



CRA
FIRST LOOK

ENAMEL - DENTIN ADHESIVES, SELF-ETCHING PRIMERS (SEP)

Newest dental adhesives all use low pH primers that dissolve & impregnate the smear layer, but do not remove it. The new primers are called "self-etching primers". By eliminating the phosphoric acid etch, rinse, & dry steps, they shorten & simplify the adhesive procedure, leave the dentin covered at all times, & get rid of the ambiguous "damp dry" step. Six+ years of international *clinical* experience with Kuraray's self-etching primers, ED Primer & Clearfil Liner Bond 2V Primer, indicate excellent post-op sensitivity control. Report below shows performance & characteristics of 7 self-etching primer adhesives compared to other formulations.

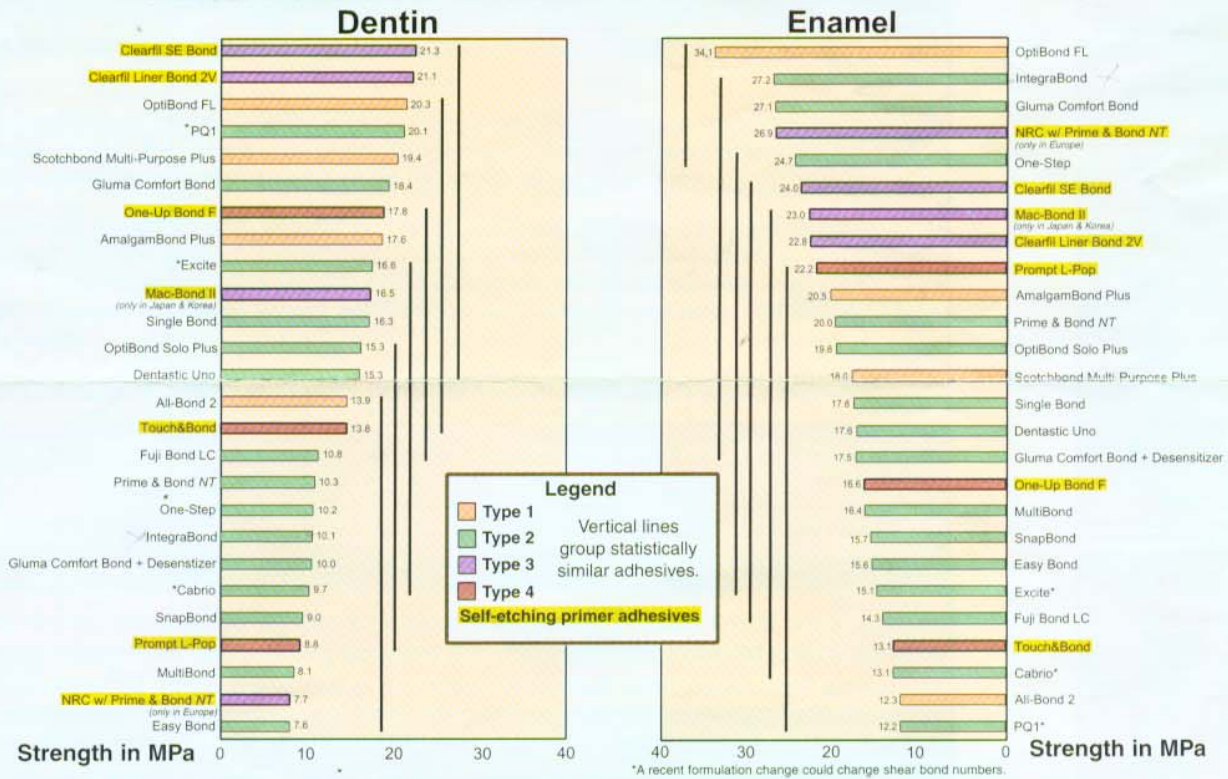
1. WHAT TYPES OF ADHESIVE SYSTEMS ARE USED TODAY ?

(Note color coding of adhesive Types which will be used throughout this report)

- TYPE 1** = Etchant applied & washed off to remove smear layer; primer & adhesive applied separately.
- TYPE 2** = Etchant applied & washed off to remove smear layer; primer & adhesive applied in single solution.
- TYPE 3** = Self-etching primer applied to dissolve smear layer & not washed off; adhesive applied separately.
- TYPE 4** = Self-etching primer & adhesive applied as single solution to dissolve & treat smear layer *simultaneously*.

2. HOW DO BOND STRENGTHS OF 7 SEP ADHESIVES COMPARE TO OTHER ADHESIVES ?

SHEAR BOND STRENGTH OF HERCULITE XRV TO DENTIN & CUT ENAMEL BY 26 ADHESIVES



SUMMARY OF GRAPH:

- 1) SEP adhesives bonded to dentin & cut enamel as well as other adhesives, including many "total etch" adhesives.
- 2) All 7 SEP adhesives did not have similar shear bond strengths. The 2 Clearfil products were overall best.
- 3) Bond strengths of Prompt L-Pop & NRC w/ Prime & Bond NT were much higher on cut enamel than dentin. The other 5 SEP adhesives bonded to dentin & enamel similarly.
- 4) Overall, on enamel Type 3 SEP adhesives had statistically highest bond strengths, & on dentin Type 3 & Type 1 were highest. However, the many overlapping significance groups indicate the complex inter-relationships of the bond strength values of the 26 adhesives tested.

Shear bond strength numbers can vary between test labs due to protocol differences, but comparison of numbers from the same lab are valid.

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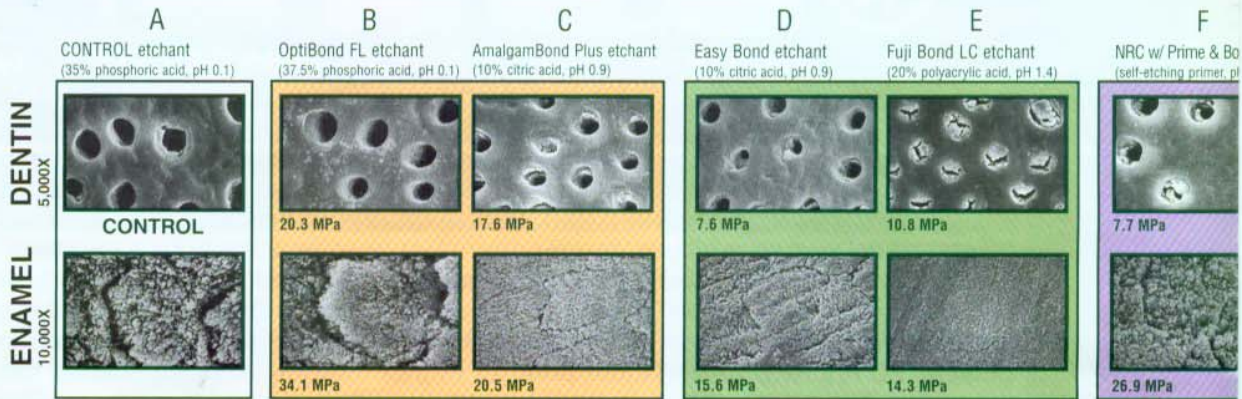
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3. HOW DO SURFACES OF DENTIN & ENAMEL DIFFER WHEN TREATED WITH VARIOUS ADHESIVES?

This section attempts to correlate dentin & enamel surface appearance with etchant pH & bond strengths to Herculite XRV. Bel



SUMMARY: SEP adhesives produced less surface etch than adhesives with a separate etch step (photos H, I, K, L compared to B, C, D enamel & dentin, but this did not necessarily result in highest shear bond strengths. For example: Note minimal surface changes with

4. CLINICAL FEATURES OF 26 ADHESIVES:



BRAND NAME (in alphabetical order)	COMPANY NAME	PHONE	A Cost per Use (US\$)	B # of Critical Adhesive Parts (see photos)	C Number of Steps in Application	D Application Time (seconds)	According to communication w/ manufacturers																
							E Cure Types Available (light, dual, self)	F Recommend Adhesive Cure Before Place Critical Resin	G Recommend Use w/ Self-Cure Composite	H Recommend Use w/ Dual-Cure Resins	I Recommend Use for Sealing Indirect Tooth-Colored Restorations	J Recommend Use w/ Fresh Amalgam Bonding	K Recommend Use w/ Resin Repair of Procelain	L Pre-Dose Dispensing Available									
TYPE 1																							
ALL-BOND 2	Bisco	847-534-6000	\$0.69	4	12	68	L,D,S	Y w/ light N w/ dual	Y	Y	Y	Y	Y	Y	Y	N							
AMALGAMBOND PLUS	Parkell	631-249-1134	\$1.86	4	9	141	S	n/a	Y	Y	Y	Y	Y	Y	N	N							
OPTIBOND FL	Kerr	714-516-7400	\$0.59	3	8	95	L	Y	Y	Y	N	Y	Y	Y	N								
SCOTCHBOND MULTI-PURPOSE PLUS	3M	651-575-5144	\$1.51	3	7	48	L,D	Y	N*	N*	N*	N*	Y	Y	N								
TYPE 2																							
CABRIO	Discus Dental	310-845-8200	\$0.34	2	7	53	L,D	Y	N*	N*	N*	N*	Y	Y	N								
DENTASTIC UNO	Pulpdent	617-926-6666	\$0.29	2	8	48	L,D	Y	N*	N*	N*	N*	Y	Y	N								
EASY BOND	Parkell	631-249-1134	\$0.45	2	7	73	L	Y	Y	Y	Y	N	N	N	N								
EXCITE	Ivoclar / Vivadent	716-691-0010	\$0.53	2	6	55	L	Y	N	Y	Y	N	Y	Y	Y								
FUJI BOND LC	GC America	708-597-0900	\$1.18	3	6	50	L	Y	Y	Y	N	N	N	N	N								
GLUMA COMFORT BOND	Heraeus Kulzer	219-291-0661	\$0.57	2	9	71	L	Y	N	N	Y	Y	N	N	N								
GLUMA COMFORT BOND + DESENSITIZER	Heraeus Kulzer	219-291-0661	\$0.60	2	9	71	L	Y	N	N	Y	Y	N	N	N								
INTEGRABOND	Premier Dental /BJM	610-239-6000	\$0.37	2	7	78	L,D	Y	N*	N*	N*	N	Y	Y	Y								
MULTIBOND	Centrix	203-929-5582	\$0.45	2	9	157	L,D	Y w/ light N w/ dual	N*	Y	N*	Y w/ light N w/ dual	Y	Y	Y								
ONE-STEP	Bisco	847-534-6000	\$0.44	2	8	51	L	Y	Y	Y	Y	Y	Y	Y	N								
OPTIBOND SOLO PLUS	Kerr	714-516-7400	\$0.49	2	5	57	L	Y	Y	Y	Y	Y	Y	Y	Y								
PQ1	Ultradent	801-572-4200	\$0.96	2	5	57	L	Y	N	N	Y	Y	Y	Y	N								
PRIME & BOND NT	Dentsply / Caulk	302-422-4511	\$0.88	2	6	65	L,D	Y	N*	Y	Y	N	N*	Y w/ light N w/ dual	Y								
SINGLE BOND	3M	651-575-5144	\$0.60	2	7	48	L	Y	N	N	Y	Y	Y	Y	N								
SNAPBOND	Cooley & Cooley	281-897-0009	\$0.28	2	11	59	L	optional	Y	Y	Y	N	Y	N	N								
TYPE 3																							
CLEARFIL LINER BOND 2V	Kuraray Dental	212-986-2230	\$0.52	3	7	69	L,D	Y	N*	N*	N*	N*	Y	Y	N								
CLEARFIL SE BOND	Kuraray Dental	212-986-2230	\$0.41	2	6	46	L	Y	N	Y	N	N	N	Y	N								
MAC-BOND II (only in Japan & Korea)	Tokuyama	81-3-3597-5101	†	3	7	64	L	Y	N	Y	N	N	N	N	N								
NRC W/ PRIME & BOND NT (only in Europe for Dyract)	Dentsply / DeTray	49-(0)75-31-583-0	†	2	6	63	L,D,S	Y	N	Y	N	N	N	N	N								
TYPE 4																							
ONE-UP BOND F	J. Morita	949-581-9600	\$0.43	2	4	38	L	Y	N	Y	N	N	N	N	N								
PROMPT L-POP	ESPE	610-277-3800	\$1.49	1	3	25	L	optional	N	N	N	N	N	N	Y								
TOUCH&BOND	Parkell	631-249-1134	\$0.52	2	7	47	L	Y	Y	Y	Y	N	N	N	N								

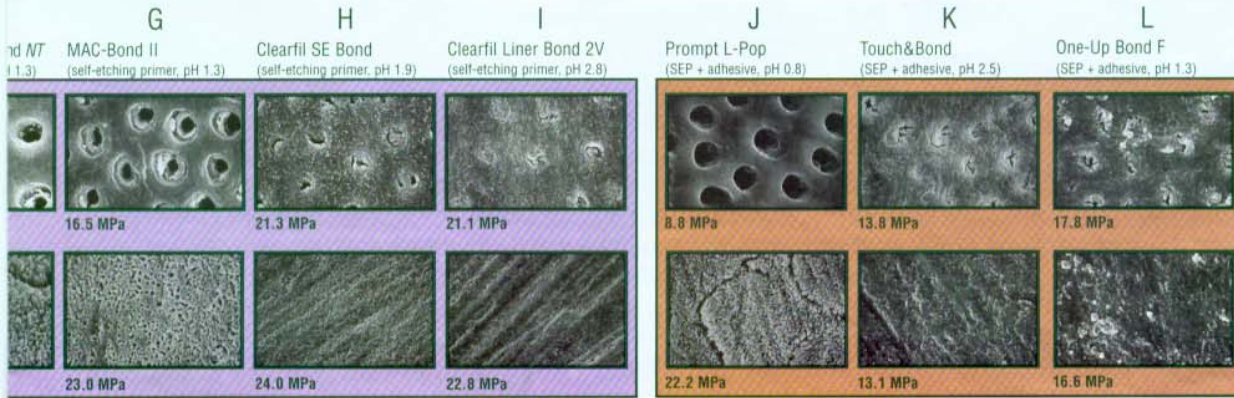
* = This NO becomes a YES if the company's separate dual cure component is used † = Contact local distributors ‡ = With company's resin cement

SUMMARY OF TABLE BY COLUMNS:

- A. Across all 4 adhesive types, cost per use varies by brand. As a group Type 3 SEP's were least expensive. Cost per use of Prompt L-Pop Type 4 SEP adhesive was almost 3 times higher than other SEP's.
- B. Most of the 26 adhesives tested had 2 critical parts. Type 1 adhesives had 3 or 4 critical parts, while Prompt L-Pop was unique with only 1 critical part.
- C. & D. SEP systems generally required fewer steps with shorter application times than other adhesives. Prompt L-Pop & One-Up Bond F had fewest steps (3 & 4) & shortest application times (25 & 35 seconds).
- E. SEP adhesives are similar to other adhesives in that most are light cured & some have dual & self-cure options.
- F. Most adhesive manufacturers recommend light-cure of adhesive before direct resin placement, 2 brands are optional & 1 is self-cure.
- G. - K. SEP adhesives do not offer the versatility of the Type 1 adhesives. Prompt L-Pop can only be used with direct light-cure resins. Clearfil Liner Bond 2V is an exception. With its dual-cure component, it has the same versatility as Type 1 adhesives.
- L. Four adhesives currently have pre-dose dispensing. Only Prompt L-Pop has pre-packaged all items needed. Most of the 18 companies in this evaluation plan pre-dose packaging in the future.

SESSIVE ETCH COMPONENTS ?

ow, note the product brand name; etchant type, percent, & pH; effect on dentin & enamel topography; & shear bond strengths.



, except for Prompt L-Pop (photo J). All adhesives where etchant pH measured below 1 (photos A, B, C, D, J) gave most profound etch on both Clearfil SE Bond & Clearfil Liner Bond 2V (photos H & I) compared to shear bond strengths listed under photos.

5. IMPORTANT POINTS CONCERNING SEP ADHESIVES:

- Two SEP adhesives (ED Primer in Panavia kit & Clearfil Liner Bond 2V Primer) have international reports of lack of post-op sensitivity. Clinical experience with newest group of SEP adhesives is needed to determine if this benefit applies to all SEP adhesives.
- SEP concept eliminates the critical damp dry step in "total etch" regimen which has always defied clear definition & consistent execution. With the SEP adhesive concept, the dentin is never denuded which seems to make it a less technique sensitive procedure that can be repeated reliably.
- Pre-dose dispensing provides fresh chemistry for each use, prevents cross-contamination, & is faster & easier to use. Currently, 4 systems are available (Excite, OptiBond Solo Plus, Prime & Bond NT & Prompt L-Pop). Prompt L-Pop has the only complete one part system. Clinicians need to be aware that it requires careful squeezing & rolling to expell & mix all components completely.
- Most light cure SEP & Type 2 adhesives cannot be used for all bonding applications. Dentists should check the chart on page 2 for manufacturer's recommendations before assuming their adhesive of choice can be used for any & all applications.
- Brand of restorative material used with an adhesive makes a difference in bond strength. CRA tests with Dyract AP compomer, Heliomolar, Herculite XRV, Spectrum TPH, & Z100 resins showed that Z100 demonstrated the highest bond strengths with all adhesives. Type 3 & 4 SEP adhesives had stronger bonds to Dyract AP compomer & weaker bonds to Heliomolar. More research is needed.
- One-Up Bond F uses color coded chemistry to indicate when steps are properly executed.

6. CRA CONCLUSIONS:

All 26 adhesives tested adhered to dentin & enamel adequately in both lab & clinical tests. Factors motivating interest in self-etching primers are reported reduction in post-operative sensitivity & elimination of ambiguous damp dry step. However, with some SEP adhesives clinicians lose the ability to bond to self & dual cure resins, indirect resins, & fresh silver amalgam. Of the SEP adhesives, only Clearfil Liner Bond 2V with its dual cure option can function as a universal adhesive. Prompt L-Pop SEP adhesive has the most unique dispensing, the fewest number of steps, & fastest application time, but it has high cost per use, & can be used only with direct light cure resin restorations. Dental adhesive technology appears to be moving toward self-etching primers, single part pre-dose dispensing, & adhesives with more restricted uses requiring multiple optional components or stocking more than one adhesive in the practice.

See CRA Web Site (www.cranews.com) for methods & detailed results.

TYPE 2 continued



One-Step



OptiBond Solo Plus



PQ1



Prime & Bond NT



Single Bond



SnapBond

TYPE 3



Clearfil Liner Bond 2V



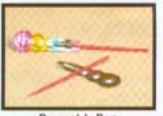
Clearfil SE Bond

only in Japan & Korea
MAC-Bond IIonly in Europe
NRC w/ Prime & Bond NT

TYPE 4



One-Up Bond F



Prompt L-Pop



Touch&Bond