

Adhesive Technology Review



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3M ESPE

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RATINGS

Excellent	+++++
Very Good	++++
Good	+++

Self-Etch (SE) Bonding Agent Comparison and Glossary

6 th -generation (Type I) Product	Company	Type of Cure	Bond Strength Enamel, MPa	Bond Strength Dentin, MPa	Rating
3M ESPE Adper Scotchbond SE Self-Etch Adhesive	3M ESPE	LC	34 (SBS)	33 (SBS)	91%
AdheSE	Ivoclar Vivadent	DC, LC	16	21	96%
Clearfil SE BOND	Kuraray America	LC	23	31	95%

7 th -generation Product	Company	Type of Cure	Bond Strength Enamel, MPa	Bond Strength Dentin, MPa	Rating
3M ESPE Adper Easy Bond Self-Etch Adhesive	3M ESPE	LC	23 (SBS)	28 (SBS)	96%
AdheSE One	Ivoclar Vivadent	LC	19	23	96% (VivaPen)
Clearfil S3 BOND	Kuraray America	LC	28	23	Bottle: 92% UD: 98%
G-BOND	GC America	LC	20	20	Bottle: 97% UD: na
iBOND Self Etch	Heraeus	LC	nt	nt	na
OptiBond All-In-One	Kerr Corporation	LC	28	28	96%
Xeno IV	DENTSPLY Caulk	LC	21	25	Bottle: 93% UD: na

DC= dual-cured, LC= light-cured , nt= not tested, SBS = Shear Bond Strength

Glossary of Terms

- **Adhesive** - resin used to bond the composite to the primed tooth surface.
- **Dual-cured bonding agent** – bonding agent that can be light-cured or self-cured.
- **Etchant** - typically phosphoric acid used to clean and demineralize the tooth surface, used primarily for 4th- and 5th-generation bonding agents.
- **Inverted cone tensile test** – test for measurement of tensile bond strength developed by Dr. John Powers at the University of Michigan in 1986.
- **Light-cured bonding agent** – use of a light-curing unit is required; bonding agents typically contain camphorquinone (CQ) as the polymerization photoinitiator.
- **Modified smear layer** – result of self-etching primers that modify and combine with the smear layer rather than removing it.
- **Primer** - hydrophilic monomer used to wet and penetrate the tooth surface.
- **Self-cured bonding agent** – bonding agent with catalyst that allows self curing without light activation.

Type of Bonding Agent	Bond Strength, MPa	
	Light-cure Mode	Self-cured Mode
4 th -generation	23-32	21-24
5 th -generation	13-99	18-28
6 th -generation (Type I)	7-28	16-35
6 th -generation (Type II)	12-31	2-29
7 th -generation	18-28	18-28

Ranges of Tensile Bond Strengths

- **Self-etching (acidic) primer** - primer with acid groups producing low pH that interact with tooth structure and resin adhesives.
- **Smear layer** – layer of tooth structure produced when enamel and dentin are ground with a diamond or carbide bur. This layer must be removed or modified for good bond strengths.
- **Ultradent bond strength test** – test for measurement of shear bond strength (SBS) developed by Ultradent Products.

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No. 4, May 2008.

EXCLUSIVE REVIEW

Description

3M ESPE Adper Easy Bond Self-Etch Adhesive is a 7th-generation, light-cured, self-etch bonding agent. It is recommended for bonding direct composite and compomer restorations, core build-ups, repair of porcelain fractures, dentin desensitization, and cementation of most indirect restorations (when used in conjunction with *RelyX ARC*). Application of the bonding agent requires 20 seconds of scrubbing the material into the preparation, followed by 5 seconds of air and 10 seconds with a curing light (halogen, LED or plasma light-curing units). **Easy Bond** is available in two delivery systems, drop-dispensing from a squeeze-bottle or unit-dose applicators. Application time from either type of packaging is approximately 35 seconds. It is recommended that uncut enamel be etched with phosphoric acid. The usual precautions of maintaining a dry operating field, avoidance of contamination by essential oils, pulp protection for deep lesions, and limited contact with soft-tissues of both patient and operator are recommended. The bottle kit includes a 5-ml bottle of material and accessories. The unit-dose kit includes 100 unit doses and accessories. Sixteen Editors used **Easy Bond** in over 400 restorations. This product received a 96% clinical rating.

Suggested Retail Cost

- \$129.00/ 5-ml bottle kit
- \$219.00/ 100 unit-dose applicators

Editors' Observations

Instructions/Packaging/Completeness of Kit

Packaging of both delivery systems for **Easy Bond** includes a well-illustrated, laminated, step-by-step graphic guide and a clearly written, detailed description of all facets of use. Each delivery style comes in a drawer-convenient sized box with all needed items included. The Editors agreed that these instructions and completeness of kits were excellent. The unit-dose packaging and the convenience of the single-drop dispensing bottle/disposable plastic cup system were also rated excellent.

Ease of Dispensing/Ease of Application/Wettability

The ease of placing this material, the overall efficiency of the single-step protocol and the wettability of the material ranked very high with the Editors. The manufacturer recommends acid etching uncut enamel for best results.

Unit-dose Convenience and Amount of Material

The unit-dose packaging was very convenient and easy to activate for most Editors. Some found the medium-size fiber brush in the unit-dose applicators a bit large for very conservative preparations. A few Editors would like to see more material in each unit dose for multiple restorations.



Editors' Comments

- ◆ "The illustrated instructions are great."
- ◆ "This is a great product - so simple to use!"
- ◆ "The unit-dose is very nice."
- ◆ "I love that I do not have to keep it in the refrigerator."
- ◆ "I wish I could use it with more types of restorations."

Time Required for Bonding Procedure/

Ease of Air Dispersal/Odor

The material dispersed easily with air and the 35-second application time was a favorite of Editors. Odor was not cited as a problem by Editors.

Usefulness for Various Procedures

Editors noted that compatibility with self- and dual-cured restorative materials would increase the usefulness of **Easy Bond**.

Ease of Band Removal/Postoperative Sensitivity

Adherence of metal matrix bands to cured composite was not a significant problem nor was postoperative sensitivity of treated teeth.

Summary

Eighty percent of Editors reported that **3M ESPE Adper Easy Bond Self-Etch Adhesive** was equal to or better than their current 7th-generation bonding agent. Eighty-seven percent would recommend it to a colleague and 67% would switch.

Clinical Tips

- The fiber brush is passively placed in the unit-dose applicators. For small cavities, remove it and replace with a smaller brush.
- Twirl the brush handle in your fingers when popping the blister to avoid bending the brush at the neck.
- After wetting a tooth surface well, blot the brush dry and scrub the preparation to enhance coating the surface while removing excess.
- For longer shelf life of the unit-doses, store them in the refrigerator and take them out one at a time. ■

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No. 4, May 2008.



Description

3M ESPE Adper Scotchbond SE Self-Etch Adhesive is a two-bottle, self-etching adhesive system (6th-generation, Type I). It is indicated for use with light-cured direct restorations, porcelain, composite and metal repair, and root surface desensitization. The primer features a pink indicator that disappears upon the application of the adhesive. The adhesive is radiopaque and tinted yellow, with the color disappearing after application over the self-etching primer. Although it is recommended that the tooth be lightly dried prior to the bonding procedure, the system is moisture tolerant, allowing for bonding to wet or dry preparations. The material is not compatible with dual- or self-cured materials or for use in bonding porcelain veneers. The introductory kit contains 5 g of primer, and 5 g of adhesive and accessories. Instructions for use begin with application of Liquid A (primer) to coat the preparation surface, followed by application of Liquid B (adhesive) for 20 seconds. A 10-second air dry is followed by a second coat of Liquid B that is lightly air thinned and light cured for 10 seconds. This bonding system received a 91% rating.

Suggested Retail Cost

- \$139.00/introductory kit

Evaluation Protocol

- Fifteen editors of THE DENTAL ADVISOR clinically evaluated **3M ESPE Adper Scotchbond SE**.
- 238 bonding procedures were completed during the evaluation period.
- **3M ESPE Adper Scotchbond SE** was evaluated on a 1 to 5 rating scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

Editors' Observations

Manufacturer's instructions/Packaging

Clear instructions and color diagrams on laminated cards make the system easy to understand. Packaging is complete, including color coding of Liquid A and B bottle tops and applicators. Clarification of time is needed in instructions for application of Liquid A (primer).

Viscosity/Ease of Application

Viscosity of both primer and adhesive was generally well-liked by editors. The primer was judged by some to be a little runny but did wet the preparation surface well. The need for two different brushes, two coats of adhesive, and 10 seconds of air drying between coats makes application more complicated than other bonding agents.



Editors' Comments

- ◆ *"Colored liquids allow visualization of surfaces coated."*
- ◆ *"Wets tooth surface well and tolerates some moisture."*
- ◆ *"Takes too long to use."*
- ◆ *"I like that it is radiopaque, if pooling occurs it will not look like recurrent decay on x-rays."*

Color Indicator

The pink color indicator is easy to see and confirms a thorough application of the self-etching primer, followed by a proper coating of adhesive to change the color. Although appreciated by some editors, this feature was judged to be unnecessary by others. Furthermore, some editors expressed concern about the pink color of the primer running outside of preparations or affecting the color of finished restorations at the margins.

Time Required for Bonding Procedure

Total time required is longer than with many other bonding systems. Application of a self-etching primer takes minimal time, but a 20-second application of Liquid B, followed by a 10-second air dispersion and a second coat of Liquid B extends the procedure.

Postoperative Sensitivity/Desensitizer Efficacy

Minimal postoperative sensitivity was noted by editors. Use as a desensitizer was sporadic, especially given other systems available with less complicated procedures.

Overall Ease of Use

Very good final results with this bonding system were offset by lengthy application procedures. Room temperature storage is a nice feature, as is minimal odor of the primer and adhesive. There were no problems noted with metal band removal, nor any instances of debonding during the evaluation period. Seventy-five percent of editors rated **3M ESPE Adper Scotchbond SE Self-Etch Adhesive** to be equivalent to their current 6th-generation bonding agent, and 67% would recommend it to a colleague. ■

3M ESPE Adper™ Single Bond Plus Adhesive

++++ 1/2

Originally Published in
Vol. 22, No. 2, March 2005.
Republished in
Vol. 24, No. 6, July-Aug 2007.



Description

3M ESPE Adper Single Bond Plus Adhesive is a 5th-generation (total-etch, single-bottle) bonding agent, combining a dentin primer and adhesive in a single bottle. It is an improvement on the original *Single Bond* with the addition of 10% by weight of 5-nm spherical silica nano-filler. Use of a phosphoric acid etchant is required, followed by application of two to three coats of the adhesive. Light curing time is 10 seconds. **Adper Single Bond Plus** is indicated for use with direct light-cured restorative materials as well as for the treatment of cervical sensitivity. It may also be used in conjunction with resin cements when bonding laboratory-fabricated composite or ceramic restorations. The adhesive is available in either a 6-g bottle or unit-dose applicators. Each unit-dose applicator contains the adhesive in a foil blister pouch, which must be pressed to deliver the material to the brush tip. The unit-dose kit evaluated contains 40 applicators and a 3-ml syringe of etchant. Thirty consultants evaluated the **Adper Single Bond Plus** in over 480 clinical cases. This product received a 93% clinical rating.

Suggested Retail Cost

- \$153.10/5.6 ml bottle
- \$78.99/40 unit-doses

Product Features

Consultants found **Adper Single Bond Plus** to be a very useful. The unit-dose applicators are easy to use and provide enough material for bonding procedures on one to two teeth. The brush tip can be bent at an angle for intraoral access. The shallow well in the foil pouch allows the bent brush to be returned for additional adhesive without having to straighten it first. The viscosity of the adhesive coats tooth surfaces well and provides very good wettability. After light curing, an even, glossy coat on the tooth is apparent. Eighty-four percent of consultants would purchase and recommend **3M ESPE Adper Single Bond Plus Adhesive**.

Clinical Tips

- Press firmly and fold the unit-dose package to dispense product.
- Angle the package down to fully express the material. ■



Consultants' Comments

- ◆ "The unit dose provides fresh material each time."
- ◆ "The addition of filler particles is not evident clinically – this handles just like the original material."
- ◆ "A great all-purpose bonding agent."
- ◆ "Provide more material in unit dose."
- ◆ "Smaller applicator tips would be nice for narrow preparations."

3M ESPE Adper™ Scotchbond™ Multi-Purpose Plus Adhesive

+++++

Originally Published in
Vol. 5, No. 3, May-June 1995.
Republished in
Vol. 24, No. 6, July-Aug 2007.



Description

3M ESPE Adper Scotchbond Multi-Purpose Plus Adhesive is recommended as an excellent all-purpose bonding system. It bonds to enamel, dentin, composite, porcelain, and metal. The adhesive has light-cured and dual-cured options. The kit contains etchant, color-coded and numbered primers, activator, adhesive, and technique guides. Nineteen consultants used **Adper Scotchbond Multi-Purpose Plus Adhesive** in over 800 various clinical applications. This product received a 97% clinical rating.

Suggested Retail Cost

- \$104.99/activator or catalyst refill
- \$151.99/primer or adhesive refill

Product Features

There was an overwhelming positive response to **3M ESPE Adper Scotchbond Multi-Purpose Plus Adhesive**. Overall, the kit was judged to be versatile and easy to use by both doctors and assistants. The adhesive bonds well to all dental surfaces and has a dual-cured option for cementation of crowns and inlays and bonding amalgam. The numbered vials are color-coded to the brush handles to prevent cross-contamination. The packaging is conservative with minimal waste. Although the instruction booklet is very detailed, the enclosed technique guides simplify the use of the kit with color pictures and short step-by-step instructions for each procedure. ■



Consultants' Comments

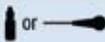
- ◆ *"A lubricant should be used on the matrix band for a bonded amalgam restoration."*
- ◆ *"An amalgam must be placed quickly because bonding agent sets quickly."*

3M ADHESIVES



We've got you covered

Every day, dental professionals help us identify their needs. And scientists at 3M ESPE have leveraged 3M's unmatched knowledge in adhesive technology to meet those needs with a full line of high-performance products. No matter how you like to work, we have you covered.

	 Adper™ Easy Bond Self-Etch Adhesive	 Adper™ Scotchbond™ SE Self-Etch Adhesive	 Adper™ Prompt™ L-Pop™ Self-Etch Adhesive	 Adper™ Single Bond Plus Adhesive	 Adper™ Scotchbond™ Multi-Purpose Plus Adhesive
Handling					
Technique	Self-Etch	Self-Etch	Self-Etch	Total-Etch	Total-Etch
Components	 or 				
Unit Dose delivery	✓		✓	✓	
Works on wet or dry dentin*	✓	✓	✓	✓	✓
Properties					
Film thickness	approximately 10 microns	approximately 20 microns	approximately 10 microns	approximately 10 microns	approximately 20 microns
Radiopacity		✓			
Filled	✓	✓		✓	
Dual-cure					✓
Visual Control		✓	✓		
Application Time	35 Seconds	46 Seconds	43 Seconds	57 Seconds	48 Seconds
Indications					
Direct	✓	✓	✓	✓	✓
Indirect	2			2	1
Desensitization of root surfaces	✓	✓	✓	✓	
Sealants			✓		

Components Key:



*Desiccation not recommended with any 3M ESPE adhesive products. All 3M ESPE adhesives are designed to tolerate a wide range of surface moisture conditions.

1. For these indications, the additional components of the Scotchbond™ Multi-Purpose Plus Adhesive System (bottle activator/bottle catalyst) are required.
2. When used in combination with 3M™ ESPE™ RelyX™ ARC Adhesive Resin Cement.

3M ESPE

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