerge through this study.

# What is CR?

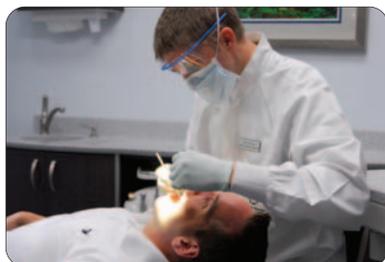
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**CR CONDUCTS LABORATORY TESTS** to determine physical and chemical characteristics of products such as compressive, tensile, and diametral tensile strengths. Thermal stressing and other methods are also used. Assays are conducted to verify product claims.



**CR HAS EXTENSIVE MICROBIOLOGY CAPABILITIES.** Team members routinely work with pathogenic viruses and bacteria in tests on hundreds of infection control products from around the world. Periodontal pathogens and organisms associated with dental decay as well as microorganisms in water and air are addressed.



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# What is CR?

## WHY CR?

CR was founded in 1976 by clinicians who believed practitioners could confirm efficacy and clinical usefulness of new products and avoid both the experimentation on patients and failures in the closet. With this purpose in mind, CR was organized as a unique volunteer purpose of testing all types of dental products and disseminating results to colleagues throughout the world.

## WHO FUNDS CR?

Research funds come from subscriptions to the *Gordon J. Christensen Clinicians Report*®. Revenue from CR's "Dentistry Update"™ courses support payroll for non-clinical staff. All Clinical Evaluators volunteer their time and expertise. CR is a non-profit, educational research institute. It is not owned in whole or in part by any individual, family, or group of investors. This system, free of outside funding, was designed to keep CR's research objective and candid.

## HOW DOES CR FUNCTION?

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3. Laboratory tests where physical and chemical properties of new products are compared to standard products.



*Clinical Success is the Final Test*

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*CRA Foundation*® changed its name to *CR Foundation*® in 2008.



*This team is testing resin curing lights to determine their ability to cure a variety of resin-based composites.*

*Every month several new projects are completed.*

## THE PROBLEM WITH NEW DENTAL PRODUCTS.

*New dental products have always presented a challenge to clinicians because, with little more than promotional information to guide them, they must judge between those that are new and better, and those that are just new. Due to the industry's keen competition and rush to be first on the market, clinicians and their patients often become test data for new products. Every clinician has, at one time or another, become a victim of this system. All own new products that did not meet expectations, but are stored in hope of some unknown future use, or thrown away at a considerable loss. To help clinicians make educated product purchases, CR tests new dental products and reports the results to the profession.*