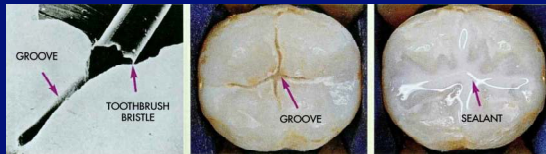


The Science of Sealants

NCIOM Task Force on Children's
Preventive Oral Health Services



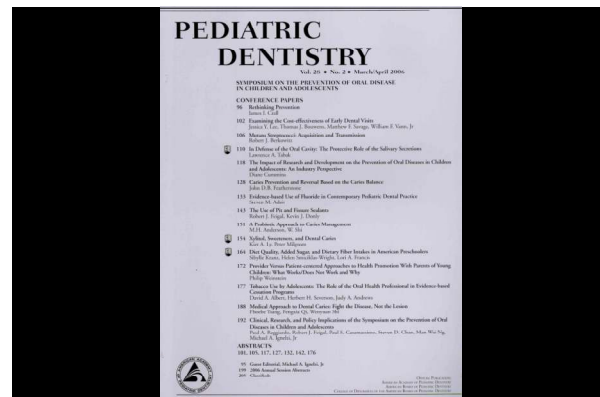
Michael A. Ignelzi, Jr., D.D.S., Ph.D.
Lake Jeanette Orthodontics & Pediatric Dentistry
Greensboro, North Carolina



**University of Michigan
School of Dentistry
Ann Arbor, Michigan**



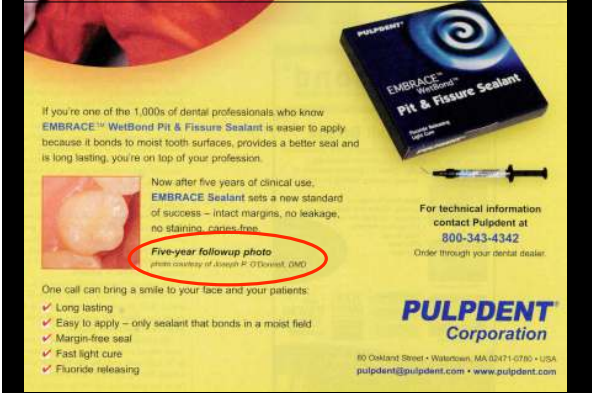
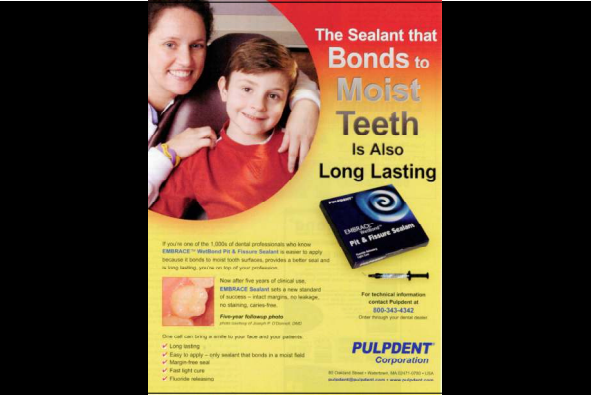
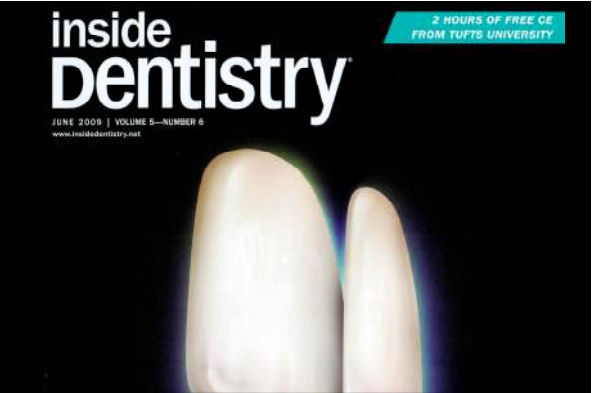
**Lake Jeanette Orthodontics
& Pediatric Dentistry
Greensboro, North Carolina**





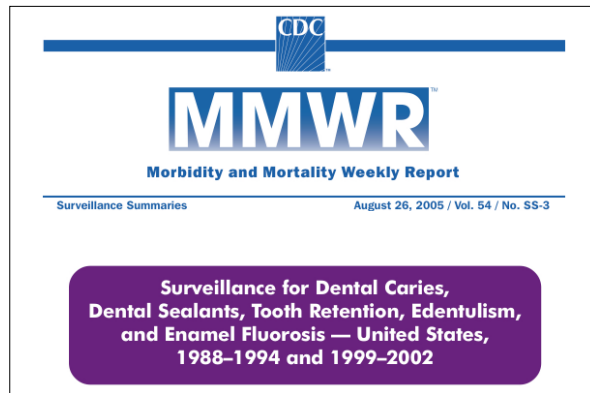
Avoid the hype

Use good science



Avoid the hype

Use good science



Surveillance for Dental Caries, Dental Sealants, Tooth Retention, Edentulism, and Enamel Fluorosis — United States, 1988–1994 and 1999–2002

18 MMWR August 26, 2005

TABLE 2. Prevalence of dental caries in primary teeth* among children aged 2–11 years, by selected characteristics — United States, National Health and Nutrition Examination Survey, 1988–1994 and 1999–2002

Characteristic	1988–1994		1999–2002		Difference in % [†]	% Change [‡]
	% [†]	SE [†]	%	SE		
Age group (yrs)						
2–5	24.23	1.32	27.91	1.68	3.68	15.19
6–11	49.74	1.77	49.00	2.43	-0.74	-1.49
Sex						
Male	30.50	1.73	43.16	2.53	3.66	9.27

15.2% increase in primary tooth caries in 2-5 year olds

Dental Caries- Primary Teeth

- 40% of children ages 2 - 8 have experienced caries
- 44% of caries found in pits and fissures

CDC, NHANES 1999-2002

Dental Caries- Permanent Teeth

- 21% of children ages 6 - 11 have dental caries
- 67% of children ages 16 - 19 have dental caries
- 90% of caries in permanent teeth is found in pits and fissures

CDC, NHANES 1999-2002





5 CONSIDER DENTAL SEALANTS.

"Sealants are the best-kept secret in dental offices," says Michael Ignelzi, an Ann Arbor, Michigan, dentist and chairman of the American Academy of Pediatric Dentistry's Council on Scientific Affairs. A sealant is a liquid that is brushed onto the chewing surfaces of the back teeth and

Only 30.5% of permanent molars in children aged 6-11 years have been sealed

Beltran-Aguilar ED, Barker LK, et al. Surveillance for dental caries, dental sealants, tooth retention, edentulism, and enamel fluorosis - United States, 1988-1994 and 1999-2002. MMWR Surveill Summ 54(3):1-43, 2005.

Less than 40% of dentists indicated they sealed non-cavitated carious lesions

Tellez, et al., Sealants and dental caries: Dentists' perspectives on evidence-based recommendations. JADA (2011) 142:1033-1040

Dentists are concerned that they will inadvertently seal over caries and that the caries will progress

The median annualized probability of progression for non-cavitated carious lesions that have been sealed was very low - 2.6%

Griffin SO, Oong E, et al. The effectiveness of sealants in managing caries lesions. J Dent Res 87(2):169-174, 2008.

Sealant will be lost and the loss of sealant will place the tooth at greater risk than if it had never been sealed

The caries rate in formerly sealed teeth, with partial or complete loss of sealant, is less than or equal to the caries rate in non-sealed teeth

Griffin SO, Kolavic-Gray S, et al. Caries risk in formerly sealed teeth. JADA 140(4):415-423, 2009.

Lessons to be learned...

- We should restore cavitated lesions, but seal the vast majority of non-cavitated lesions
- Sealants must remain intact to confer protection

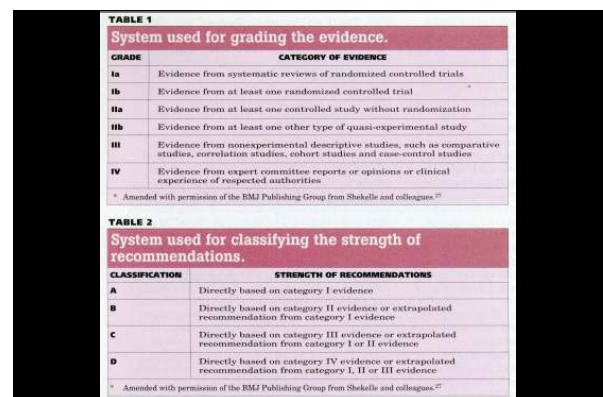
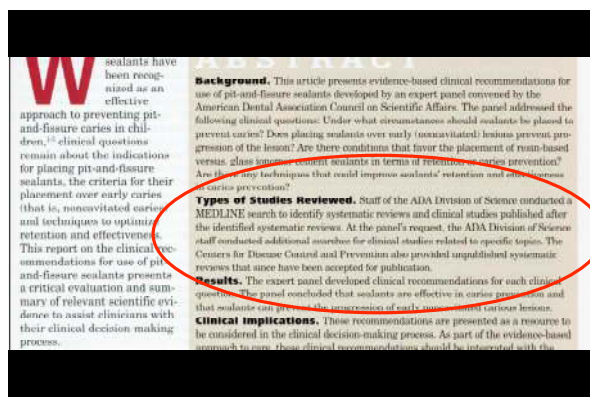
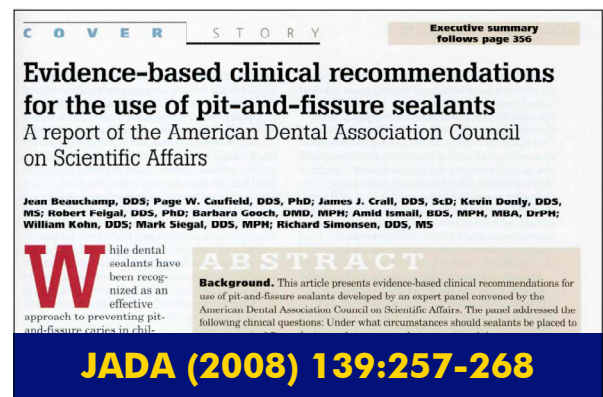
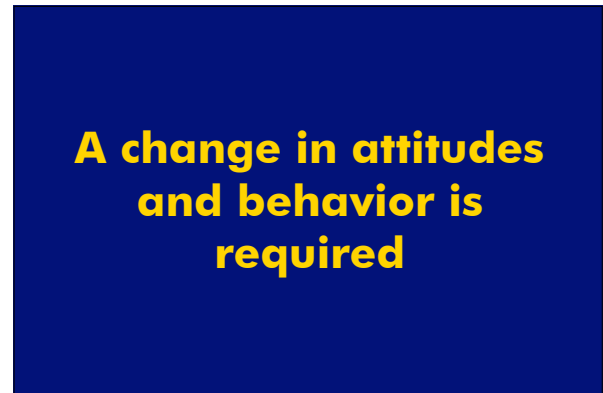
Sealants do not last forever

Retention = Prevention

**Sealants prevent:
86% of caries after one year
79% of caries after two years
59% of caries after three years**

Llodra JC, Bravo M, et al. Community Dent Oral Epidemiol 21(5):261-268, 1993.

Ahovuo-Saloranta A, Hiri A, et al. Cochrane Database Sys Rev (3):CD001830, 2004.



COVER STORY

Executive summary follows page 356

Evidence-based clinical recommendations for the use of pit-and-fissure sealants

A report of the American Dental Association Council on Scientific Affairs

- Should sealants be placed on primary teeth?
- How should we manage non-cavitated lesions?

COVER STORY

Executive summary follows page 356

Evidence-based clinical recommendations for the use of pit-and-fissure sealants

A report of the American Dental Association Council on Scientific Affairs

- Should we stop using resin-based sealants and switch to glass ionomer cement sealants?
- Are there any techniques that improve retention and effectiveness?

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¹ Includes Original, STF and NTF Fissurotomy Burs

TABLE 3
Summary of evidence-based clinical recommendations regarding pit-and-fissure sealants.

The clinical recommendations in this table are a resource for dentists to use in clinical decision making. These clinical recommendations must be balanced with the practitioner's professional judgment and the individual patient's needs and preferences.

Dentists are encouraged to employ caries risk assessment strategies to determine whether placement of pit-and-fissure sealants is indicated as a primary preventive measure. The risk of experiencing dental caries exists on a continuum and changes across time as risk factors change. Therefore, caries risk status should be re-evaluated periodically. Manufacturers' instructions for sealant placement should be consulted, and a dry field should be maintained during placement.

TOPIC	RECOMMENDATION	GRADE OF EVIDENCE ^a	STRENGTH OF RECOMMENDATION
Caries Prevention	Sealants should be placed in pits and fissures of children's primary teeth when it is determined that the tooth, or the patient, is at risk of developing caries ^b .	III	D
	Sealants should be placed on pits and fissures of children's and adolescents' permanent teeth when it is determined that the tooth, or the patient, is at risk of developing caries ^b .	Ia	B
	Sealants should be placed on pits and fissures of adults' permanent teeth when it is determined that the tooth, or the patient, is at risk of developing caries ^b .	Ia	D
Noncavitated Lesions	Pit-and-fissure sealants should be placed on early noncavitated carious lesions, as defined in this document, in children, adolescents and young adults to reduce the percentage of lesions that progress.	Ia	B
	Pit-and-fissure sealants should be placed on early noncavitated carious lesions, as defined in this document, in adults to reduce the percentage of lesions that progress.	Ia	D
Resin-Based Versus Glass Ionomer Cement	Resin-based sealants are the first choice of material for dental sealants.	Ia	A
	When a patient cannot tolerate the use of a resin-based material, glass ionomer cement sealants are indicated for the placement of a sealant-based material that contains about 50 percent or less of resin component.	II	B
Placement Techniques	A computerized, one-handed loading system, which contains built-in additive and a sensor, and the most accepted for placement and clinical studies, is the best for sealant placement.	II	B
	Use of available nonloading loading system, which does not contain a separate mixing tray, may provide less protection than the standard one-handed technique and is not recommended.	III	C
	When possible, a two-handed technique should be used for placement of resin-based sealants.	III	C
	When possible, a two-handed technique should be used for placement of glass ionomer cement sealants.	III	D
	The seal should have professional clinical evaluation and regularly monitored on a routine basis.	IV	D

TABLE 3
Summary of evidence-based clinical recommendations regarding pit-and-fissure sealants.

The clinical recommendations in this table are a resource for dentists to use in clinical decision making. These clinical recommendations must be balanced with the practitioner's professional judgment and the individual patient's needs and preferences.

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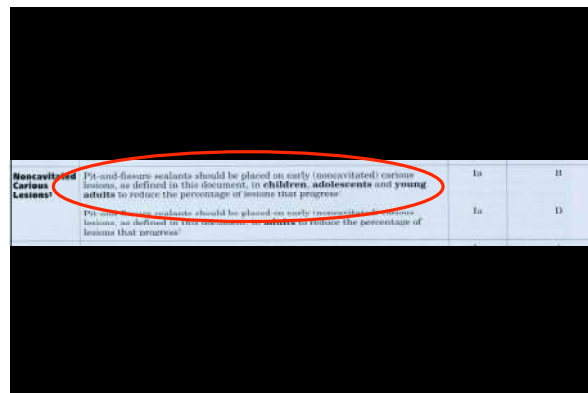
- ... professional judgment, patient's needs and patient's preferences
- ... caries risk assessment
- ... risk changes over time
- ... dry field should be maintained during placement

TABLE 3
Summary of evidence-based clinical recommendations regarding pit-and-fissure sealants.

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	Sealants should be placed on pits and fissures of adults' permanent teeth when it is determined that the tooth, or the patient, is at risk of developing caries ^b .	Ia	D



Noncavitated Carious Lesions

teria for dental radiographs.

❖ "Noncavitated carious lesion" refers to pits and fissures in fully erupted teeth that may display discoloration not due to extrinsic staining, developmental opacities or fluorosis. The discoloration may be confined to the size of a pit or fissure or may extend to the cusp inclines surrounding a pit or fissure. The tooth surface should have no evidence of a shadow indicating dental caries, and, if radiographs are available, they should be evaluated to determine that neither the occlusal nor proximal surfaces have signs of dental caries.

8. The clinical recommendation is as follows:

The effect of dental sealants on bacteria levels in caries lesions

A review of the evidence

Ella M. Oong, DMD, MPH; Susan O. Griffin, PhD; William G. Kohn, DDS; Barbara F. Gooch, DMD, MPH; Page W. Caulfield, DDS, PhD

Strong evidence shows that sealants are effective in preventing caries in children at varying degrees of risk.^{1,2} Despite this evidence of effectiveness, sealant prevalence among lower-income children (who are at higher risk of experiencing dental caries) remains at around 30 percent,³ well below the Healthy People 2010 objective of 50 percent.⁴ Survey data of dentists suggest that one of the major barriers to their providing sealants is concern about inadvertently sealing over caries.^{5,6} This concern has become an obstacle to implementing

ABSTRACT
Background. Concern about inadvertently sealing over caries often prevents dentists from providing dental sealants. The objective of the authors' review was to examine the effects of sealants on bacteria levels within caries lesions under dental sealants.
Methods. The authors searched electronic databases for comparative studies examining bacteria levels in sealed permanent teeth. To measure the effect of sealants on bacteria levels, they used the log₁₀ reduction in mean total viable bacteria counts (TVBC) between sealed and non-sealed caries and the percentage reduction in the proportion of samples with viable bacteria.
Results. Six studies—three randomised controlled trials, two controlled trials and one before-and-after study—were included in the analysis.

RESEARCH REPORTS

Clinical

S.O. Griffin^{1*}, E. Oong², W. Kohn³, B. Vidokovic⁴, B.F. Gooch⁵, and CDC Dental Sealant Systematic Review Work Group: J. Bader⁶, J. Clarkson⁷, M.R. Fontana⁸, D.M. Meyer⁹, R.G. Razier⁷, J.A. Weintraub⁹, and D.T. Zero⁹

¹Centers for Disease Control and Prevention, Division of Oral Health Surveillance, Investigations, and Research Branch, 4770 Buford Highway, MSF10, Chamblee, GA 30341, USA; ²Wallace H. Coulter School of Biomedical Engineering, 2100 Whitaker Building, 111 Fern Dr., Georgia Tech, Atlanta, GA 30332-0815, USA; ³School of Dentistry, University of North Carolina, Chapel Hill, NC 27599-7430, USA; ⁴Dental Health Services Research Unit, Dundee DD24HF, Scotland, UK; ⁵Oral Health Research Institute, Indiana University School of Dentistry, 415 Lansing Street, Indianapolis, IN 46202, USA; ⁶American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611, USA; ⁷Department of Health Policy and Administration, The University of North Carolina at Chapel Hill, 1109F McGovern-Greenberg Hall, CB#7411, Chapel Hill, NC 27599-7411, USA; and ⁸Center to Address Disparities in Children's Oral Health, University of California, San Francisco School of Dentistry, 3333 California Street, Suite 408, San Francisco, CA 94143-1561

The Effectiveness of Sealants in Managing Caries Lesions

INTRODUCTION

There is strong evidence that sealants are effective in both clinical and school settings for preventing caries in children at various levels of risk (Trisman *et al.*, 2002; Ahoval-Saloranta *et al.*, 2004). The evidence for sealant effectiveness in the management of dental caries is limited, however. One review that examined the effectiveness of interventions to manage caries for the National Institutes of Health (NIH) Caries Consensus Development Conference included only 1 study on sealants (Bader *et al.*, 2001). Despite the strong evidence of primary effectiveness, sealant prevalence among lower-income children (who are at higher risk for dental caries) is about 30% (Dye *et al.*, 2007), well below

Mertz-Fairhurst et al.

ULTRACONSERVATIVE AND CARIOSTATIC SEALED RESTORATIONS: RESULTS AT YEAR 10

EVA J. MERTZ-FAIRHURST, D.D.S.; JAMES W. CURTIS JR., D.M.D.; JANET W. EROLE, C.D.A.; FRED A. RUGGERBERG, D.D.S., M.S.; STEVEN M. ADAIR, D.D.S., M.S.

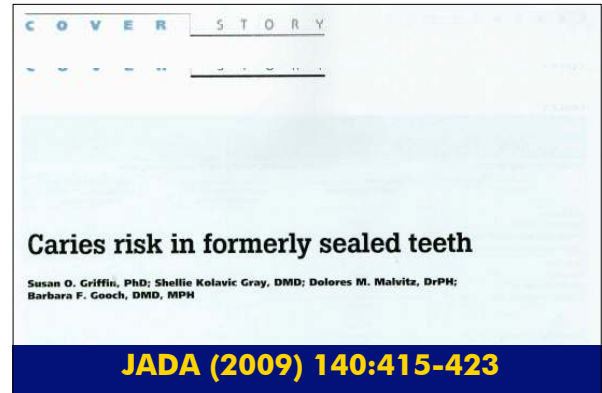
The traditional treatment for carious lesions was outlined nearly a century ago by G.V. Black.¹ This treatment consists

ABSTRACT
Changes in restorative techniques and the development of

the sugars in the host's diet. All three groups of causative factors must interact simultaneously for caries to occur or

J Dent Res (2008) 87:169-174

JADA (1998) 129:55-66



Teeth with fully or partially lost sealant were not at a higher risk of developing caries than were teeth that had never been sealed

Resin-Based Versus Glass Ionomer Cement	Resin-based sealants are the first choice of material for dental sealants. Glass ionomer cement may be used as an interim preventive agent when there are indications for placement of a resin-based sealant but concerns about sealant control may compromise such placement.	Is IV	A B
---	--	----------	--------



Placement Techniques	A compatible one-bottle bonding agent, which contains both an adhesive and a primer, may be used between the previously acid-etched enamel surface and the sealant material when, in the opinion of the dental professional, the bonding agent would enhance sealant retention in the clinical situation.	IB	D
	Use of etchable self-etching bonding agents, which do not involve a separate etching step, may promote sealant retention by the one-step technique and is not recommended.	IIb	B
	Routine mechanical preparation of enamel before acid etching is not recommended.	IBc	D
	When possible, a four-handed technique should be used for placement of resin-based sealants.	III	C
	When possible, a four-handed technique should be used for placement of glass ionomer cement sealants.	IV	D
	The oral health care professional should monitor and resupply sealants as needed to maximize effectiveness.	IV	D

RESEARCH REPORTS Biomaterials & Bioengineering

R.J. Feigal¹*, P. Musharraf², B. Gillespie², M. Levy-Polack³, I. Quelhas⁴, and J. Hebling⁵

¹Department of Orthodontics and Pediatric Dentistry, 1228 School of Dentistry, University of Michigan, Ann Arbor, MI 48109-1075; ²Center for Statistical Consultation and Research, University of Michigan, Pediatric Dentistry Practice, Ann Arbor, MI; and ³Pediatric Dentistry Practice, Minneapolis, MN; *corresponding author, rfeigal@umich.edu
J Dent Res 79(11): 1850-1856, 2000

Improved Sealant Retention with Bonding Agents: A Clinical Study of Two-bottle and Single-bottle Systems

ABSTRACT

Recent *in vitro* work and a short clinical study suggest that adding a bonding agent layer between sealant and saliva-contaminated enamel allows for adequate bond strength and retention of resin sealants and may improve success of all sealant applications. This five-year clinical study scored 617 occlusal and 441 buccal/lingual molar sealants, with use of a split-mouth design, with half

INTRODUCTION

Treating caries-susceptible pits and fissures with resin sealants enjoys wide acceptance as a preventive strategy. Dental sealants and policy-makers have endorsed the use of sealants (ADA, 1997), and health goals estimate the target numbers for sealant application to US children at 50% by the year 2000 (US Public Health Service, 1991). In spite of the enthusiasm of many in the dental community, however, sealant treatment is far from universal. In fact, analysis of national data suggests that sealants are applied to less than 20% of children (Brown *et al.*, 1996; Sebaste *et al.*, 1996).

J Dent Res (2000) 79:1850-1856

**After etch, before sealant...
place bonding agent
that contains an
adhesive and a primer**

**Feigal et al.
J Dent Res (2000) 79:1850-1856**

WHICH ADHESIVE GENERATION AM I USING?

While adhesives' generational nomenclature developed arbitrarily over the last 20 years, it serves as an excellent classification tool for the clinical dentist. Since more than 200 adhesive systems are available worldwide, learning the properties and procedures of every material is daunting if not impossible. It makes much more sense to group these adhesives into family groups based upon chemistry, functionality, and ease of use.

All too often, we may not even be certain which adhesive material generation we are using in our own practice. Advertising and company promotion may be confusing. Lectures and articles offer data and extensive information that may be difficult to digest. Two simple questions can quickly ascertain a bonding agent's generational status:

- Do I need to etch separately?
- How many bottles (components)?

The separate etching step is characteristic of fourth- and fifth-generation adhesives. The single bottle is characteristic of fifth- and seventh-generation adhesives. These paradigms are utilized to sort the generations.

The following table can easily determine the status of any current adhesive material:

	SEPARATE ETCH STEP	NO SEPARATE ETCH
Single component	Fifth generation	Seventh generation
Multiple component	Fourth generation	Sixth generation

WHICH ADHESIVE GENERATION AM I USING?

	SEPARATE ETCH STEP	NO SEPARATE ETCH
Single component	Fifth generation	Seventh generation
Multiple component	Fourth generation	Sixth generation



3M ESPE Adper Single Bond Plus

Placement Techniques	A compatible ¹ one-bottle bonding agent, which contains both an adhesive and a primer, may be used between the previously acid-etched enamel surface and the sealant material when, in the opinion of the dental professional, the bonding agent would enhance sealant retention in the clinical situation ² .	IIb	B
	Use of available self-etching bonding agents, which do not involve a separate etching step, may provide less retention than the standard acid-etching technique and is not recommended.	Ib	B
	Routine mechanical preparation of enamel before acid etching is not recommended.	IIIb	B
	When possible, a four-handed technique should be used for placement of resin-based sealants.	III	C
	When possible, a four-handed technique should be used for placement of glass ionomer cement sealants.	IV	D
	The oral health care professional should monitor and reapply sealants as needed to maximize effectiveness.	IV	D

WHICH ADHESIVE GENERATION AM I USING?			
	SEPARATE ETCH STEP	NO SEPARATE ETCH	
Single component	Fifth generation	Seventh generation	
Multiple component	Fourth generation	Sixth generation	

Table 4. Self-etching adhesives.	
Two-Step Self-Etch (2-SEA)	
Adper ScotchBond SE	3M-ESPE
Clearfil Liner Bond 2V	Kuraray
Clearfil SE Bond	Kuraray
Apex Dental	Kuraray
Tyrian SPE	Bisco
Simplicity	Apex Dental
Single-Step Self-Etch Mix systems (1-SEA)	
Den-Mat	Ivoclar/Vivadent
Prompt-L-Pop	3M-ESPE
Touch and Bond	Parkell
One-Up Bond F Plus	J. Morita
Single-Step Self-Etch No-Mix system (1-SEA)	
IBOND Self Etch	Heraeus
OptiBOND All-in-One	Kerr
G-Bond	GC America
Xeno IV	Dentsply
Clearfil S3	Kuraray
Adper Easy Bond SE	3M-ESPE

Placement Techniques	A compatible ¹ one-bottle bonding agent, which contains both an adhesive and a primer, may be used between the previously acid-etched enamel surface and the sealant material when, in the opinion of the dental professional, the bonding agent would enhance sealant retention in the clinical situation ² .	IIb	B
	Use of available self-etching bonding agents, which do not involve a separate etching step, may provide less retention than the standard acid-etching technique and is not recommended.	Ib	B
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Mix 'n' Match 300 Burs¹, Get 100 FREE!¹

¹ Includes Original, STF and NTF Fissurotomy Burs

COVER STORY

Exploring four-handed delivery and retention of resin-based sealants

Susan O. Griffin, PhD; Karl Jones, PhD; Shelle Kolavic Gray, DMD, MPH;
Dolores M. Malvitz, DrPH; Barbara F. Gooch, DMD, MPH

ABSTRACT

Expert panels assembled by the American Dental Association (ADA) and the Centers for Disease Control and Prevention (CDC) have published a background paper on the use of sealants. To date, no trials have been published.

JADA (2008) 139:281-289

BOX 1**Qualifying notes on clinical recommendations.**

* Change in caries susceptibility can occur. It is important to consider that the risk of developing dental caries exists on a continuum and changes across time as risk factors change. Therefore, clinicians should re-evaluate each patient's caries risk status periodically.

† Clinicians should use recent radiographs, if available, in the decision-making process, but should not obtain radiographs for the sole purpose of placing sealants. Clinicians should consult the American Dental Association's U.S. Food and Drug Administration's guidelines regarding selection criteria for dental radiographs.

‡ "Noncavitated carious lesion" refers to pits and fissures in fully erupted teeth that may display discoloration not due to extrinsic staining, developmental opacities or fluorosis. The discoloration may be confined to the size of a pit or fissure or may extend to the cuspal inclines surrounding a pit or fissure. The tooth surface should have no evidence of a shadow indicating dental caries, and, if radiographs are available, they should be evaluated to determine that neither the occlusal nor proximal surfaces have signs of dental caries.

§ These clinical recommendations offer two options for situations in which moisture control, such as with a newly erupted tooth at risk of developing caries, patient compliance or both are a concern. These options include use of a glass ionomer cement material or use of a compatible one-bottle bonding agent, which contains both an adhesive and a primer. Clinicians should use their expertise to determine which technique is most appropriate for an individual patient.

¶ Clinicians should consult with the manufacturer of the adhesive and/or sealant to determine material compatibility.

Qualifying Notes

- Caries susceptibility changes
- Use radiographs if available
- Non-cavitated lesions...
- Glass ionomer sealants when moisture control is a concern

Take Home Messages

- Sealants should be placed on primary and permanent teeth
- Resin-based sealants better than glass ionomer cement sealants
- Moisture control is essential
- Use one bottle bonding agent (adhesive and primer) after total etch with 37% H3PO4

Take Home Messages

- Self-etching bonding agents are "not recommended"
- Routine mechanical preparation of enamel NOT indicated
- 4 hands are better than 2
- Re-apply when needed

Best Practices

- Clean teeth
- Total etch with 37% H3PO4 for 30 seconds
- Apply bonding agent (one bottle that contains an adhesive and primer)
- Apply sealant (Clinpro - 3M ESPE)



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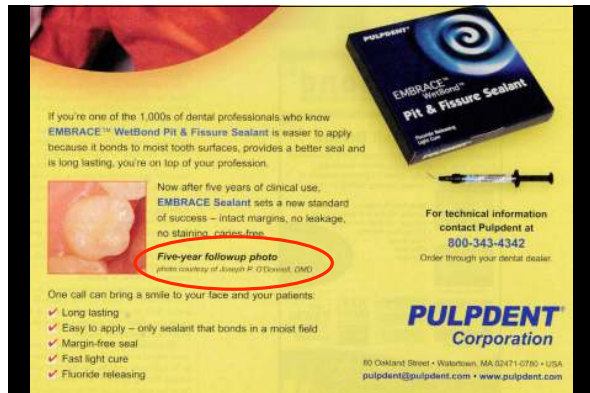
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Five-year followup photo
photo courtesy of Joseph P. O'Donell, DMD

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SUMMARY




THANK YOU!