



Adhesives 2018: Are They Getting Better?

Gordon’s Clinical Observations: Most dentists are relatively pleased with their choice of bonding agents. However, some practitioners are still complaining about occasional post-operative tooth sensitivity when placing either direct or indirect restorations. Bonding agents certainly play a role in preventing this sensitivity, and in helping hold direct and indirect restorations in place. *In this issue, CR scientists and clinicians, as well as CR survey data, provide you with highly useful information relative to these challenges and update you on current brands.*

- **Long-term enamel bond** is generally well-established across adhesive brands, influenced primarily by acid etching to create mechanical retention.
- **Long-term dentin bond** continues to be a clinical challenge, degrading gradually with time.
- **Zirconia or metal bonds** are made possible with MDP-containing primer/adhesive applied inside restoration. (Note: Multiple universal bonds contain MDP). Mechanical retention (e.g., grooves/channels in tooth prep) is vital, since chemical bond is minimal.
- **Glass ceramic bond (lithium disilicate IPS e.max)** is very reliable when restoration interior is hydrofluoric acid etched (or Etch & Prime by Ivoclar Vivadent) and then primed with silane-containing primer/adhesive. (Note: Multiple universal bonds contain silane).



One-component universal adhesives are becoming most popular. Are newer versions better?

This report provides: recent CR clinical survey results and clinical tips for adhesive success; a comparison of new adhesive brands with proven classics; and CR conclusions.

CR Survey Summary and Clinical Tips

A recent CR survey returned some interesting results. At first glance, it appears that adhesives are working well and that sensitivity levels are not an issue. However, products and technique could still be better! Below the survey results, CR suggests clinical tips to help make your clinical success rate with cements, adhesives, and direct resin restorations more successful.

N = 1,175 respondents	Percent of Respondents who Place this Material (at least occasionally)	Adhesion Success Rate	Post-operative Tooth Sensitivity
Direct resin-based composite	98%	Excellent: 97%	Minimal: 4%
Amalgam	55%	Excellent: 97%	Minimal: 4%
Zirconia	89%	Excellent: 97%	Minimal: 3%
Lithium disilicate (IPS e.max)	86%	Excellent: 98%	Minimal: 2%
Porcelain-fused-to-metal (PFM)	77%	Excellent: 97%	Minimal: 3%
Gold alloy	63%	Excellent: 97%	Minimal: 3%
Hybrid polymer (e.g., Lava Ultimate, Enamic)	16%	Excellent: 97%	Minimal: 2%
CR Clinical Tips	<p>Always examine a debonded indirect restoration to find the reason for failure:</p> <ul style="list-style-type: none"> • Tooth-side debond • Restoration-side debond • Cement structural failure 	<p>Although statistically the occurrence of post-operative sensitivity appears to be minimal, any sensitivity issues have been shown to be reduced or eliminated by the following:</p> <ol style="list-style-type: none"> 1. Application of a glutaraldehyde-HEMA desensitizer/disinfectant on tooth prep (Two 1-minute applications, then suction off) Examples: Gluma by Kulzer or MicroPrime G by Zest Dental Solutions. 2. Use of RMGI products when possible (liner for direct, cement for indirect). 	
<ul style="list-style-type: none"> • Moisture control (rubber dam, cotton rolls, Isolite Systems (various), etc.). Proper dry field ensures all chemical components in the primers, adhesives, and cements used do not become contaminated during placement. • Provide mechanical retention wherever possible. Roughening the tooth prep axial surfaces with a diamond, as well as etching enamel, are both crucial. Additional options include: grooves, undercuts, pins, channels, and non-parallel walls. Note: Use of ‘total-etch’ technique may increase post-operative sensitivity. 			

Adhesives 2018: Are They Getting Better? *(Continued from page 1)*

CR Survey Summary and Clinical Tips *(Continued)*

CR Clinical Tips *(Continued)*

- **Follow manufacturer instructions precisely.** For procedural steps that are accompanied by specified time intervals (*example: “Rub in adhesive for 30 seconds”*), consider having an assistant start a timer to ensure proper technique. Note: The “rubbing” (*or “waiting”*) step in many manufacturer protocols allows acid etch to occur and solvents to evaporate, resulting in a more consistent and reliable bond.
- **Multiple coats of adhesive for direct restorations.** Except where film thickness is expected to matter greatly, research has shown multiple adhesive coats produce better clinical results, for both adhesion and desensitization purposes.

New Adhesives: Brand comparison

The following table compares several newer adhesive brands with two controls that continue to be very popular. Brands are listed in descending order of overall score. Additional newer brands are available; brands listed are representative. In addition, in blue below the table is a list of “proven classic” adhesives recently featured in CR Buying Guide 2018 (*Clinicians Report December 2017*).

Brand, Manufacturer	Approx. Cost per Use	Universal Indication	Dual Cure	Ease of Application	Initial Bond strength (Dentin / Enamel)	Overall CR Rating
Clearfil Universal Bond QUICK, Kuraray Noritake Dental  	\$1.40	Yes	†	Excellent	50 / 36	Excellent <i>CR Choice</i>
One Coat 7 Universal, Coltene 	\$1.20	Yes	†	Excellent–Good	44 / 28	Excellent <i>CR Choice</i>
G-Premio Bond, GC America 	\$1.40	Yes	†	Excellent	36 / 31	Excellent <i>CR Choice</i>
E-On Universal Bond, Benco Dental	\$1.00	Yes	†	Excellent–Good	30 / 23	Excellent–Good
MPa MAX, Clinician’s Choice	\$0.90	Yes	No	Excellent	33 / 38	Excellent–Good
Prelude One, Zest Dental Solutions 	\$1.20	Yes	No	Excellent–Good	34 / 28	Excellent–Good
Superb Universal Adhesive, Apex Dental 	\$1.20	Yes	No	Good	39 / 33	Excellent–Good
OptiBond Universal, Kerr  	\$1.50	Yes	No	Excellent–Good	28 / 18	Good
Connexio, Centrix	\$2.70	Yes	Yes	Excellent–Good	21 / 14	Good
Tokuyama Universal Bond, Tokuyama Dental  	\$1.40	Yes	Yes	Excellent–Good	12 / 36	Good
Parkell Universal Adhesive, Parkell 	\$1.30	Yes	No	Good	12 / 17	Good–Fair
Ecosite Bond, DMG America	\$1.30	No	No	Good	21 / 18	Good–Fair
SeptoBond, Septodont	\$0.60	No	No	Excellent–Good	10 / 11	Good–Fair
Control: Scotchbond Universal, 3M  	\$1.70	Yes	†	Excellent–Good	50 / 37	Excellent <i>CR Choice</i>
Control: Clearfil SE Bond 2, Kuraray Noritake Dental 	\$2.20	Yes	†	Good	52 / 34	Excellent–Good

 Contains silane; assists in bond to glass ceramic.  Contains MDP; assists in bond to zirconia/metal.

Summary of Table

- **Approx. Cost per Use:** This value was calculated using an approximate average of two drops of adhesive per use. Multiple low-cost brands are available, as low as \$0.60 per use.
- **Universal Indication:** The term “universal” is used frequently in marketing as a catch-all phrase. For the purposes of this product comparison, it is meant by whether manufacturers indicate the product for use with direct restorations as well as for indirect restorations (*glass ceramic, zirconia, metal, etc.*).
- **Dual Cure:** This column shows whether or not the adhesive contains a self-curing component that makes it capable of setting without light activation; all adhesives listed may be light activated. Those brands with a “†” symbol have a separate dual-cure activator solution available for indicated situations, such as indirect restorations.
- **Ease of Application:** This rating is a composite score of multiple factors including: quantity of required components (*bottles*) and steps; application times (*rubbing, waiting, multiple coats indicated, etc.*); and the ability to create a reliably thin adhesive film prior to restoration placement.
- **Initial Bond Strength:** These values were generated using the notched shear bond strength method, after 24 hours of water storage at body temperature. Important: Dentin bonds have been shown to degrade with time, clinically, among all available brands to date; higher in-vitro values for dentin reported in the table are likely indicative of longer service for patients.
- **Overall CR Rating:** Each product tested was given an overall score based on the following criteria (*in descending order of assigned importance*): initial bond strength to multiple substrates, approximate cost per use, dual-cure capability, universal indication, and ease of application. Clearfil Universal Bond QUICK had best overall results, most notably for its superior bond strength values and best ease of application.

Proven Classic Adhesives (CR Buying Guide 2018)

- Adhese Universal, Ivoclar Vivadent
- Brush & Bond, Parkell
- Clearfil SE Bond, Kuraray Noritake Dental
- OptiBond Solo Plus and OptiBond XTR, Kerr
- Peak, Ultradent
- Prime & Bond Elect, Dentsply Sirona
- Scotchbond Universal, 3M

CR CONCLUSIONS:

- New adhesive brands evaluated in this report with best overall performance include: Clearfil Universal Bond QUICK by Kuraray Noritake Dental, One Coat 7 Universal by Coltene, and G-Premio Bond by GC America. Scotchbond Universal by 3M and Clearfil SE Bond 2 continue to be most popular clinically. Proven classic adhesives (*blue text box above*) have continued clinical success.
- Proper clinical technique is very important in use of adhesives (*see clinical tips on page 3*).
- Long-term bond to dentin continues to be a challenge, despite recent innovation in adhesives and cements. CR will keep you updated on further clinical findings.

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?

Each year, CR tests in excess of 750 different product brands, performing about 20,000 field evaluations. CR tests all types of dental products, including materials, devices, and equipment, plus techniques. Worldwide, products are purchased from distributors, secured from companies, and sent to CR by clinicians, inventors, and patients. There is no charge to companies for product evaluations. Testing combines the efforts of 450 clinicians in 19 countries who volunteer their time and expertise, and 40 on-site scientists, engineers, and support staff. Products are subjected to at least two levels of CR's unique three-tiered evaluation process that consists of:

1. Clinical field trials where new products are incorporated into routine use in a variety of dental practices and compared by clinicians to products and methods they use routinely.
2. Controlled clinical tests where new products are used and compared under rigorously controlled conditions, and patients are paid for their time as study participants.
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. Because of 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.

Products evaluated by CR Foundation® (CR®) and reported in the *Gordon J. Christensen Clinicians Report®* have been selected on the basis of merit from hundreds of products under evaluation. CR® conducts research at three levels: 1) multiple-user field evaluations, 2) controlled long-term clinical research, and 3) basic science laboratory research. Over 400 clinical field evaluators are located throughout the world and 40 full-time employees work at the institute. A product must meet at least one of the following standards to be reported in this publication: 1) innovative and new on the market, 2) less expensive, but meets the use standards, 3) unrecognized, valuable classic, or 4) superior to others in its broad classification. Your results may differ from CR Evaluators or other researchers on any product because of differences in preferences, techniques, product batches, or environments. CR Foundation® is a tax-exempt, non-profit education and research organization which uses a unique volunteer structure to produce objective, factual data. All proceeds are used to support the work of CR Foundation®. ©2018 This report or portions thereof may not be duplicated without permission of CR Foundation®. Annual English language subscription: US\$199 worldwide, plus GST Canada subscriptions. Single issue: \$18 each. See www.CliniciansReport.org for additional subscription information.