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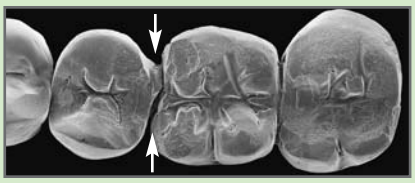
Zirconia Cutting Diamonds for Crown Removal

Gordon's Clinical Bottom Line: Zirconia-based restorations are very popular; therefore, need for endodontic therapy and occasional removal of these restorations is increasing. Cutting through zirconia with carbide burs is not indicated due to their inefficiency. Some conventional diamond rotary instruments used for tooth preparation cut zirconia as well as special zirconia cutting rotary instruments. This first look at zirconia cutting instruments addresses diamonds for crown removal, while an upcoming report will address in more detail endodontic access.

There has been a significant increase in the use of zirconia-based restorations as an alternative to conventional metal ceramic restorations *(for a detailed description of zirconia-based restorations, see the CRA Newsletter November 2006).* As with metal ceramic restorations, occasionally zirconia-based restorations will need to be removed for various clinical reasons or an access drilled through the restoration to perform an endodontic procedure. Zirconia has very different mechanical and thermal characteristics than metal. Burs that cut metal typically won't cut zirconia as efficiently. Zirconia is a very brittle material, and when cut can develop cracks that may "grow" through the framework resulting in clinical failure of the crown by fracture. This is of concern especially when performing an endodontic access through a zirconia-based restoration. Crown removal, on the other hand, sacrifices the restoration and cutting efficiency becomes the desired goal.



Zirconia-based FPD requiring removal

This report addresses zirconia-based restoration removal.

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Reducing the Confusion about Resin Cements

Gordon's Clinical Bottom Line: Resin cements are strong, insoluble, and can simulate tooth color very well. They are needed for veneers, post cementation, moderate strength ceramics, salvage situations, low-retention restorations, and tooth colored onlays and inlays, but they are not needed for all cementations. Resin-modified glass ionomer serves most routine needs well.

Selecting the correct type and brand of cement can be confusing. **Resin-modified glass ionomer *(RMGI)*** cements dominate routine use with porcelain-fused-to-metal, zirconia based, and metal restorations. RMGI has moderate strength allowing relatively easy restoration removal if needed; bond to tooth structure; expansion and contraction similar to tooth structure; fluoride release; and relative insolubility. The two major brands are RelyX Luting Plus cement from 3M ESPE and FujiCEM Automix from GC America. In light of the popularity and success of RMGI, **why are resin cements needed?** During the past several years, numerous resin cements have been introduced on the market claiming various desirable properties and competing for universal use.

Some clinical situations, such as ceramic onlays, demand resin cement for strength and acceptable tooth color

This report compares RMGI with resin cement, explains the types of resin cements related to bonding agents, and makes suggestions about the most preferred type of resin cement for specific clinical uses.

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Provisional Cements—Selecting the Best One for Specific Uses

Gordon's Clinical Bottom Line: ZOE or non-ZOE provisional cements are acceptable for simple situations. Non-ZOE has no taste or smell and strength similar to ZOE, but it often causes tooth sensitivity during the provisional period. Contrary to popular belief, non-ZOE is best suited primarily for patients who have sensitivities to eugenol. Indirect inlay and onlay provisionals are best without cement, since removal of cement debris is difficult in these preps. Use of modified resin temporary material as a provisional restoration does not require cement and simplifies sealing the restoration. Provisional veneers are best cemented with clear resin cements. Long-term cementation of crowns over screw-retained implant abutments may require weakened resin cements for retentive abutments. Non-eugenol is acceptable for retentive screw-retained implant restorations.

Provisional cement use relates directly to the success or failure of final dental restorations. Zinc-oxide and eugenol cements are the most commonly used. ZOE cements are adequate for single crowns, short-span fixed prostheses, and retentive long-span fixed prosthesis. ZOE can be used as a provisional cement before final cementation with any category of final cements if a period of about two weeks is present between tooth preparation and seating restorations to allow dissipation of the free eugenol. There are many brands of provisional cements, most of which are very similar. At least four major situations demand use of provisional cements. **In the table on page 4, several uses are listed, with categories of provisional cements suggested for each, popular brand names indicted, and comparative costs of the cements.**

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Evaluators Reports and Clinical Tips

Staff Meeting in a Box: Monthly in-office staff training available on DVD. ***(Page 4)***

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Zirconia Cutting Diamonds for Crown Removal *(Continued from page 1)*

Recently, several zirconia cutting bur systems have been marketed with claims of ability to cut zirconia-based restorations more efficiently and with less effort than standard crown cutting diamonds. **This study compared these systems to both conventional diamonds and carbides to determine which burs can be effectively used to remove zirconia-based crowns.**

CR's test included seven carbide burs reported for crown removal and 14 diamond burs that were advertised or recommended by diamond companies for removing zirconia-based restorations. A combination of zirconia fabricated discs, zirconia copings, and zirconia-based restorations were used to test the cutting efficiency of each brand of rotary instrument.

All of the diamond burs tested received an excellent or excellent to good rating. It was noted that the grit of the diamond was not a major factor in its ability to cut zirconia. However, the larger grit diamonds demonstrated more chatter and slightly less control than medium or fine grit diamonds. Furthermore, the grit may prove to be a factor in causing microcrack formation. All of the carbide burs tested rated poor and were unable to cut the zirconia in a reasonable amount of time.

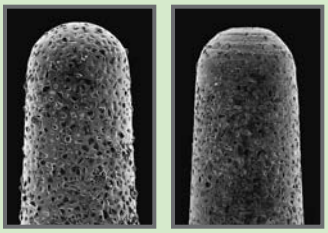
CR tests demonstrated that diamond burs used for zirconia-based restoration cutting should not be reused. A previous CRA Newsletter *(September 2001)* demonstrated that multiple use of a diamond in crown preparation can lead to considerable damage to the diamond such as general loss of diamond particles, change of shape, and a bald tip. This same report showed that a high water spray cooled, minimized clogging, lubricated the diamond during cutting, and decreased the cutting time. **It is imperative to use a high water spray *(>25 ml/min)* to remove a zirconia-based restoration.**

Overall Grading of 14 Diamond Brands Tested *(Cutting Rate, Control, Clogging, & Diamond Degradation)*

Company Information	Brand and/or Product Number	Cost/Bur	Description*	Overall Rating
Crosstech Diamond Tools 800-996-0686 • www.dentalree.com	B6LC	$1.60	Course grit	Excellent
Komet USA LLC 800-208-1630 • www.komet-usa.com	ZR850-016	$8.50	Indicated for Zr use, Medium grit	Excellent
Microcopy 800-235-1863 • www.neodiamond.com	Neodiamond 1116.8M	$1.50	Indicated for Zr use, Medium grit	Excellent
Axis Dental Corporation 800-355-5063 • www.axisdental.com	Zir-Cut Z856-018	$9.98	Indicated for Zr use, Z grit *(fine)*	Excellent to Good
Brasseler U.S.A. 800-841-4522 • www.brasselerusa.com	856-018	$8.15	Medium grit	Excellent to Good
Garrison Dental Solutions, Inc. 888-437-0032 • www.garrisondental.com	G-Force GRT-020	$9.85	Medium grit	Excellent to Good
HOPF, Ringleb, & Co. 011 49 030 830 00 30 • www.horico.de	198C-016	*International*	Fine grit	Excellent to Good
Microdont USA 888-642-7610 • www.microdont-usa.com	2135EC	$1.20	Super Coarse grit	Excellent to Good
DENTSPLY Professional 800-989-8826 • www.dentsply.com	Midwest KS3-016SC	$6.88	Super Coarse grit	Excellent to Good
Premier Dental Products Co. 888-670-6100 • www.premusa.com	Two Striper 770.8VF	$10.06	Very Fine grit	Excellent to Good
Shofu Dental Corporation 800-827-4638 • www.shofu.com	Robot PN835F-1	$5.33	Fine grit	Excellent to Good
SS White Burs, Inc. 800-535-2877 • www.sswhiteburs.com	Great White Z GWZ 856-018	$6.70	Indicated for Zr use, Fine grit	Excellent to Good
Strauss Diamond Instruments, Inc. 800-982-9641 • www.straussdiamond.com	Magic Touch 856-016PF	$8.75	Indicated for Zr use, Fine grit	Excellent to Good

** General diamond grit sizes: Super Course (black) ~180 um, Course (green) ~120–150 um, Medium/Normal (blue/none) ~80–120 um, Fine (red) ~45 um, Very Fine (yellow) ~25 um. Variation of grit size by classification is significant.*

All diamonds performed well with light touch and copious amounts of water.



Before **After**

Diamonds degrade with use, especially at the tip.

Clinical Tips for Removing a Zirconia-Based Restoration

- Use as much water spray as possible without impeding visibility.
- Use caution in the amount of pressure applied when cutting the zirconia to avoid damaging the underlying tooth structure.
- Use a new diamond to make a clean cut up the buccal surface extending onto the occlusal or incisal surface.
- Use a crown removing instrument such as a crown spreader to fracture the crown and/or break the cement layer. *(Use caution to avoid the crown or pieces of porcelain dislodging into the patient's throat.)*
- Based on what type of cement or resin was used, additional careful dislodgement is usually required for complete removal of smaller pieces.

Initial Endodontic Access Observations

A future report will identify the best performing diamond burs for endodontic access through zirconia-based restorations.

Initial CR tests indicate that round or flat end, taper or cylinder diamonds used for crown removal *(i.e. 856)* may not be best for initial endodontic access due to the poor ability to cut the porcelain and zirconia, as well as diamond degradation at the tip of the diamond instrument *(see images above)*. Endodontic access may weaken the crown, cause porcelain chipping, and initiate microcracks in the zirconia coping. Propagation of microcracks may lead to delayed crown failure. **A new, fine *round* diamond *(i.e. 801)* should be used with copious amounts of water for initial endodontic access.**

CR Conclusions:

All carbide burs evaluated cut zirconia poorly. Despite commercial efforts and claims of zirconia cutting instruments used for more efficient crown removal, conventional cylindrical diamonds also cut effectively through zirconia. Combined CR data showed highest rated diamonds for cutting efficiency and cost were Crosstech and Microcopy. Single-use diamonds and some conventional multi-use diamonds may be more cost effective to clinicians in comparison to the more costly zirconia cutting diamonds. When cutting through zirconia, it is important to use copious amounts of water and a light touch.

Reducing the Confusion about Resin Cements *(Continued from page 1)*

Resin Cement Characteristics

Advantages

1. Resin is the strongest dental cement.
2. Resin cementation procedure is easy because of light or dual cure properties. After short light cure, partially cured excess cement can be easily removed before final set.
3. Light and dual cure resin cements allow fast cementation procedure.
4. Colors of resin cement can match tooth structure well.
5. Resin has good wear resistance in areas where margins are exposed to occlusion.
6. Resin is insoluble in mouth fluids.

Disadvantages

1. Resin has little or no cariostatic activity compared to RMGI.
2. Resin cement excess is difficult or nearly impossible to remove and can be inadvertently left on the teeth.
3. Resin is too strong for some situations. If restoration needs to be removed after service period, difficulty is encountered.
4. Some cementation techniques with resin can cause tooth sensitivity or pulpal death.

For more information on individual cement types, see the CRA Newsletter July 2007.

Resin Cement Types* Related to Bonding Agent:

* *Types relate to the following table.*

1. **Total Etch + Resin:** Two procedures, total-etch followed by resin cement
2. **SE + Resin:** Two procedures, self-etch followed by resin cement
3. **Self-Adhesive Resin:** One procedure, self-etch incorporated into resin cement

Suggested Uses for Resin Cements

	CR Evaluators' Prioritized Uses of Resin Cements	CR Evaluators' Most Preferred Types	CR Evaluators' Most Preferred Brands *(Many other brands are available)*
1	Veneers	Total Etch + Resin✢	Calibra *(Dentsply Caulk)*, Insure *(Cosmedent)*, NX3 Nexus 3rd Generation *(Kerr)*, RelyX Veneer *(3M ESPE)*, Variolink II *(Ivoclar Vivadent)*
2	Post-cementation	SE + Resin or Self-Adhesive Resin	*See line 3 for SE + Resin brands, See line 6 for Self-Adhesive brands*
3	Moderate strength ceramic restorations *(Example: Empress)*	SE + Resin	Clearfil Esthetic Resin Cement or Panavia F 2.0 *(Kuraray)*, Multilink Automix *(Ivoclar Vivadent)*
4	Tooth colored onlays and inlays *(Example: Empress, Cerac, E4D, or polymer; stacked porcelain not indicated)*	SE + Resin	*Same as row 3*
5	Restorations lacking retention	SE + Resin	*Same as row 3*
6	High strength need, high sensitivity potential *(large pulps, weak retention)*	Self-Adhesive Resin	Maxcem Elite *(Kerr)*, RelyX Unicem *(3M ESPE)*
7	Universal cementation of PFM, zirconia based, or metal restorations	RMGI preferred❖	RMGIs: RelyX Luting Plus *(3M ESPE)*, FujiCEM Automix *(GC America)*

✢ *Total Etch + Resin assuming that most of the tooth preparation is enamel. If significant dentin is present, total etch of enamel only followed by Self-Etch + Resin.*

❖ *Resin-modified glass ionomer is preferred for routine universal cementation instead of resin.*

Clinical Tips When Using Resin Cements

1. Tack dual cure cements with minimal light activation on initial seating of restorations to avoid extremely difficult subgingival cement removal and inability to clear cement from contact areas.
2. Use light cure resin for veneers to avoid the slight discoloration that may occur subsequent to seating with dual cure cements. This discoloration is caused by tertiary amines in the dual cure cements.
3. Use dual cure resin cement for deep tooth colored onlays and inlays to ensure that the deepest portion of the box forms or thick restoration portions allow the cement to cure.
4. Try-on gels in general do not represent the actual color of resin cements because of varied thickness of the cement under the restorations and differences between the color of the try-on gels and the cured cement. Cure a trial sample of the cement color being used and compare it with the try-on gel before making a final selection of color.
5. When using resin cement with a self-etch bonding agent, do not allow moisture contamination of the mixed two self-etch components while they are on the tooth preparations. Moisture contamination destroys the self-etch chemistry and could cause postoperative tooth sensitivity with some of the resin cements.
6. Resin cements with self-etch incorporated are slightly weaker than resin cements with separate self-etch primers. When optimum strength is needed, use resin cements with separate self-etch primers.
7. Because of the lack of bond of most resin cements to metal surfaces, roughen the inside of PFM and metal restorations with a rotary diamond before seating with resin cement to provide optimum mechanical retention for the restorations.
8. Since most dentin bonding systems show depreciated bonds after time, roughen the inside of post channels with a small flame-shaped diamond before cementation to ensure optimum mechanical retention of posts with resin cement.
9. Total-etch bonding systems used on dentin surfaces before resin cement have a proven history of more postoperative tooth sensitivity than self-etch cementation systems. Self-etch resin cement systems provide more predictable avoidance of postoperative tooth sensitivity.
10. Cementation of ceramic veneers over enamel surfaces require only phosphoric acid etch of the enamel plus adhesive. They do not require other components of bonding systems.

CR Conclusions: Resin cements are preferred or mandatory for some situations including veneers; post cementation; moderate strength ceramic restorations; tooth colored onlays and inlays; and low retention restorations. Although there has been significant commercial emphasis for dentists to use resin cements for routine cementation of all types of restorations, the lack of desirable preventive characteristics, the potential for postoperative tooth sensitivity with some of them, and their excessive strength make resin-modified glass ionomer cement a better choice for routine cementation.

Provisional Cements—Selecting the Best One for Specific Uses (Continued from page 1)

	Cement Use	CR Evaluators' Preferred Cement Type	CR Evaluators' Most Preferred Brands *(Many other brands are available)*	Approximate Cost per Mix✢	Company Information
1	Single Crowns and Short-Span Fixed Dental Dentures	ZOE	Many brands with similar characteristics Most Popular: TempBond, tubes *(Kerr)* TempoCem *(Zenith)*	Low *(Kerr)* Moderate *(Zenith)*	Kerr: 800-537-7123 Zenith: 800-662-6383
2	Single Crowns and Short-Span Fixed Partial Dentures *(eugenol sensitivity)*	Non-ZOE	Many brands with similar characteristics Most Popular: TempBond NE, tubes *(Kerr)* TempoCem NE *(Zenith)*	Low *(Kerr)* Moderate *(Zenith)*	Kerr: 800-537-7123 Zenith: 800-662-6383
3	Long-Span Fixed Partial Dentures *(retentive)*	ZOE	*See brands and information on row 1 above*		
4	Long-Span Fixed Partial Dentures *(questionable retention or long-term use)*	Weakened Polycarboxylate	Durelon *(3M ESPE)* Mixed with petroleum jelly and tooth lubricated with petroleum jelly	Moderate–High	3M ESPE: 800-634-2249
5	Veneers	Resin	TempBond Clear *(Kerr)* Conventional resin cement such as Variolink II❖	Moderate–High	Kerr Corp: 800-537-7123
6	Indirect Onlays and Inlays	Resin without cement	Fermit–N *(Ivoclar Vivadent)* Material is placed into prep, contoured, light cured, and not removed	High	Ivoclar Vivadent: 800-533-6825
7	Crowns or FPDs over Screw-Retained Abutments *(retentive)*	Non-ZOE	*See brands and information on row 2 above*		
8	Crowns or FPDs over Screw-Retained Abutments *(questionable retention)*	Resin	Premier Implant Cement *(Premier Dental)* Cement is placed only on most apical 2 mm of abutment to allow removal if necessary Improv Temporary Implant Cement *(Alvelogrow and Salvin)*	High	Premier Dental: 888-670-6100 Alvelogrow: 888-268-3286 Salvin: 800-535-6566

✢ *Costs of cements are not comparable. One single mix varied from ~$1.50 to $15.00.*
❖*Any brand of conventional resin cement bonded to 2 mm diameter and etched enamel surface in center of prep*

CR Conclusions: Zinc oxide-eugenol cements in tubes still dominate provisional cement use. However, non-eugenol cements are indicated when patients have sensitivities to eugenol. Resin provisional cements, usually reduced significantly in strength by manufacturers, are indicated for veneers, indirect inlays and onlays, and low retention crowns supported by implant abutments. Provisional restorations should be used for the shortest time possible for reasons of cement and margin leakage, tooth sensitization, occlusal collapse, tooth movement, esthetics, and premature breakage.

Evaluator Reports and Clinical Tips

"Clinical Success is the Final Test"

Staff Meeting in a Box

Gordon's Clinical Bottom Line: Every dental practice needs to have staff members working as a ***team.*** This requires constant positive interaction of staff members. Many dental offices could have more effective staff meetings. Some offices have only infrequent staff meetings or none at all. Staff Meeting in a Box provides motivation and help for developing effective staff meetings and includes continuing useful tips on practice improvement.

An in-office DVD training series comprised of 30-minute basic and common sense lessons with ideas that can be of immediate use. A new lesson is mailed to the office each month. Includes worksheets and other teaching aids that are designed to unify the dental team and improve the practice. The 100% money-back guarantee and no contract allow any office to try this product with no risk.

Advantages:
- Presentations are professional, concise, and entertaining
- Pertinent topics
- Motivates and unifies team
- Support materials compliment video instruction
- Easy to understand and implement
- Keeps costs down for training

Disadvantages:
- Possibly too simple
- Cost
- Content deals primarily with office management

Staff Meeting in a Box

Staff Meeting in a Box
Sold exclusively through Patterson Dental
800-873-7683
www.staffmeetinginabox.com/pattersondental
$1,995/12 Lessons

Topics in Series I include: Unifying Your Team, The Early Bonding Experience, The Language of Patient Delight, Team Building, Measuring Your Success, Managing Stress in the Office, Gathering Patient Input, Gentle Policy Administration, Establishing a Culture that Puts Patients on a Pedestal, Effective Communication Systems, Solving Problems at their Root, and Rewards and Recognition

CR Conclusions: 70% of 23 Evaluators stated they would incorporate Staff Meeting in a Box into their practices. 91% rated it excellent or good and worthy of trial by colleagues. Well organized and professionally presented training in the office can motivate and unify the dental team, and be revisited as new team members are hired. This program is especially useful for new practices.