Adhere today, gone tomorrow?

The current status of bonding to dentine

Disclosures

"I am not paid by any company to promote their products"

"I will discuss materials, devices and techniques that I have used, but there may be others that are better"

Some manufacturers fund my research"

"I will try to be evidence-based rather than anecdotal"

What I plan to talk about

- The evolution of dentine bonding agents via resin luting cements
- The development of contemporary bonding agents
- Choosing the right material and using it correctly!
- If bonding is as good as this…….
- Alternatives!
- Final thoughts

In the beginning

We thought that this was bonding!

1875

The function of a traditional luting cement is to provide *retention* by interlocking the minor irregularities on the prepared tooth surface and the restoration surface

Smith, Wright and Brown, 1986

1875

1875

1875

Zinc Phosphate

Advantages	Disadvantages
History of success	Post-op sensitivity
Adjustable working time	Long set time
High impact resistance	Mix technique
High rigidity	No measurable shear adhesion
Mechanical retention only	High solubility
	Low compressive strength
	Low diametral tensile strength
	Low fracture toughness

The first *adhesive* cement: Polycarboxylate cement

Luting Materials

TODAY!

PASSIVE LUTING

Moving on to the 1980s

Additionally……

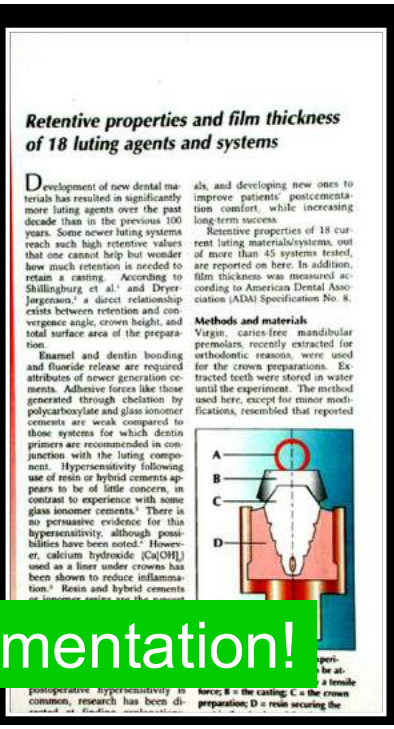
resin cements may be used as part of an adhesive approach where preparation geometry is suboptimal

1996

1996

- Polycarboxylate cement produced lowest value
- Ketac-Cem value was X2 that of phosphate
- Dentine bonding and resin produced highest values for retention

Think adhesive cementation!



Retentive properties and film thickness of 18 luting agents and systems

Development of new dental materials has resulted in significantly more luting agents over the past decade than in the previous 100 years. Some newer luting systems reach such high retentive values that one cannot help but wonder how much retention is needed to retain a casting. According to Shillingburg et al.[1] and Dyer-Jorgensen,[2] a direct relationship exists between retention and convergence angle, crown height, and total surface area of the preparation.

Enamel and dentin bonding and fluoride release are required attributes of newer generation cements. Adhesive forces like those generated through chelation by polycarboxylate and glass ionomer cements are weak compared to those systems for which dentin primers are recommended in conjunction with the luting component. Hypersensitivity following use of resin or hybrid cements appears to be of little concern, in contrast to experience with some glass ionomer cements.[3] There is no persuasive evidence for this hypersensitivity, although possibilities have been noted.[4] However, calcium hydroxide [Ca(OH)$_2$] used as a liner under crowns has been shown to reduce inflammation.[5] Resin and hybrid cements

als, and developing new ones to improve patients' postcementation comfort, while increasing long-term success.

Retentive properties of 18 current luting materials/systems, out of more than 45 systems tested, are reported on here. In addition, film thickness was measured according to American Dental Association (ADA) Specification No. 8.

Methods and materials

Virgin, caries-free mandibular premolars, recently extracted for orthodontic reasons, were used for the crown preparations. Extracted teeth were stored in water until the experiment. The method used here, except for minor modifications, resembled that reported

Think adhesive cementation!

- As the resin luting materials provided retention that was double the values of zinc phosphate or conventional cements, these results provide an ***overwhelming indication for the use of adhesive luting.***

Zidan O, Ferguson GC The retention of complete crowns prepared with three different tapers and luted with four different cements. J.Prosthet.Dent.2003:89:565-571.

Heintze SD
Crown pull off test (crown retention test) to evaluate the bonding effectiveness of luting agents. Dent.Mater.2010:26: 193-206.

Systematic review including 18 studies.

Most important factors for crown dislodgment were stump height, convergence angle and luting agent. Frequency of debonding was higher for restorations luted with zinc phosphate than all other types.

Resin cements

Advantages	Disadvantages
Not soluble in oral environment	Requires acid etch technique
High compressive & tensile strengths	Requires dentine bonding
Good fracture toughness	Technique sensitive
Capable of bonding to tooth structure via DBA	Moisture control is critical
	Clean –up time is critical

Resin cements taught us a lot about adhesion!

…resin luting has become much simpler since the introduction of self-adhesive luting materials

The first self-adhesive resin luting material, 2002

2014

What I plan to talk about

- The evolution of dentine bonding agents via resin luting cements
- The development of contemporary bonding agents
- Choosing the right material and using it correctly!
- If bonding is as good as this…….
- Alternatives!
- Final thoughts

Direct placement restorations

Michael Buonocore

Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J.Dent.Res.**1955:**34(6):849-853.

21

Problems in bonding to dentine

COMPOSITION OF DENTINE

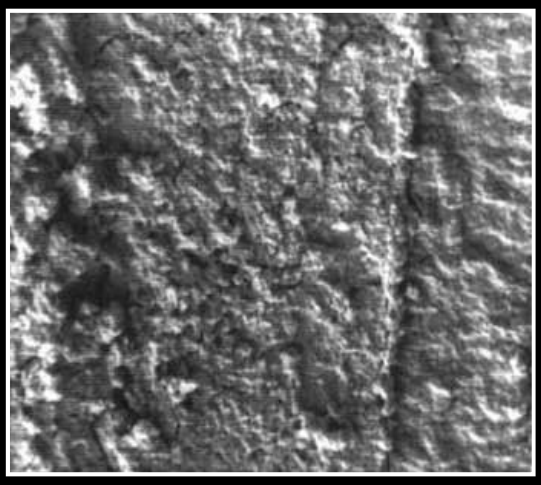
70% Inorganic

Bonding to dentine is therefore more difficult

It is a vital substrate

Another consideration: The smear Layer

- Thickness:
  0.5 - 5.0 microns
- Will not wash off
- Weak bond to tooth,
  2 – 3 MPa
- Very soluble in
  weak acid

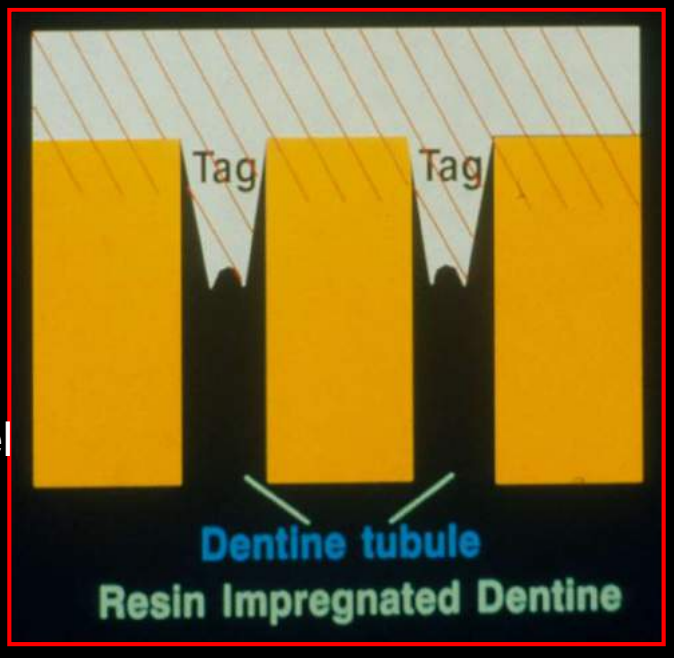


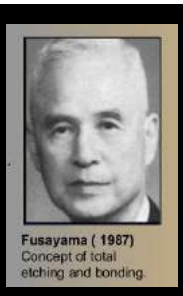
B. Van Meerbeek in: Summitt Fund. Oper. Dent. 2001,

Enamel and Dentin Adhesives, Col Kraig S. Vandewalle, USAF Dental Investigation Service,

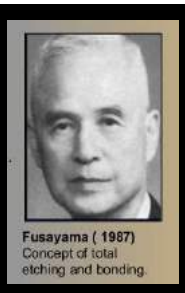
How we thought that dentine adhesives worked…..

1960s
Buonocore discusses “resin tags as the principal adherents“ to etched enamel



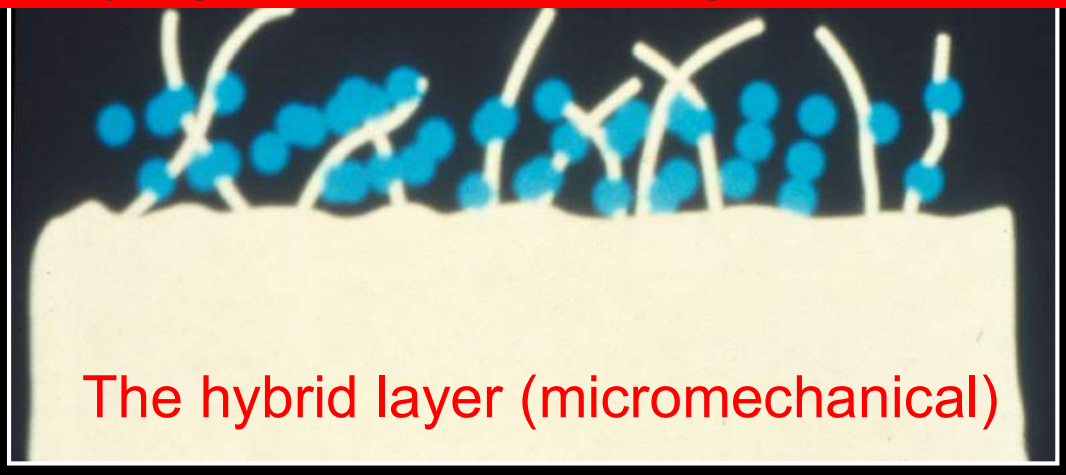


1980s:Fusayama advocated simulataneous etching of enamel and dentine (total-etch)



Fusayama T. New concepts in operative dentistry. Chicago USA, Quintessence Publishing Co.1980

Overdrying causes the collagen to collapse

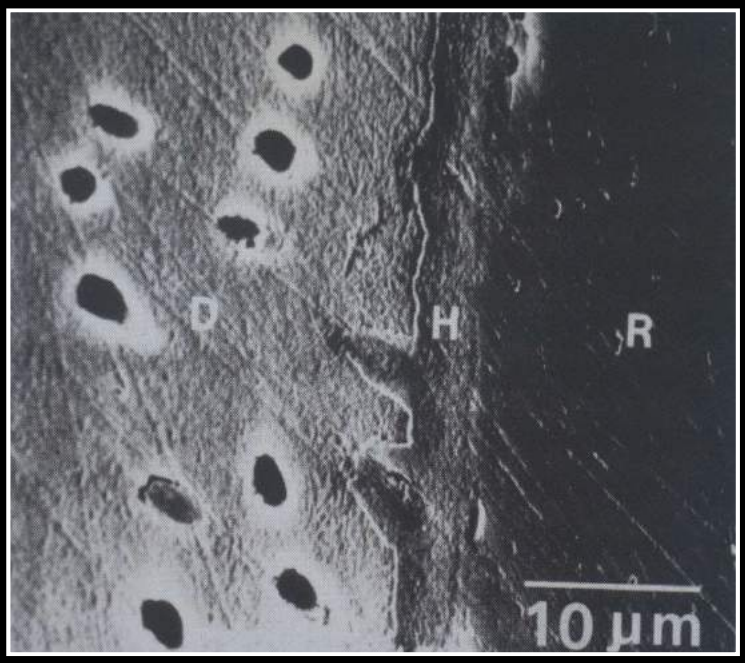


The hybrid layer (micromechanical)

Nakabayashi N, Kojilma K, Masuhara E. The promotion of adhesion by the infiltration of monomers into tooth substrates. J Biomed Mater Res 1982; 16: 265–273.

Nakabayashi N, Kojima K, Masuharsa E. The promotion of adhesion by infiltration of monomers into tooth substance. J.Biomed.Mater.Res. 1982:16:265-273

Hybrid layer = 5 -10 microns



What happens if the tooth surface is overdried?

- What happens if the tooth surface is overdried?
  - Collapsed collagen decreases porosity and reduces adhesive absorption:
    Increases chance for sensitivity

- The tooth surface needs to be moist!
  - Expanded collagen is porous and will absorb adhesive:
    Minimizes post-op sensitivity

Dull dentin appearance indicates dehydration

Total-Etch (etch and rinse) Adhesives

4th and 5th Generations

- Use for all indications including uncut enamel
- Decent clinical history
- Decent bond strength

Early 1990s

3 step process:
Total etch and rinse
Priming & evaporation of solvent
Application of adhesive and light cure

Etch & Rinse

The dentine is etched with 35% phosphoric acid (1), this is rinsed off (2), then dried (3) bond then applied (4)

Four steps, I can make a mistake with any of them!

Trends in the late 1990s

- To reduce post-op sensitivity (SE)
- To make the procedure easier
- Fewer steps
- High, consistent bond strengths

Hence, the advent of the self etch adhesives!

Burke FJT. What's new in dentine bonding? Self etch adhesives Dent.Update 2004:31:580-589.

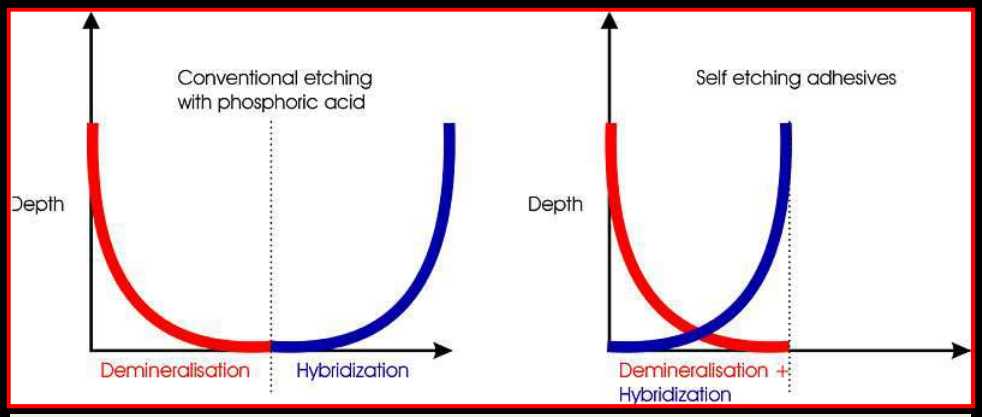
RESTORATIVE DENTISTRY

What's New in Dentine Bonding? Self-Etch Adhesives

F.J. Trevor Burke

BONDING TO DENTINE

An application error of 10% in any stage can be magnified to 59% overall if there are 5 steps!



Why we don't get post-op sensitivity from the so-called self-etch adhesives

C-P Ernst, Univ of Mainz

….Self-Etch Adhesives

- It was not possible to over etch the dentine, hence:
- Low post-op sensitivity

Post-op sensitivity drove the self-etch market… plus better patient comfort and ease of use.

Self-Etch Adhesives

(6th and 7th Generations)

- Low post-op sensitivity
- Less technique sensitive
- Moisture tolerant
- Good bond strengths
- Growing clinical history

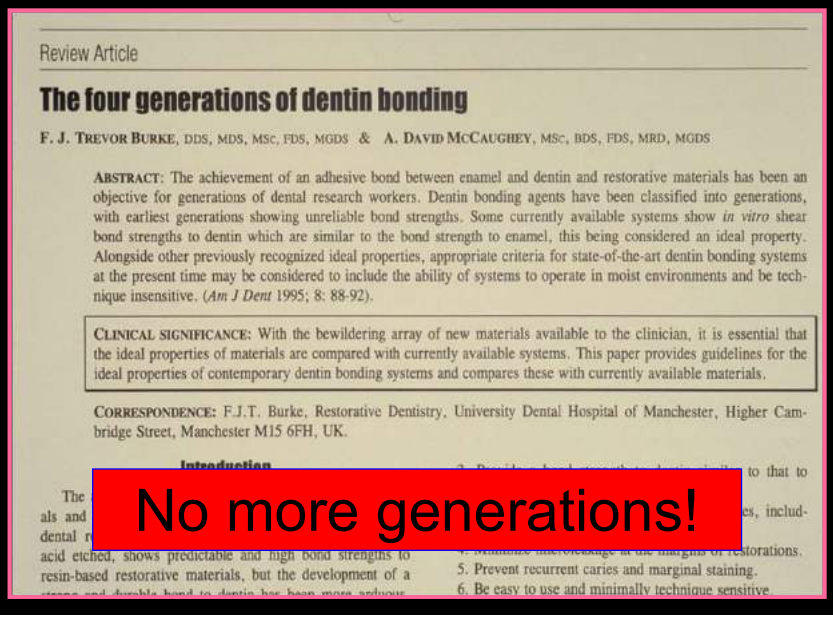
circa 2000

One bottle bonding made bonding easier for the clinician

Advantages of self-etching systems

- Simultaneous demineralisation and resin-infiltration
- No post-conditioning rinsing
- Possible time-saving application procedure
- Not so sensitive to degree of wetness/dryness
- Low technique sensitivity
- Single dose packaging possible/Less risk of cross infection

Classification of dentine bonding systems



Review Article

The four generations of dentin bonding

F. J. Trevor Burke, DDS, MDS, MSc, FDS, MGDS & A. David McCaughey, MSc, BDS, FDS, MRD, MGDS

Abstract: The achievement of an adhesive bond between enamel and dentin and restorative materials has been an objective for generations of dental research workers. Dentin bonding agents have been classified into generations, with earliest generations showing unreliable bond strengths. Some currently available systems show *in vitro* shear bond strengths to dentin which are similar to the bond strength to enamel, this being considered an ideal property. Alongside other previously recognized ideal properties, appropriate criteria for state-of-the-art dentin bonding systems at the present time may be considered to include the ability of systems to operate in moist environments and be technique insensitive. (*Am J Dent* 1995; 8: 88-92).

Clinical significance: With the bewildering array of new materials available to the clinician, it is essential that the ideal properties of materials are compared with currently available systems. This paper provides guidelines for the ideal properties of contemporary dentin bonding systems and compares these with currently available materials.

Correspondence: F.J.T. Burke, Restorative Dentistry, University Dental Hospital of Manchester, Higher Cambridge Street, Manchester M15 6FH, UK.

Introduction

No more generations!

5. Prevent recurrent caries and marginal staining.
6. Be easy to use and minimally technique sensitive.

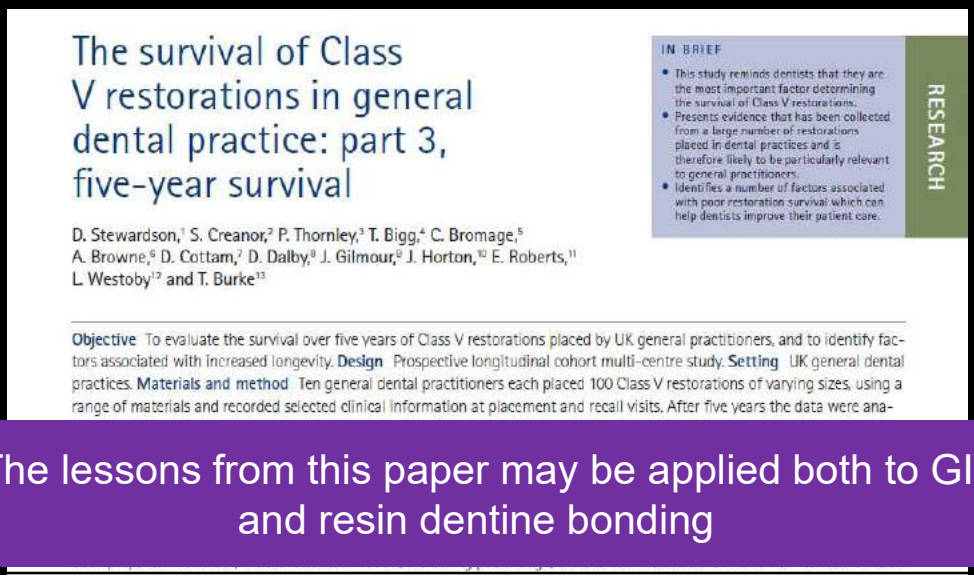
In the old days!

The closest thing to a dentine bonding agent was an inverted cone bur!

1970 and earlier

How to bond to sclerotic dentine

Maximising class V effectiveness



The survival of Class V restorations in general dental practice: part 3, five-year survival

IN BRIEF

- This study reminds dentists that they are the most important factor determining the survival of Class V restorations.
- Presents evidence that has been collected from a large number of restorations placed in dental practices and is therefore likely to be particularly relevant to general practitioners.
- Identifies a number of factors associated with poor restoration survival which can help dentists improve their patient care.

RESEARCH

D. Stewardson,[1] S. Creanor,[2] P. Thornley,[3] T. Bigg,[4] C. Bromage,[5] A. Browne,[6] D. Cottam,[7] D. Dalby,[8] J. Gilmour,[9] J. Horton,[10] E. Roberts,[11] L. Westoby[12] and T. Burke[13]

Objective To evaluate the survival over five years of Class V restorations placed by UK general practitioners, and to identify factors associated with increased longevity. **Design** Prospective longitudinal cohort multi-centre study. **Setting** UK general dental practices. **Materials and method** Ten general dental practitioners each placed 100 Class V restorations of varying sizes, using a range of materials and recorded selected clinical information at placement and recall visits. After five years the data were ana-

The lessons from this paper may be applied both to GI and resin dentine bonding

Maximising class V effectiveness: what is associated with failure at 5 years?

Restorations involving dentine only: hazard of failure increased by 39%

Large restorations compared with small: hazard of failure increased by 85%

Major or minor moisture contamination: hazard of failure increased by 29%

Preparation method/rotary instrument used: hazard of failure decreased by 40%

Maximising class V effectiveness: what material is best at 5 years?

Five year survival

RMGI 78.6%

Amalgam 75%

Compomer 71.2%

Flowable composite 69%

Composite 68.3%

Glass ionomer 50.6%

Class V meta analysis: conclusions

"The dentist shall roughen the dentine and enamel surfaces"

"Additional bevelling of enamel can be omitted"

"Isolation with rubber dam is recommended"


Review

Clinical performance of cervical restorations—
A meta-analysis

Zimmerli B, De Munck J, Lussi A, Lambrechts P, van Meerbeck B. Long-term bonding to eroded dentin requires *superficial bur preparation.* Clin.Oral Invest.2012:16:1451-1461.

Roughen the surface – make shiny surfaces not shiny using an intraoral sandblaster or, simply, a steel bur

How to bond to sclerotic dentine

Read all about it!

RestorativeDentistry

F J Trevor Burke

Dental Materials: What Goes Where? Class V Restorations

Abstract: A large number of Class V restorations are placed per annum to restore cervical lesions. This paper evaluates the pathogenesis of these lesions, with particular reference to the role of occlusal factors, and reviews the literature in order to provide advice on the material(s) which are most likely to produce optimal longevity of a Class V restoration.

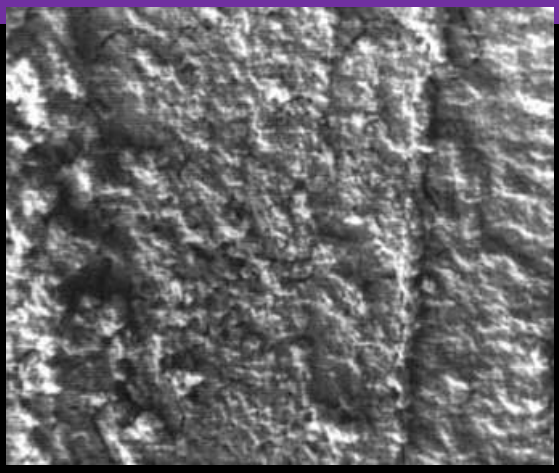
CPD/Clinical Relevance: Resin-modified glass ionomer materials appear to provide optimal survival for a Class V restoration, but a (flowable) composite might produce a better aesthetic result.

Dental Update 2015; 42: 829–839

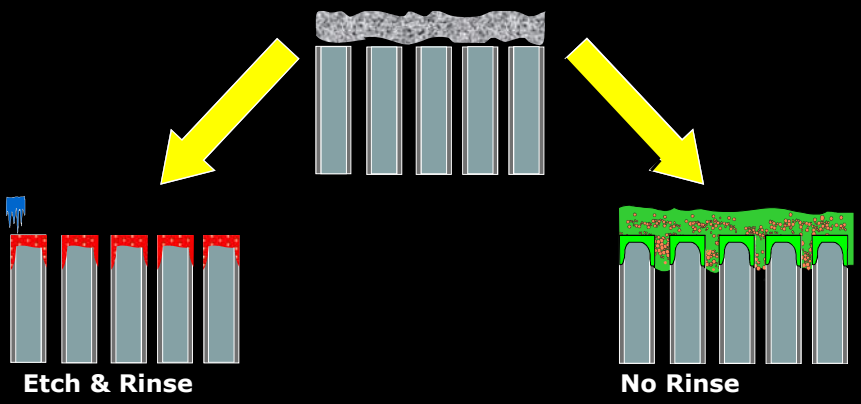
Problems in bonding to dentine

The 1990s: The Smear Layer

- Thickness
  - 0.5 - 5.0 microns
- Will not wash off
- Weak bond to tooth
  - 2 – 3 MPa
- Soluble in weak acids



Therefore: *Previous* Strategies to treat the smear layer



The classification, ***until recently***, of dentine adhesives

1.Etch and rinse
(etch & bond, total etch)
2.Self etch ⇒ **One bottle**
⇒ **Two bottles**

…a landmark paper

Five-year Clinical Effectiveness of a Two-step Self-etching Adhesive

Marleen Peumans[a]/Jan De Munck[b]/Kirsten Van Landuyt[c]/Paul Lambrechts[a]/
Bart Van Meerbeek[a]

Purpose: The purpose of this prospective randomized controlled clinical study was to evaluate the clinical performance of a "mild" two-step self-etching adhesive, Clearfil SE, in Class V restorations after 5 years of clinical functioning.

Materials and Methods: Twenty-nine patients received two or four restorations following two randomly assigned experimental protocols: (1) a mild self-etching adhesive (Clearfil SE, Kuraray) was applied following manufacturer's instructions on both enamel and dentin (C-SE non-etch); (2) similar application of Clearfil SE, but including prior selective acid-etching of the enamel cavity margins with 40% phosphoric acid (C-SE etch). Clearfil AP-X (Kuraray) was used as the restorative composite for all 100 restorations. The clinical effectiveness was recorded in terms of retention, marginal integrity, marginal discoloration, caries recurrence, postoperative sensitivity, and preservation of tooth vitality after 5 years of clinical service. The hypothesis tested was that selective acid etching of enamel with phosphoric acid improved retention, marginal integrity, and clinical microleakage of Class V restorations.

Results: Only one restoration of the C-SE non-etch group was lost at the 5-year recall. All other restorations were clinically acceptable. Marginal integrity deteriorated with time in both groups. The number of restorations with defect-free margins was significantly lower in the C-SE non-etch group ($p = 0.0043$). This latter group presented significantly more small incisal marginal defects on the enamel side ($p = 0.0169$). Superficial marginal discoloration increased in both groups, but was more pronounced in the C-SE non-etch group and was related to the higher frequency of small incisal marginal defects.

Conclusion: The clinical effectiveness of the two-step self-etching adhesive Clearfil SE remained excellent after 5 years of clinical service. Additional etching of the enamel cavity margins resulted in an improved marginal adaptation on the enamel side; however, this was not critical for the overall clinical performance of the restorations.

Keywords: adhesives, clinical trial, cervical lesions, composite restoration.

J Adhes Dent 2007; 9: 7-10. *Submitted for publication: 10.07.06; accepted for publication: 16.11.06.*

Similar results at 13 years

DENTAL MATERIALS 26 (2010) 1176–1184

available at www.sciencedirect.com

Eight-year clinical evaluation of a 2-step self-etch adhesive with and without selective enamel etching

M. Peumans, J. De Munck, K.L. Van Landuyt, A. Poitevin, P. Lambrechts, B. Van Me...*

Leuven BIOMA... Surgery, Catholic Unive...

5. Conclusion

At 8 years, the clinical effectiveness of Clearfil SE, a mild 2-step self-etch adhesive, appeared excellent. Selective phosphoric acid-etching of the enamel margins had only some minor positive effect on secondary clinical parameters like a lower incidence of small marginal defects/discolorations at the enamel side. These clinically acceptable marginal shortcomings, however, did not require any restorative intervention at the 8-year recall.

introducing a new approach….
the concept of selective enamel etching
(with *so-called* self-etch adhesives)

….NOW

Universal Adhesives

Treatment of the smear layer

- REMOVE (Etch & Rinse/Total etch)
- LEAVE/PENETRATE (Self Etch)
- UNIVERSAL MATERIALS (Etch & Rinse, Selective enamel etch, Self etch) (use for direct and indirect)

Etch&Rinse and Self Etch were type specific

Definition of a Universal Adhesive

- capable of being used in whichever etching mode that the operator considers appropriate (total etch, self-etch or selective enamel etch):
- may be used for direct and indirect dentistry, the latter generally in conjunction with a resin-based luting system from the same manufacturer as the bonding agent, with the luting system incorporating a material-specific initiator (Burke et al)
- the addition of the monomer 10-MDP to provide chemical bonding to hard tissue & metals (Matos et al),
- a single-bottle, no-mix adhesive system that performs equally well with any adhesion strategy and bonds to tooth structure & to different direct/indirect restorative materials (Nagarkar and colleagues).
- suitable for clinical applications, e.g. direct/indirect restorations, core build-ups, zirconia primers and dentine densensitising (Perdigao et al)

Bonding agents:The first Universal

Scotchbond Universal Adhesive

- Works with both Total- and Self-Etch technique, therefore high flexibility in clinical procedures
- Provides procedural simplicity
- Total-etch or Selective-enamel etch for highest enamel bond strength, e.g. incisal edges
- Self-etch for low post-op sensitivity
- Fast technique where isolation is difficult, or with non-co-operating patients

Scotchbond Universal Adhesive: Composition

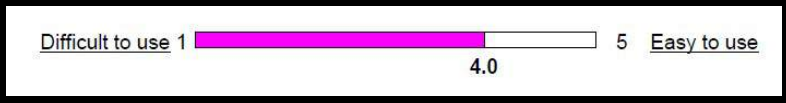
- BisGMA
- MDP
- Vitrebond Copolymer
- HEMA
- Ethanol
- Water
- Filler
- Silane
- Initiators

Handling evaluation of 3M ESPE Scotchbond Universal by the PREP Panel

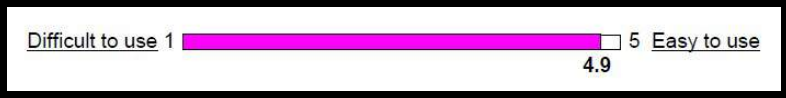
- 12 evaluators
- Variety of bonding agents used pre-study
- 875 restorations placed (Class 1:172, Class II:189, Class III:134, Class IV:178, Class V:182, Other:20)
  Also used for dentinal hypersensitivity, repair of fractured porcelain, bonding of posts.
- Rated material on visual analogue scales
- 75% of evaluators would be prepared to pay extra for the convenience of single-unit doses
- All stated that the resin liquid easily wet the tooth surface, that the bond was easily visible. Some commented that it was “too yellow”

Handling evaluation of 3M ESPE Scotchbond Universal by the PREP Panel

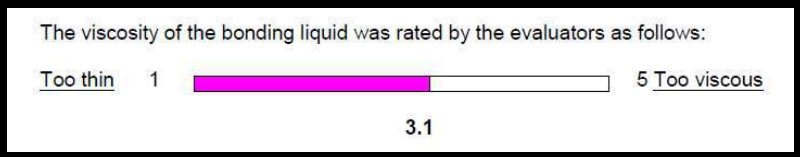
Ease of use of previous bonding agent



Ease of use of Scotchbond Universal



Viscosity of Scotchbond Universal



I switched to Scotchbond Universal Adhesive in September 2012

Much better adhesive performance in wear cases than previously!

Universal Adhesives

New additions are here!

Most contain the resin 10-MDP

What's in it?

- 4-META
- 10-MDP
- 10-Methacroyldecyl dihydrogen thiophospate
- Methacrylate ester
- Acetone
- Distilled water
- Photoinitiators
- Silica fine powder

Coltene One Coat 7 Universal

10-MDP
Methacrylated polyacid
2-HEMA
Urethane dimethacrylate
Photoinitiators
Ethanol
Water

A Universal from Dentsply

What's in it?

10-MDP
PENTA
Initiator
Isopropanol
Water

pH=2.5

SUMMARY: Universal Adhesives:

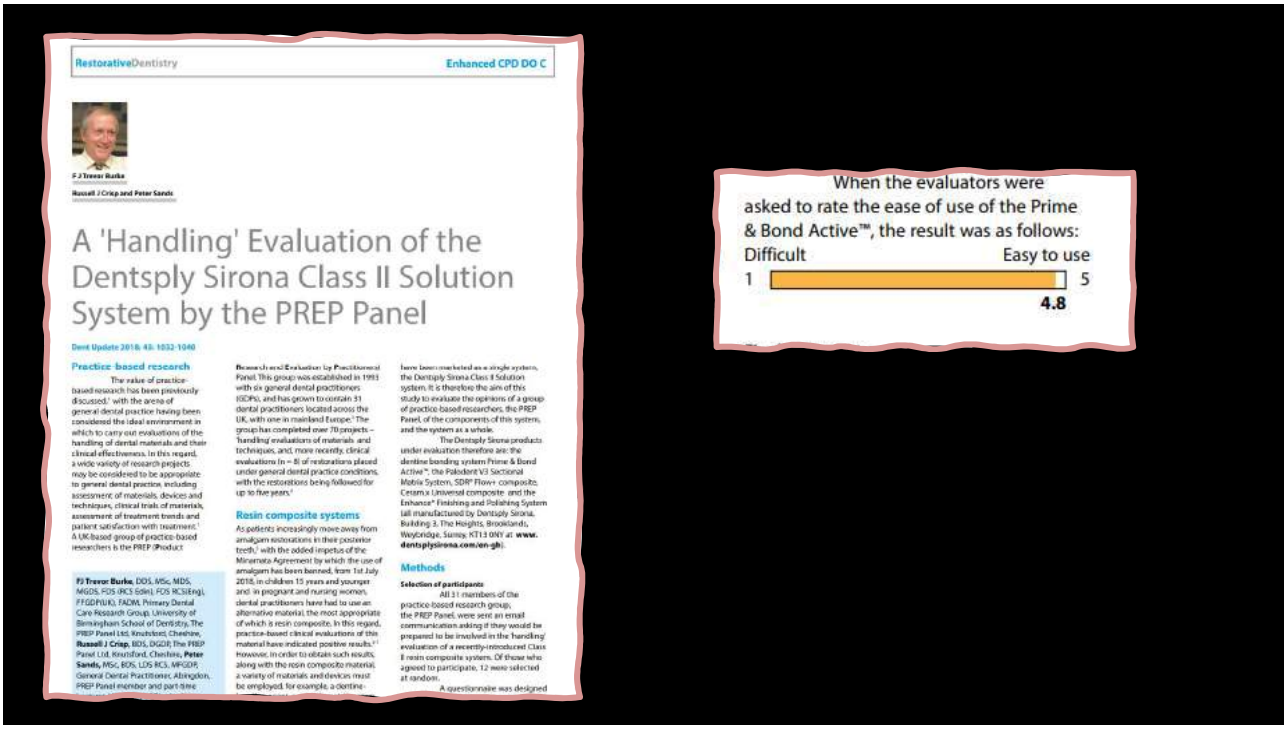
- Can be used in total etch, self etch, selective enamel etch modes
- Are compatible with direct & indirect procedures
- Can be used with self & dual cure luting materials (with separate activator)
- Are suitable primers for silica & zirconia
- Can bond to different substrates (e.g.metal)

The PREP Panel evaluation of G-Premio Bond

2 evaluators, 719 restorations placed

When the evaluators were asked to rate the ease of use of the bonding system which they currently used, the result was as follows:

When the evaluators were asked to rate the ease of use of the G-Premio Bond, the result was as follows:



The PREP Panel evaluation of Zipbond

Background information

When the evaluators were asked to rate the ease of use of the bonding system used prior to the evaluation, the result was as follows:

Difficult to use 1 — 5 Easy to use

4.7

A total of 593 restorations were placed using Zipbond, comprised as follows:

Class 1	149
Class II	186
Class III	96
Class IV	104
Class V	58

The PREP Panel evaluation of Zipbond

A good result!

100% would purchase if available at “average” price

When they were asked if there were any changes the considered essential to the acceptability of the material the following comments were made:

“None”

“Make single dose compule easier to use- may have been just my inexperience using them”

“Packaging of single dose compules a little bulky”

When the evaluators were asked to rate the ease of use of SDI Zipbond, the result was as follows:

Difficult to use 1  5 Easy to use

4.9

CONCLUSION

Universal bonding agents generally represent improved ease of use and performance compared with previous bonding agents

FJ Trevor Burke
Anna Lawson, David JB Green and Louis Mackenzie

What's New in Dentine Bonding?: Universal Adhesives

Abstract: The ability to bond restorations to dentine successfully is central to minimally invasive restorative dentistry. While dentine-bonding agents have gone through a variety of 'generations', it is the purpose of this paper to describe the latest dentine-bonding agents, the Universal Bonding Agents. These materials may be considered 'Universal' insofar as they may be considered to be capable of being used for direct and indirect dentistry, as well as being suitable for use in whichever etching modality the clinician considers appropriate, namely self-etch, etch and rinse or selective enamel etch. Laboratory investigations and initial clinical studies hold the promise that Universal Bonding Agents are a forward step in the quest for the ultimate bond to tooth substance.
CPD/Clinical Relevance: New Universal Bonding Agents appear to present a promising advance in bonding to dentine.
Dent Update 2017; 44: 777 ??

Dentine-bonding agents play a strategic role in the sealing and retention (where necessary) of resin composite restorations, which are increasingly placed by dentists worldwide.[1] Bonding to dentine is also central to the practice of minimally invasive dentistry, given that bonded restorations do not require macro-mechanical retentive features such as locks and keys, which are a feature of non-adhesive (amalgam) cavity preparations.[2]

A dentine-bonding agent should perform the following functions:[3]
- Provide a strong, immediate and permanent bond to dentine;
- Seal the cavity and minimize leakage;
- Resist microbial or enzymatic degradation;
- Provide adhesion per se of the restoration in cases where this is necessary;
- Prevent post-operative sensitivity;
- Reduce the risk of recurrent caries;
- Prevent marginal staining;
- Be easy to use.

It is the intention of this paper to update readers on the new group of Universal Dentine Bonding Agents, this being a follow-up to a paper published in 2004 giving details of the last major innovation in bonding to dentine, the introduction of the so-called self-adhesive dentine bonding agents[3] and to other *Dental Update* publications on the subject which readers may wish to read as background or a further update, such as those by Green and Banerjee,[1] Green, Mackenzie and Banerjee[4] and others.[5,6]

FJ Trevor Burke, DDS, MSc, MDS, MGDS, FDSRCS (Edin), FDS RCS(Eng), FFGDP (UK), FADM, Primary Dental Care Research Group, University of Birmingham School of Dentistry, **Anna Lawson**, BDS, MSc, MFDS RCS (Edin), General Dental Practitioner, Nottingham, **David JB Green**, BDS (Hons), BSc, MFDS RCS(Edin), SHO Restorative Dentistry, Birmingham Dental Hospital and **Louis Mackenzie**, BDS, General Dental Practitioner, Birmingham and University of Birmingham School of Dentistry, 5 Mill Pool Way, Pebble Mill, Birmingham B5 7EG, UK.

A brief history of bonding to dentine

In the past, dentine-bonding agents were classified into generations.[7] However, this means of identifying different groups of bonding agents fell into disarray because of the failure of authorities in the subject to agree on the type of bonding agent which fitted a given 'generation'. Until recently, the classification has therefore been simply, glass ionomer materials, and resin-based dentine-bonding agents, the latter being further classified into etch-and-rinse materials and self-etch materials, with some workers classifying the self-etch materials according to their pH.[8]

There are two principal means by which a bond to dentine may be achieved:[9]
- First, glass ionomer materials (GIC – glass-ionomer cements) which were developed in the 1970s, initially being devised from the Fluoro-Alumino-Silicate glass used in the silicate cement materials which were used until the 1960s, but with the phosphoric acid used in silicate cements being substituted by a

Conclusion from this publication:

New Universal bonding agents are an advance in bonding

Dent.Update.2017:44:328-340

Scotchbond Universal Plus: What's different?

It bonds to caries affected dentine

Does everything that SBU did, but better bond (manufacturer's data)

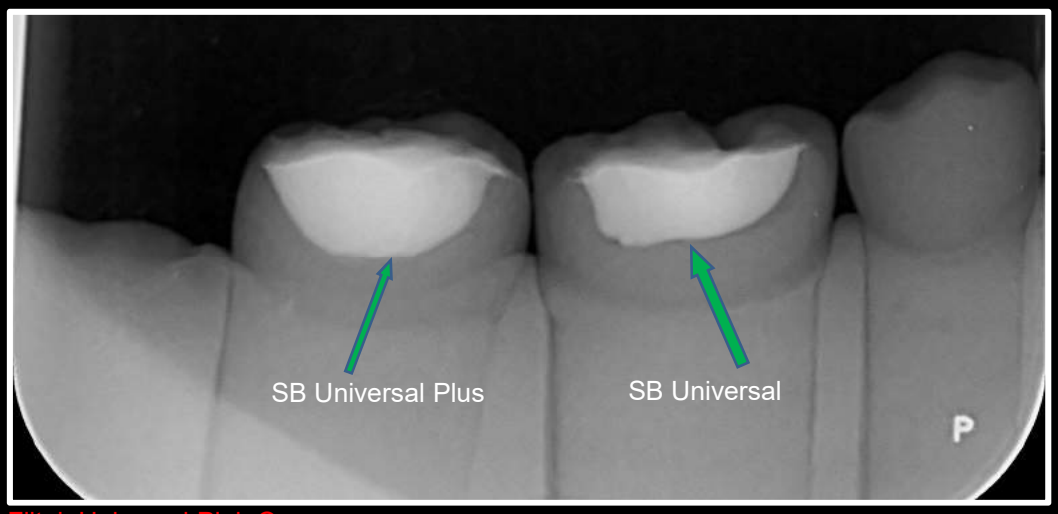
Improved silane

BPA free

The gamechanger

A longstanding question

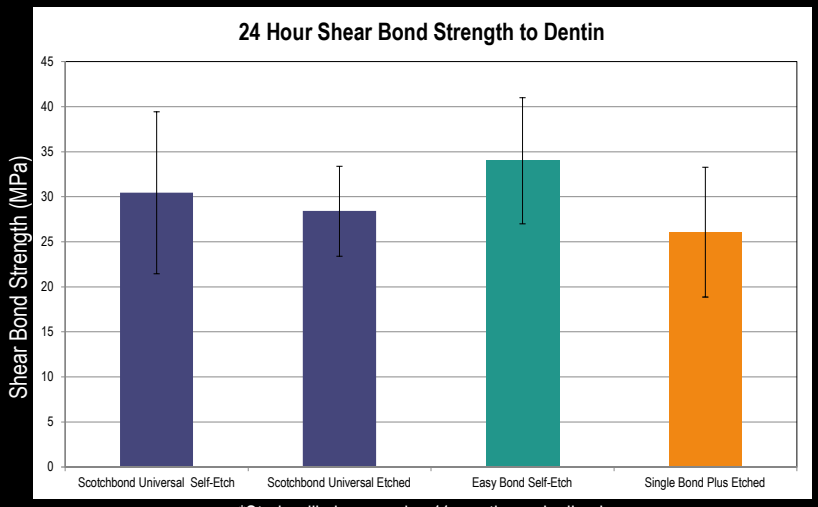
Is it a layer of bond? Or is it caries?



Filtek Universal Pink Opaque

Selective enamel etching …or not?

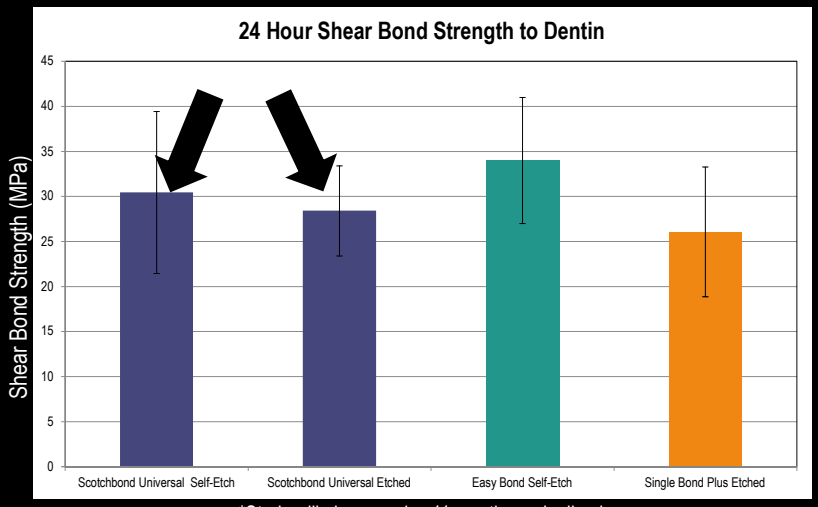
Dentine Shear Bond Strength – Etched and Unetched



*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

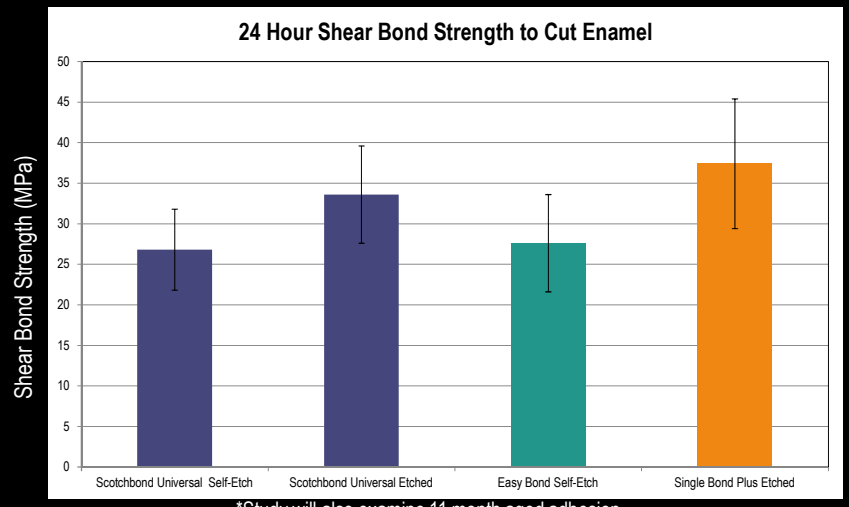
Dentine Shear Bond Strength – Etched and Unetched



*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

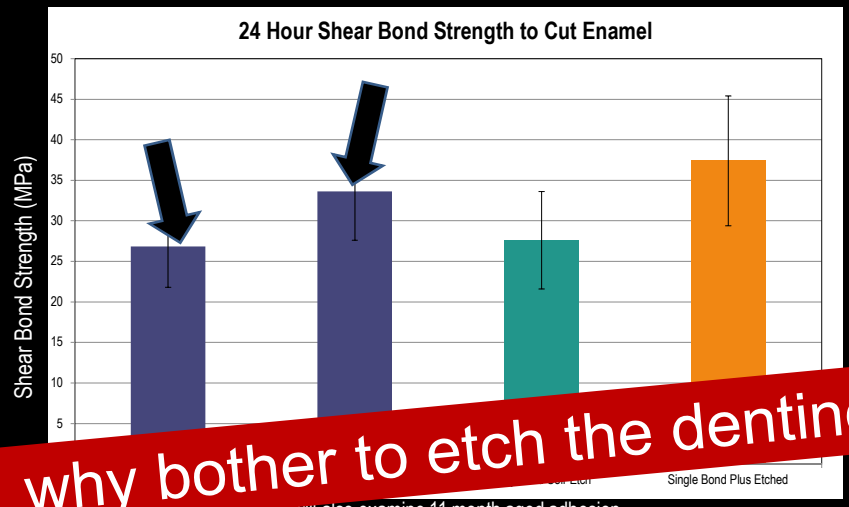
Cut **Enamel** Shear Bond Strength – Etched and Unetched



*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

Cut **Enamel** Shear Bond Strength – Etched and Unetched

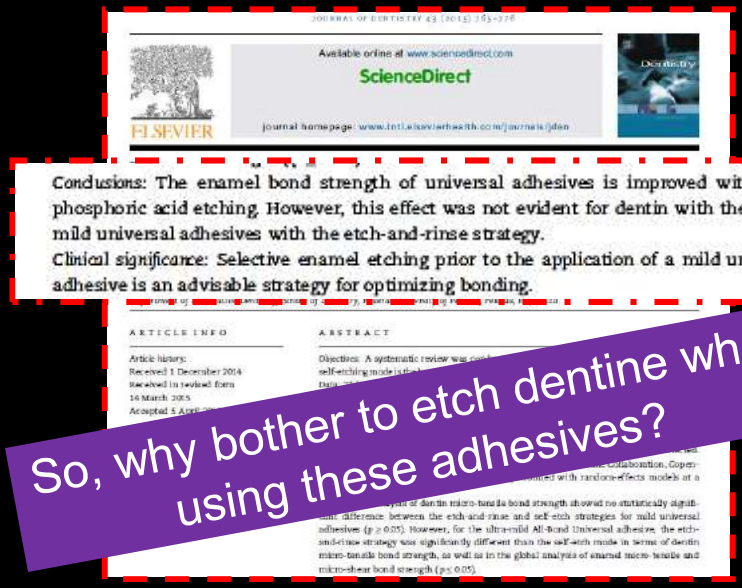


So, why bother to etch the dentine?

Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

Universal adhesives



Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.intl.elsevierhealth.com/journals/jden

Conclusions: The enamel bond strength of universal adhesives is improved with prior phosphoric acid etching. However, this effect was not evident for dentin with the use of mild universal adhesives with the etch-and-rinse strategy.

Clinical significance: Selective enamel etching prior to the application of a mild universal adhesive is an advisable strategy for optimizing bonding.

ARTICLE INFO

ABSTRACT

So, why bother to etch dentine when using these adhesives?

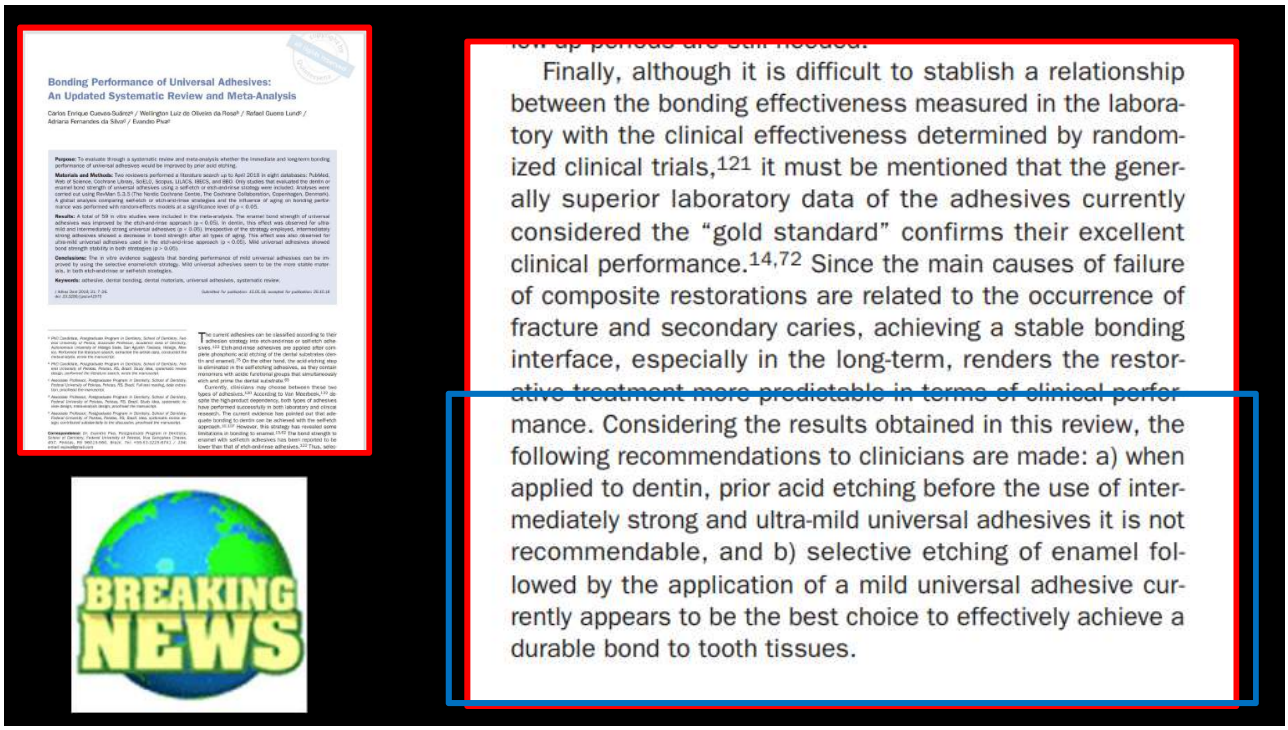
18 pages!!

Shear bond strength tests

Bonding Performance of Universal Adhesives: An Updated Systematic Review and Meta-Analysis

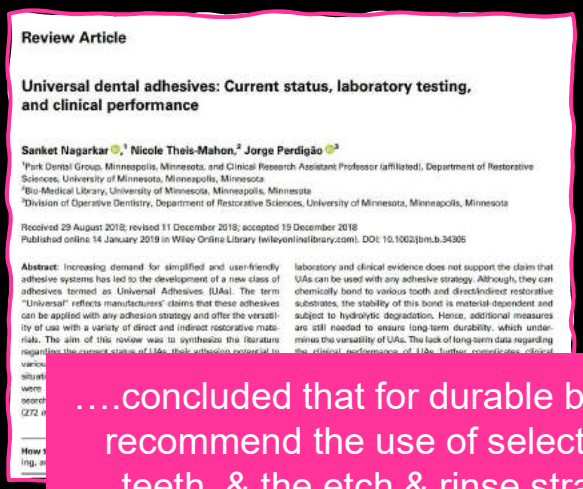
Carlos Enrique Cuevas-Suárez[a] / Wellington Luiz de Oliveira da Rosa[b] / Rafael Guerra Lund[c] / Adriana Fernandes da Silva[d] / Evandro Piva[e]

9284 publications, 81 read in full, 57 reviewed


Bonding Performance of Universal Adhesives:
An Updated Systematic Review and Meta-Analysis
BREAKING
NEWS
Finally, although it is difficult to stablish a relationship between the bonding effectiveness measured in the laboratory with the clinical effectiveness determined by randomized clinical trials,[121] it must be mentioned that the generally superior laboratory data of the adhesives currently considered the "gold standard" confirms their excellent clinical performance.[14,72] Since the main causes of failure of composite restorations are related to the occurrence of fracture and secondary caries, achieving a stable bonding interface, especially in the long-term, renders the restorative treatment more predictable in terms of clinical performance. Considering the results obtained in this review, the following recommendations to clinicians are made: a) when applied to dentin, prior acid etching before the use of intermediately strong and ultra-mild universal adhesives it is not recommendable, and b) selective etching of enamel followed by the application of a mild universal adhesive currently appears to be the best choice to effectively achieve a durable bond to tooth tissues.


SUGGESTION
For Scotchbond Universal,
the
concept of
etching
My hunch is that this applies to all
Universal adhesives

Other recent laboratory review articles



Review Article

Universal dental adhesives: Current status, laboratory testing, and clinical performance

Sanket Nagarkar,[1] Nicole Theis-Mahon,[2] Jorge Perdigão[3]

[1]Park Dental Group, Minneapolis, Minnesota, and Clinical Research Assistant Professor (affiliated), Department of Restorative Sciences, University of Minnesota, Minneapolis, Minnesota
[2]Bio-Medical Library, University of Minnesota, Minneapolis, Minnesota
[3]Division of Operative Dentistry, Department of Restorative Sciences, University of Minnesota, Minneapolis, Minnesota

Received 29 August 2018; revised 11 December 2018; accepted 19 December 2018
Published online 14 January 2019 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/jbm.b.34305

Abstract: Increasing demand for simplified and user-friendly adhesive systems has led to the development of a new class of adhesives termed as Universal Adhesives (UAs). The term "Universal" reflects manufacturers' claims that these adhesives can be applied with any adhesion strategy and offer the versatility of use with a variety of direct and indirect restorative materials. The aim of this review was to synthesize the literature regarding the current status of UAs, their adhesion potential to

laboratory and clinical evidence does not support the claim that UAs can be used with any adhesive strategy. Although, they can chemically bond to various tooth and direct/indirect restorative substrates, the stability of this bond is material-dependent and subject to hydrolytic degradation. Hence, additional measures are still needed to ensure long-term durability, which undermines the versatility of UAs. The lack of long-term data regarding the clinical performance of UAs further complicates clinical

From Buonocore's Pioneering Acid-Etch Technique to Self-Adhering Restoratives. A Status Perspective of Rapidly Advancing Dental Adhesive Technology

Bart Van Meerbeek[a] / Kumiko Yoshihara[b] / Kirsten Van Landuyt[c] / Yasuhiro Yoshida[d] / Marleen Peumans[e]

Summary: This literature-based OPINION PAPER reflects in an introductory historical perspective on the rapid advancement of dental adhesive technology. Past and current techniques to bond to tooth tissue, in particular to dentin as the most challenging bonding substrate, are critically appraised. Including the historical perspective in (1), this paper focuses on fourteen items thought to be of primary importance with regard to the current status of dental adhesive technology. In (2) the primary mechanisms involved in adhesion to enamel and especially dentin are dealt with having (3) also revisited the previously introduced adhesion-decalcification concept (AD concept) as basis of biomaterial-hard tissue interaction; the worldwide accepted classification of today's adhesives into etch&rinse (E&R) and self-etch (SE) adhesives are presented in (4), along with presentation of their respective PLUS-MINUS balances in (5) and (6); nomination of the GOLD-STANDARD E&R (7) and SE (8) adhesives is based on evidence of successful laboratory and long-term clinical performance, resulting in a recommended 3-step full E&R bonding route in (9) and the preferred 3-step combined selective enamel E&R with 2-SE bonding route in (10); (11) description of the main bond-degradation pathways and eight strategies to preserve bond stability; (12) cover-

….concluded that for durable bonding with UAs, laboratory studies recommend the use of selective enamel etching for permanent teeth, & the etch & rinse strategy was "undoubtedly" the best bonding strategy to enamel

October 2015:The first clinical trial on Scotchbond Universal

Journal of Dentistry 43 (2015) 1229–1234

Contents lists available at ScienceDirect

Journal of Dentistry

journal homepage: www.intl.elsevierhealth.com/journals/jden

ELSEVIER

Two-year clinical trial of a universal adhesive in total-etch and self-etch mode in non-carious cervical lesions☆☆

Nathaniel C. Lawson[a,*], Augusto Robles[b], Chin-Chuan Fu[c], Chee Paul Lin[d], Kanchan Sawlani[a], John O. Burgess[a]

[a]University of Alabama at Birmingham School of Dentistry, Clinical and Community Sciences, Division of Biomaterials, 1919 7th Avenue South, Birmingham, AL 35205, USA
[b]University of Alabama at Birmingham School of Dentistry, Restorative Sciences, Division of General Dentistry, 1919 7th Avenue South, Birmingham, AL 35205, USA
[c]University of Alabama at Birmingham School of Dentistry, Restorative Sciences, Division of Prosthodontics, 1919 7th Avenue South, Birmingham, AL 35205, USA
[d]UAB Center for Clinical and Translational Science, 401P Medical towers, 717 11th Ave S, Birmingham, AL 35294, USA

October 2015:The first clinical trial on Scotchbond Universal

37 adults, 126 teeth with NCCLs,
42 in SBU total-etch group
42 in SBU self etch group
42 in SB Multipurpose group

Observed after 24 months

October 2015:The first clinical trial on Scotchbond Universal

Total etch

Marginal discolouration greater in self etch group

Self etch

October 2015:The first clinical trial on Scotchbond Universal

CONCLUSIONS

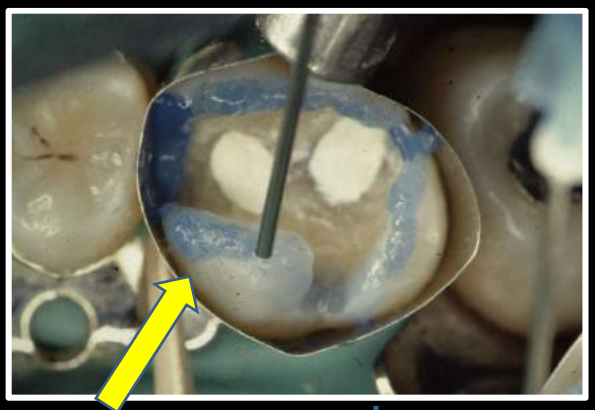
Scotchbond Universal in total etch or self etch modes performed similar to or better than Scotchbond Multipurpose

But, more post-op sensitivity in total etch group

So, why bother to etch dentine when using Scotchbond Universal?

Trevor's view: Use selective enamel etching.

For composite, it is not necessary to wash the etchant off with a 3 in1 syringe. A damped cotton roll or pledget will suffice.



Too much etchant

There is no need to extend the etchant beyond the enamel margin

Recent clinical studies on Universal Adhesives

Scotchbond Universal and Filtek Supreme: RCT

No difference in margins which were etched or not etched.

European Journal of Prosthodontics and Restorative Dentistry (2007) 25: 229-227

A Randomised Controlled Trial of a Universal Bonding Agent at Three Years: Self Etch vs Total Etch

Keywords
Randomized Controlled Trials
Bonding Agent
Self Etching
Total Etching

Authors
Prof. F J Trevor Burke *
Russell John Crisp *
Anthony J Cowan *
Lynda Raybould *
Philip Redfern *
Peter Sands *
Owen Thompsen *
Vahid Ravaghi *

Address for Correspondence
Prof. F J Trevor Burke *
Email: F.T.Burke@bham.ac.uk

* University of Birmingham
# The PREP Panel Ltd
‡ General Dental Practitioner, Buxton, England
* General Dental Practitioner, Wrexham, England
† General Dental Practitioner, Hamilton, Scotland

ABSTRACT

General dental practice is increasingly being recognised as the ideal situation for the conduct of clinical trials into the longevity of restorations. The aim of this study was to investigate the survival of 64 unmilled resin composite (Filtek Supreme XT) restorations placed principally in loadbearing cavities using a Universal dentine bonding agent (Scotchbond Universal), in five UK dental practices by members of the UK based practice based research group, the PREP Panel. A split mouth design was used, comprising patients who required two restorations, with one of the restorations receiving a total etch approach using phosphoric acid and the other being placed using a self etch approach. The results indicated good performance of the restorations examined, with no difference, in terms of marginal characteristics, between the restorations which received total etching and those which did not.

INTRODUCTION

PRACTICE-BASED RESEARCH

It may be considered that dental practice increasingly should become the prime location for clinical dental research, given that dental practice is the real world, and given that, if a technique or material is to be successful, it must be readily operable in the dental practice situation. Practice-based research has been considered as "the silent partner in dental practice, and the scaffolding on which we build and sustain a practice".[1] In addition, the volume of clinical material seen in general dental practice makes dental practice an area of importance in the assessment of new techniques and materials. Since the majority of restorations, worldwide, are placed in the real world of general dental practice, it may be considered that it is here that the performance/survival of restorations should predominantly be assessed.[2]

Therefore, use Scotchbond Universal or a 10-MDP Universal in self etch mode - no etchant to wash off!

Trevor's view on his work!
The numbers were quite small and it was only for 3 years

…slightly contradictory advice from a large Randomised Controlled Trial

(larger numbers, longer observation time)

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.intl.elsevierhealth.com/journals/dema
dental materials
ELSEVIER

Five-year clinical evaluation of a universal adhesive: A randomized double-blind trial

Thalita de Paris Matos[a], Jorge Perdigão[b,], Eloisa de Paula[c,d], Fabiana Coppla[e], Viviane Hass[f], Rafael F. Scheffer[c], Alessandra Reis[a], Alessandro D. Loguercio[a]*

[a] School of Dentistry, Department of Restorative Dentistry, State University of Ponta Grossa, Ponta Grossa, PR, Brazil
[b] University of Minnesota, School of Dentistry, Department of Restorative Sciences, Minneapolis, MN, USA
[c] Department of Restorative Dentistry, School of Dentistry, State University of West Parana, Cascavel, PR, Brazil
[d] Methodist University, Santos, SP, Brazil
[e] School of Dentistry, Centro de Ensino Superior dos Campos Gerais, Ponta Grossa, PR, Brazil
[f] Postgraduate Program in Dentistry, University Northern Parana, Londrina, PR, Brazil

ARTICLE INFO

Keywords:
Universal adhesives
Randomized clinical trial
Etch-and-rinse
Self-etch
Selective enamel etching

ABSTRACT

Objective. To evaluate the five-year clinical performance of Scotchbond Universal Adhesive (SU; 3M Oral Care, St. Paul, MN, USA) in non-carious cervical lesions (NCCLs) using two evaluation criteria.

Methods. Thirty-nine patients participated in this study. Two hundred restorations were assigned to four groups: SU-ERm: etch-and-rinse + moist dentin; SU-ERd: etch-and-rinse + dry dentin; SU-Se: selective enamel etching; and SU-SE: self-etch. A nanofilled composite resin was placed incrementally. The restorations were evaluated at baseline and after 5 years using both the World Dental Federation (FDI) and the United States Public Health Service (USPHS) criteria. The survival rates (retention/fractures) were calculated with the Kaplan-Meier and the log-rank test. For the secondary outcomes, Friedman repeated measures analysis of variance by rank was applied ($\alpha = 0.05$).

Results. After 5 years the recall rate was 86%. The retention/fracture rates were 93% for ERm and ERd, 88.4% for SEet and 81.4% for SE. A significant difference was observed for SE vs. ERd and SE vs. ERm ($p = 0.01$). Also, marginal discoloration and adaptation showed significant differences with ERm and ERd resulting in fewer marginal discrepancies than SE ($p < 0.05$).

Significance. After 5 years, the clinical behavior of the universal adhesive in the etch-and-rinse strategy was better when compared to the self-etch strategy. The use of selective enamel etching is highly recommended for the self-etch strategy. The FDI and USPHS evaluation criteria showed similar results after 5 years.

- SBU etch&rinse + moist dentine
- SBU E&R dry dentine
- SBU selective enamel etch
- SBU self etch

39 patients, 200 Class V restorations, 4 groups

Dent.Mater 2020:36:1474-1485

RESULTS at 5 years

- ✓ Recall rate 86%
- ✓ 19 restorations lost
- ✓ SE restorations 2.6 times more likely to debond
- ✓ Etched margins better, selective enamel etching advised for self etch strategy
- ✓ No difference moist or dry dentine

Dent.Mater 2020:36:1474-1485

Atalay et al*Clin.Oral Investig*.2020:**24:**1569-1578.

3-year performance of Scotchbond Universal used with different adhesive strategies in NCCL.

165 restorations in 35 patients, 3 etch protocols, s*elective enamel etch*, *etch & rinse* and *self-etch*

RESULTS: 98% recvall:
3 restorations (one from each group) failed due to loss of retention.
Only one criterion was significantly different, with restorations in the self-etch mode showing “less satisfying” performance for marginal staining and marginal adaptation.

Oz et al.*J.Appl.Oral Sci*.2019:ISSN 1678-7765.

Randomised Controlled Prospective Trial 20 patients, who each had a minimum of seven NCCLs, total of 155 restorations. Seven different adhesives and application modes were employed.
RESULTS: Recall rate was 82%. Retention rate for worse for the *self-etch* groups.
GLUMA Universal (Hereaus Kulzer, Germany) and All-Bond Universal (Bisco, IL, USA) showed better results in *etch & rinse* and *selective enamel etch* modes, compared with *self-etch* mode
CONCLUSIONS: when the enamel was etched, there were better clinical outcomes, including retention, marginal adaptation and marginal staining.

Three-year Randomized Clinical Study of a One-step Universal Adhesive and a Two-step Self-etch Adhesive in Class II Composite Restorations

Jan WV van Dijken[a] / Ulla Pallesen[b]

Purpose: To evaluate in a randomized clinical evaluation the 3-year clinical durability of a one-step universal adhesive and compare it intraindividually with a 2-step self-etch adhesive in Class II restorations.

Materials and Methods: Each of 57 participants (mean age 58.3 years) received at least two extended Class II restorations that were as similar as possible. The cavities in each of the 60 individual pairs of cavities were randomly distributed to the 1-step universal adhesive (All-Bond Universal: AU) and the control 2-step self-etch adhesive (Optibond XTR: OX). A low shrinkage composite (Ariste LS) was used for all restorations, which were evaluated using slightly modified USPHS criteria at baseline and 1, 2, and 3 years.

Results: 114 Class II restorations were evaluated at three years. Eight restorations, 3 AU and 5 OX, failed during the follow-up, resulting in 94.7% (AU) and 91.2% (OX) success rates ($p > 0.05$). Annual failure rates were 1.8% and 2.9%, respectively. The main reason for failure was composite fracture.

Conclusion: Class II composite restorations placed with a 1-step universal adhesive showed good short-term efficacy.

Keywords: adhesive, clinical, posterior, composite, self etch, universal.

Dental adhesives are generally classified as etch-and-rinse (E&R) or self-etch (SE) systems. E&R adhesives have been acknowledged as the most effective approach, but they are also very technique sensitive, with a risk of collagen fiber collapse and incomplete impregnation of the entire depth of demineralized dentin.[44] Self-etch adhesives contain acidic monomers, which simultaneously demineralize and infiltrate the dental tissues. In both type of adhesives, the primer and bonding agent can be used separately or combined, depending on the system. The mild SE adhesives partially demineralize dentin, leaving a substantial amount of hydroxyapatite crystals around the collagen fibrils.[47] Due to the relatively low acidity of most SE adhesives, enamel etching is less effective and does not produce

Stronger self-etch adhesives have been introduced with better etching performance on enamel, but with inferior bonding to dentin and higher clinical failure rates.[32,45] To ensure a durable bond to both enamel and dentin, etching of enamel margins with phosphoric acid combined with application of a mild self-etch adhesive on both enamel and dentin (the so-called selective etching approach) has been suggested.[45] A recent meta-analysis showed that the retention of restorations placed in NCCLs (non-carious cervical lesions) were improved by the selective enamel etching approach, confirming the higher enamel bond strength reported in vitro after selective etching.[4,10,15,27]

A novel adhesive approach was the introduction of the first multi-mode universal adhesives in 2012. These are

Van Dijken JWV, Pallesen U. *J.Adhes.Dent*.2017:**19**:287-294.

3 year clinical evaluation of All Bond Universal: Bisco, IL, USA) with the control, the 2-step *self-etch* adhesive Optibond XTR (Kerr, Orange CA, USA).

*RESULTS:*114 "extended" Class II resin composite restorations were assessed. 8 restorations failed, principally due to composite fractures. The success rate of the restorations placed with the UA adhesive was 94.7% and the control 91.2%.

CONCLUSION:
Class II restorations placed using a one-step UA showed good short time performance.

Clinical Trial > Am J Dent. 2019 Oct;32(5):223-228.

Three-year clinical evaluation of universal adhesives in non-carious cervical lesions

Vanessa C Ruschel [1], Sheila C Stolf [1], Shizuma Shibata [2], Yunro Chung [3], Lee W Boushell [4], Luiz N Baratieri [1], Ricardo Walter [5]

Affiliations + expand

PMID: 31675189

Abstract

Purpose: To compare the performance of universal adhesives containing different monomers, namely 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP) and dipentaerythritol penta-acrylate monophosphate (PENTA), in the restoration of non-carious cervical lesions (NCCLs).

Methods: This was a randomized controlled clinical trial involving 63 subjects in need of restorations of 203 NCCLs. Notch-shaped lesions were restored with Kalore (GC Corporation) after application of Scotchbond Universal (SU) or Prime&Bond Elect (PBE) following the etch-and-rinse (ER) or self-etch (SE) technique. Restorations were assessed after 1 week, 18 and 36 months. Logistic regression was performed for each outcome separately with compound symmetric variance-covariance structure assumed to consider a correlation of restorations within subjects. All analyses were conducted using SAS 9.4 (SAS).

Results: 150 teeth in 41 subjects were assessed at 36 months. Three restorations in the PBE_SE group failed the retention criterium. Statistically significant differences were reached for the following comparisons: restorations with SU_SE were 75% less likely to maintain a score of Alfa for marginal discoloration than PBE_SE; restorations with PBE_SE were 83% less likely to maintain a score of Alfa for marginal adaptation than PBE_ER.

Clinical significance: More than 20% of restorations restored with universal adhesives developed marginal degradation after 36 months. The impact of phosphoric acid on the restoration seems to be

Ruschel VC et al. *Am.J.,Dent*.2019:**32**:223-228.

3 year clinical evaluation
Two UAs (Scotchbond Universal (SBU:3M) and Prime&Bond Elect (PBE:Dentsply) used in either *self-etch* or *etch & rinse* modes.

*RESULTS:*150 restorations assessed:
3 restorations in the PBE self-etch group failed due to loss of retention,

CONCLUSION:
Restorations with etched margins were more likely to score optimally for marginal discolouration than in the self-etch groups.

CONCLUSIONS, loud and clear

Selective enamel etching provides best margins, but also contributed to restoration retention in NCCL in some studies

What I plan to talk about

- The evolution of dentine bonding agents via resin luting cements
- The development of contemporary bonding agents
- Choosing the right material and using it correctly!
- If bonding is as good as this…….
- Alternatives!
- Final thoughts

Me too:
Are own label brands a threat to the development of new materials?

Comment

Me too

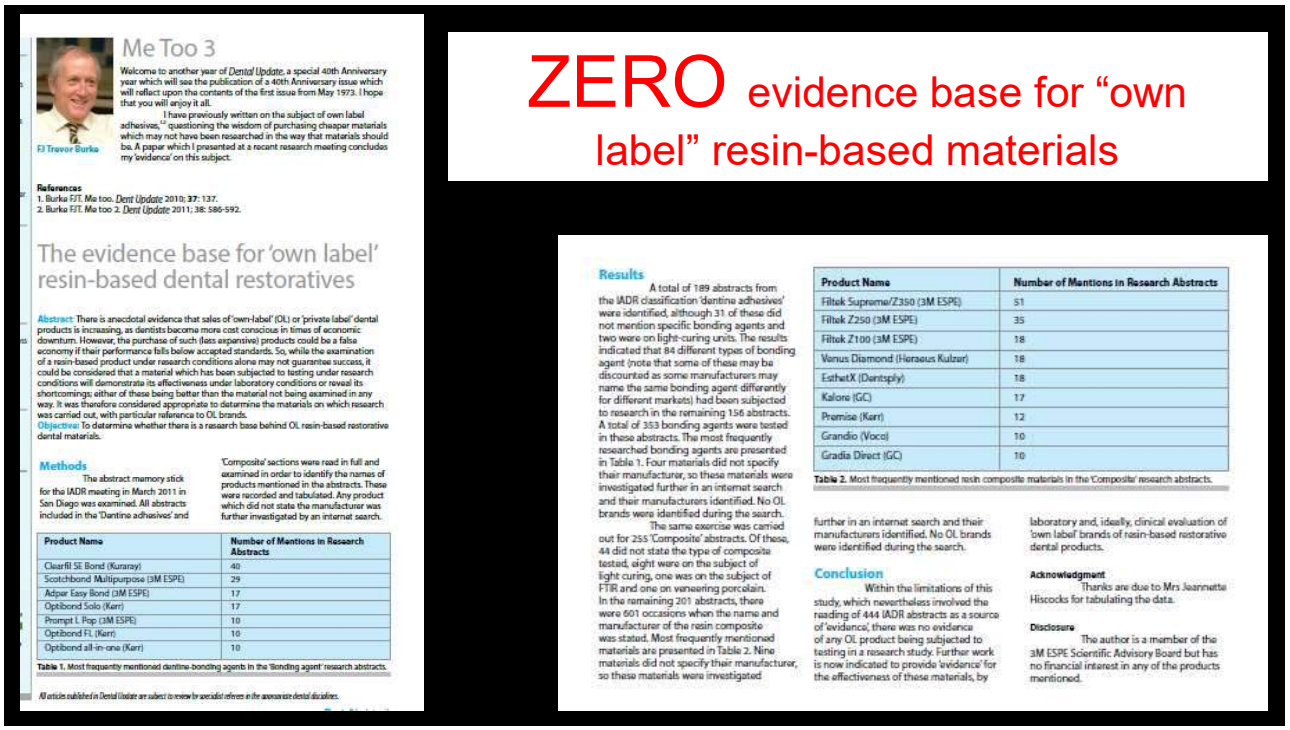
There is no evidence base for "own label" Glass Ionomer materials

DentalMaterials

Steffen Mickenautsch

How Well are GIC Product Labels Related to Current Systematic Review Evidence?

Abstract: Systematic reviews have been recommended as providing the best source of evidence to guide clinical decisions in dentistry. They appraise evidence from trials focused on investigating clinical effects of dental material categories, such as conventional glass-ionomer cements (GIC) or resin-modified GIC. In contrast, the general dental practitioner is introduced to these categories of materials in the form of branded or private product labels that are marketed during dental conventions or through advertisements. Difficulties may arise in recognizing material categories that have been subjected to systematic reviews, because of the multitude of product labels on the current market. Thus, the value and relevance of published systematic review evidence concerning the material categories represented by these labels may remain obscure. Based on a systematic literature search, this article identifies glass-ionomer cement product labels used during clinical trials which, in turn, were subsequently reviewed in systematic review articles (published between 15 April 2009 and 14 April 2011). This article further clarifies how these product labels relate to the systematic review conclusions. The results show that the conventional and resin-modified glass-ionomer cements that were used in most trials were marketed by GC and 3M ESPE, respectively. The conventional GICs used in most of the reviewed trials were Fuji III and Fuji IX, while Vitremer was the most commonly used resin-modified GIC. Evidence from the reviewed trials suggests that GIC provides beneficial effects for preventive and restorative dentistry. However, more trials of higher internal validity are needed in order to confirm (or disprove) these findings. Only GIC products of branded labels and none of private labels were identified, suggesting that private label GIC products have little or no research back-up.
Clinical Relevance: Dental products, such as glass-ionomers cements (GIC), can only be judged as effective when they are based on sufficient research back-up. Systematic reviews of clinical trials provide such back-up at the highest level. Thus clinicians must be able to identify GIC products for which reliable evidence from systematic reviews of clinical studies is available and know about what such evidence contains.
Dent Update 2011; 38: 634–644



Me Too 3

FJ Trevor Burke

Welcome to another year of *Dental Update*, a special 40th Anniversary year which will see the publication of a 40th Anniversary issue which will reflect upon the contents of the first issue from May 1973. I hope that you will enjoy it all.

I have previously written on the subject of own label adhesives,[1,2] questioning the wisdom of purchasing cheaper materials which may not have been researched in the way that materials should be. A paper which I presented at a recent research meeting concludes my 'evidence' on this subject.

References

1. Burke FJT. Me too. *Dent Update* 2010; **37**: 137.
2. Burke FJT. Me too 2. *Dent Update* 2011; 38: 586-592.

The evidence base for 'own label' resin-based dental restoratives

Abstract: There is anecdotal evidence that sales of 'own-label' (OL) or 'private label' dental products is increasing, as dentists become more cost conscious in times of economic downturn. However, the purchase of such (less expensive) products could be a false economy if their performance falls below accepted standards. So, while the examination of a resin-based product under research conditions alone may not guarantee success, it could be considered that a material which has been subjected to testing under research conditions will demonstrate its effectiveness under laboratory conditions or reveal its shortcomings; either of these being better than the material not being examined in any way. It was therefore considered appropriate to determine the materials on which research was carried out, with particular reference to OL brands.

Objective: To determine whether there is a research base behind OL resin-based restorative dental materials.

Methods

The abstract memory stick for the IADR meeting in March 2011 in San Diego was examined. All abstracts included in the 'Dentine adhesives' and 'Composite' sections were read in full and examined in order to identify the names of products mentioned in the abstracts. These were recorded and tabulated. Any product which did not state the manufacturer was further investigated by an internet search.

Product Name	Number of Mentions in Research Abstracts
Clearfil SE Bond (Kuraray)	40
Scotchbond Multipurpose (3M ESPE)	29
Adper Easy Bond (3M ESPE)	17
Optibond Solo (Kerr)	17
Prompt L Pop (3M ESPE)	10
Optibond FL (Kerr)	10
Optibond all-in-one (Kerr)	10

Table 1. Most frequently mentioned dentine-bonding agents in the 'Bonding agent' research abstracts.

All articles published in Dental Update are subject to review by specialist referees in the appropriate dental disciplines.

ZERO evidence base for "own label" resin-based materials

Results

A total of 189 abstracts from the IADR classification 'dentine adhesives' were identified, although 31 of these did not mention specific bonding agents and two were on light-curing units. The results indicated that 84 different types of bonding agent (note that some of these may be discounted as some manufacturers may name the same bonding agent differently for different markets) had been subjected to research in the remaining 156 abstracts. A total of 353 bonding agents were tested in these abstracts. The most frequently researched bonding agents are presented in Table 1. Four materials did not specify their manufacturer, so these materials were investigated further in an internet search and their manufacturers identified. No OL brands were identified during the search.

The same exercise was carried out for 255 'Composite' abstracts. Of these, 44 did not state the type of composite tested, eight were on the subject of light curing, one was on the subject of FTIR and one on veneering porcelain. In the remaining 201 abstracts, there were 601 occasions when the name and manufacturer of the resin composite was stated. Most frequently mentioned materials are presented in Table 2. Nine materials did not specify their manufacturer, so these materials were investigated further in an internet search and their manufacturers identified. No OL brands were identified during the search.

Product Name	Number of Mentions in Research Abstracts
Filtek Supreme/Z350 (3M ESPE)	51
Filtek Z250 (3M ESPE)	35
Filtek Z100 (3M ESPE)	18
Venus Diamond (Heraeus Kulzer)	18
EstheteX (Dentsply)	18
Kalore (GC)	17
Premise (Kerr)	12
Grandio (Voco)	10
Gradia Direct (GC)	10

Table 2. Most frequently mentioned resin composite materials in the 'Composite' research abstracts.

Conclusion

Within the limitations of this study, which nevertheless involved the reading of 444 IADR abstracts as a source of 'evidence', there was no evidence of any OL product being subjected to testing in a research study. Further work is now indicated to provide 'evidence' for the effectiveness of these materials, by laboratory and, ideally, clinical evaluation of 'own label' brands of resin-based restorative dental products.

Acknowledgment

Thanks are due to Mrs Jeannette Hiscocks for tabulating the data.

Disclosure

The author is a member of the 3M ESPE Scientific Advisory Board but has no financial interest in any of the products mentioned.

European Journal of Prosthodontics and Restorative Dentistry (2006) 24, 122-129

Keywords

Filler
Degree of Conversion
Own Label
Private Label
Resin Composite
Flexural Modulus

'Own-Label' Versus Branded Commercial Dental Resin Composite Materials: Mechanical And Physical Property Comparisons

Authors

Dr Kathryn Shaw *
(MJDF (RCS Eng.))

Dr Ricardo Martins *
(LMD, MSc)

Dr Mohammed Abdul Hadis *
(PhD, BSc (Hons.))

Prof Trevor Burke *
(BDS, MDS, DDS, MSc, MGDS, FDS RCS (Edin.), FDS RCS (Eng.), FFGDP(UK), FADM)

Prof William Palin *
(BMedSci, MPhil, PhD, MSc, FADM)

ABSTRACT

A majority of dental materials are manufactured by companies who have experience in the field. However, a number of "own label" materials have become available, principally marketed by distributors and other companies with little or no experience in the field. These materials are attractive because of their reduced cost, but they may have no research on which clinicians might base their potential performance. It is therefore the purpose of this work to compare the performance of different batches of a number of "own-label" dental materials with a similar number from manufacturers with experience in the field, using a variety of laboratory test regimes which include filler determination, degree of conversion, flexural strength and flexural modulus, in order to evaluate key material properties. The results indicated that own-label dental resin composites produced similar results to materials from established companies in terms of flexural strength characteristics and degree of conversion. However, a greater batch-to-batch variation in several mechanical and physical properties of the own-label materials was noted.

Some own label materials performed as well in testing as those from manufacturers in the field

However, greater batch to batch variation in several mechanical & physical properties of the own-label materials was noted

Is it worth using low-cost glass ionomer cements for occlusal ART restorations in primary molars? 2-year survival and cost analysis of a Randomized clinical trial

Isabel Cristina Olegário[a,b], Nathalia de Miranda Ladewig[b], Daniela Hesse[c], Clarissa Calil Bonifácio[c], Mariana Minatel Braga[b], José Carlos Pettorossi Imparato[b], Fausto Medeiros Mendes[b], Daniela Prócida Raggio[b,*]

SHORT ANSWER!

NO! They don't last as long, and, despite the fact that Fuji IX is more expensive, they are not cost-effective.

The "evidence" for Own Label Brands

In the current situation, it might be tempting to save £s on materials, but the saving should be considered alongside the cost of one premature failure

Patients care more about dental materials than I suspected!

A practice-based assessment of patients' knowledge of dental materials

F. J. T. Burke*[1,2] and R. J. Crisp[1,2]

IN BRIEF

- Suggests that dental practice should be the prime location for clinical dental research.
- Discusses patients concerns regarding which dental materials are used.
- Demonstrates that patients care strongly that the materials are of a high quality and have been thoroughly researched.

RESEARCH

Aims It is the aim of this study to determine, by means of a questionnaire completed by patients attending ten UK dental practices, patients' level of knowledge on dental materials and techniques. **Materials and methods** Members of The PREP (Product Research and Evaluation by Practitioners) Panel were asked to recruit patients to participate in a questionnaire-based assessment of their knowledge of dental materials. **Results** Two hundred and forty-nine patients took part in the questionnaire. Sixty-three percent (n = 157) of the respondents were female and 92% (n = 229) of the respondents stated they were regular attenders at the dental practice. The respondents were asked how important the quality of dental materials used in their mouth was, and on a Visual Analogue Scale (VAS) where 1 = not important and 10 = very important, the result was 9.6. The same score was recorded when they were asked how important it was that the materials used in their mouth were supported with relevant clinical research evidence and long term data of the success of the material. They were also questioned on the subjects of price, manufacturer, source or material and type of filling material. A significant amount of respondents demonstrated that they had concerns over the use of amalgam. **Conclusions** Respondents expressed strong views that the materials used on their teeth should have a robust evidence base and they care about the materials that are used in their mouths.

Refereed Paper
Accepted 9 November 2015
DOI: 10.1038/sj.bdj.2015.956
*British Dental Journal 2015; 219: 577-582

BRITISH DENTAL JOURNAL VOLUME 219 NO. 12 DEC 18 2015

10 members of the PREP Panel
Ethical approval
Questionnaire to 250 patients
249 useable responses

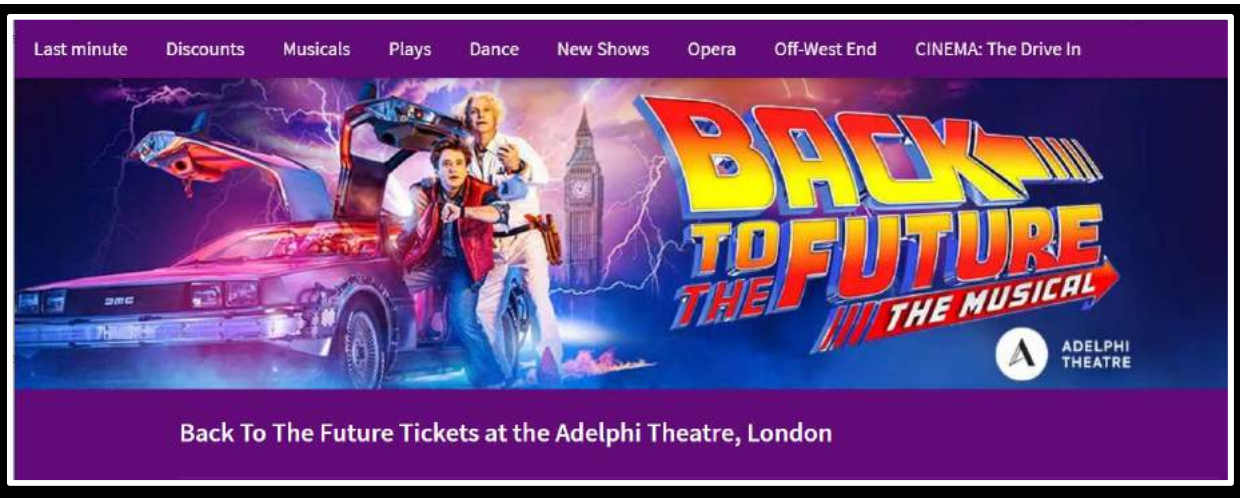
Refereed Paper
Accepted 9 November 2015
DOI: 10.1038/sj.bdj.2015.956
*British Dental Journal 2015; 219: 577-582

BRITISH DENTAL JOURNAL VOLUME 219 NO. 12 DEC 18 2015

CONCLUSIONS:

- Patients feel that materials should have a robust evidence base, produced by manufacturers with experience in the field
- Patients care about the materials that we use
- Almost half did not wish “own label” materials to be used in their mouths
- One third expressed anxieties regarding the use of amalgam in their teeth

Anyone prefer a 2-bottle (plus etch) system to a one-bottle bonding system?



A new 2-bottle bonding system

Released recently!

…another alternative to Optibond FL, perhaps?

Some slides from GC

Bart van Meerbeck's "wish list": What is the ideal modern bonding approach with multi-step adhesive?

The ideal adhesive system should contain:

1. A separate primer
   - Acting as the adhesion promoter; **allows use of selective enamel etching**
   - with **chemical bond** ability based on **10-MDP**
   - **containing also photo-initiators**, to make sure all areas, even in the deeper parts of the hybri… layer, will be covered by photo-initiators
2. A separate bonding agent that can be light-cured immediately
   - **Solvent-poor/free adhesive resin, hydrophobic** to reduce the water uptake
   - applied in a **sufficient thick layer**, with stress-absorbing potential like flowable composite & presenting high mechanical properties
   - that provides a **good seal of the interface**

G-2 Bond Universal contains all these features

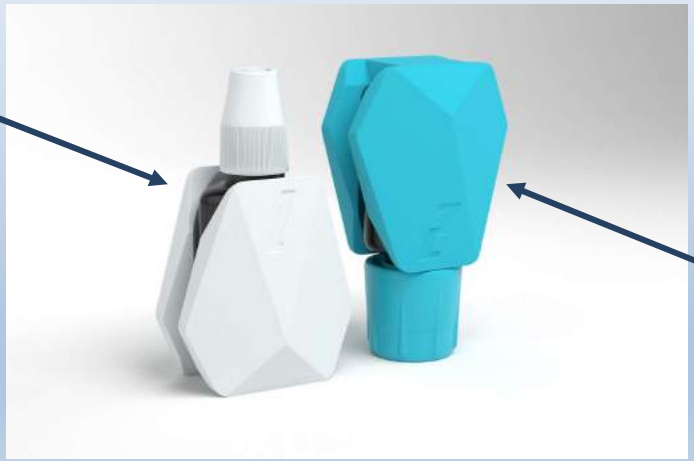
Buonocore's Pioneering Acid Etch Technique to Self Adhering Restoratives. A Status Perspective of Rapidly Advancing Dental Adhesive Technology. Van Meerbeek et al. Journal of Adhesive Dentistry.2020:22:7-34

G2-BOND Universal

- All-round 2-bottle Universal Bonding system

G2-BOND Universal
1-PRIMER

- **Self-etching** process
- **Chemical BOND** to tooth structure with MDP
- **Photoinitiator:** cures in depth of hybrid layer
- **HEMA free** for long-term durability



G2-BOND Universal
2-BOND

- **Hydrophobic,** solvent **& HEMA free** for long term durability
- **Sufficient thick layer** that can absorb & relieve stress
- **High mechanical properties**
- Seal the interface

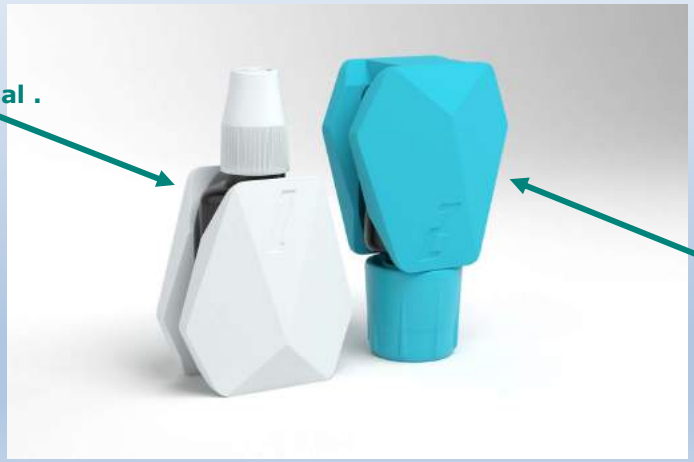
G2-BOND Universal - Composition

G2-BOND Universal .
1-PRIMER

4MET, MDP, MDTP,

Dimethacrylates
Water, Acetone,

Photoinitiator ,
Filler



G2-BOND Universal .
2-BOND

Dimethacrylates,

Bis GMA, Fillers,
Photoinitiator

NO SOLVENT

G2-BOND Universal

G2-BOND Universal is a universal 2-bottle system, offering

- Clinician's preferred etching mode
- Superior durability and bond strength
- Superior resistance to marginal staining
- Optimal film thickness & flexural strength which can provide shock absorbing features
- Superior dispensing and low technique sensitivity
- Multiple indications

£ £ £ £ £ £ £ £ £ £ £ £ £ £ £

How much does one *sensitive* posterior composite cost?

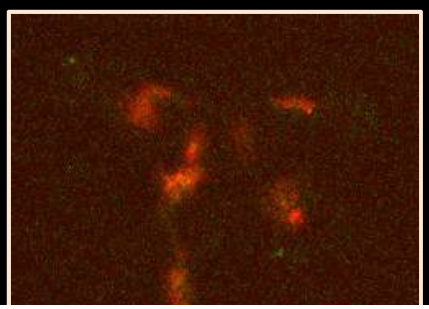
Avoiding post-op sensitivity when using dentine adhesives

- Use a *so-called* self etch or Universal Bonding Agent, and *DO NOT* etch the dentine
- Do not overdry the dentine
- Rub it in!
- Ensure good adaptation at the gingival margin (indeed, all margins)
- Use a reliable manufacturer's material
- Ensure adequate light curing

IMPORTANT!

..last

What is this?



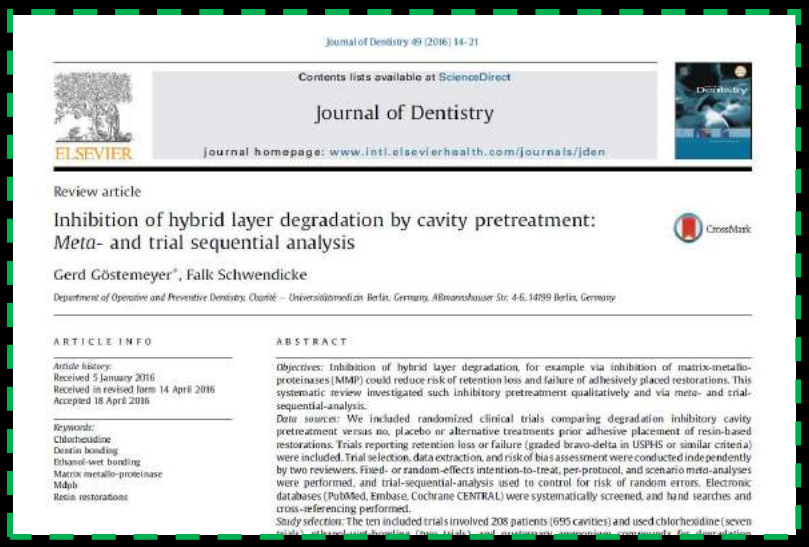
This is a matrix metalloproteinase!

Suggestions for inactivation of MMPs

- EDTA
- Glutaraldehyde
- Carbodiimide
- Chlorhexidine
- Quarternary ammonium salts (eg MDPB)

Trevor's view: At present, this is a theoretical concept

Latest *clinical* research on MMPs



Journal of Dentistry 49 (2016) 14–21

Contents lists available at ScienceDirect

Journal of Dentistry

journal homepage: www.intl.elsevierhealth.com/journals/jden

Review article

Inhibition of hybrid layer degradation by cavity pretreatment: *Meta-* and trial sequential analysis

Gerd Göstemeyer*, Falk Schwendicke

Department of Operative and Preventive Dentistry, Charité – Universitätsmedizin Berlin, Germany, Aßmannshauser Str. 4-6, 14199 Berlin, Germany

ARTICLE INFO

Article history:
Received 5 January 2016
Received in revised form 14 April 2016
Accepted 18 April 2016

Keywords:
Chlorhexidine
Dentin bonding
Ethanol-wet bonding
Matrix metallo-proteinase
Mdph
Resin restorations

ABSTRACT

Objectives: Inhibition of hybrid layer degradation, for example via inhibition of matrix-metallo-proteinases (MMP) could reduce risk of retention loss and failure of adhesively placed restorations. This systematic review investigated such inhibitory pretreatment qualitatively and via *meta-* and trial-sequential-analysis.

Data sources: We included randomized clinical trials comparing degradation inhibitory cavity pretreatment versus no, placebo or alternative treatments prior adhesive placement of resin-based restorations. Trials reporting retention loss or failure (graded bravo-delta in USPHS or similar criteria) were included. Trial selection, data extraction, and risk of bias assessment were conducted independently by two reviewers. Fixed- or random-effects intention-to-treat, per-protocol, and scenario *meta*-analyses were performed, and trial-sequential-analysis used to control for risk of random errors. Electronic databases (PubMed, Embase, Cochrane CENTRAL) were systematically screened, and hand searches and cross-referencing performed.

Study selection: The ten included trials involved 208 patients (695 cavities) and used chlorhexidine (seven

Latest *clinical* research on MMPs

Given the high risk of bias and the limited quantity of evidence, our findings were graded as being supported by very weak evidence only. Therefore, degradation inhibitory cavity pretreatment prior adhesively placing resin-based restorations can neither be recommended nor refuted.

Phew!

In conclusion, there is [illegible] evidence to recommend or refute hybrid layer degradation inhibitory cavity pretreatment prior adhesively placing resin-based restorations. Based on this review and the included studies, dentists could pretreat cavities prior adhesively placing restorations (for example as part of re-wetting the cavity, or introduced to an adhesive), while evidence supporting this strategy is lacking. The impact of further effects (e.g. disinfection, pulp-irritation) of pretreatment remains unclear.

Regarding MMPs

The way to obviate problems is to protect the collagen by thorough resin infilatration

Should we be worried about MMPs?

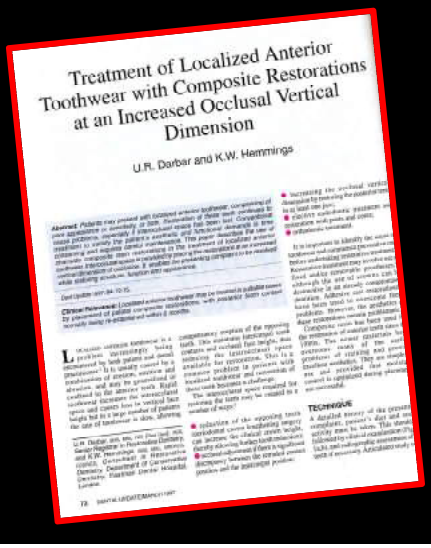
The evidence at present says no

What I plan to talk about

- The evolution of dentine bonding agents via resin luting cements
- The development of contemporary bonding agents
- Choosing the right material and using it correctly!
- If bonding is as good as this…….
- Alternatives!
- Final thoughts

A *Dental Update* first

Durbar UR, Hemmings KW. Treatment of localised anterior toothwear with composite restorations at an increased occlusal vertical dimension. Dent.Update.1997:**24**:72-75.



Treatment of Localized Anterior Toothwear with Composite Restorations at an Increased Occlusal Vertical Dimension

U.R. Durbar and K.W. Hemmings

RESTORATIVE DENTISTRY

Read more!
Br.Dent.J.1999:186: 614-617

PRACTICE
restorative dentistry

Incisal edge reattachment: indications for use and clinical technique

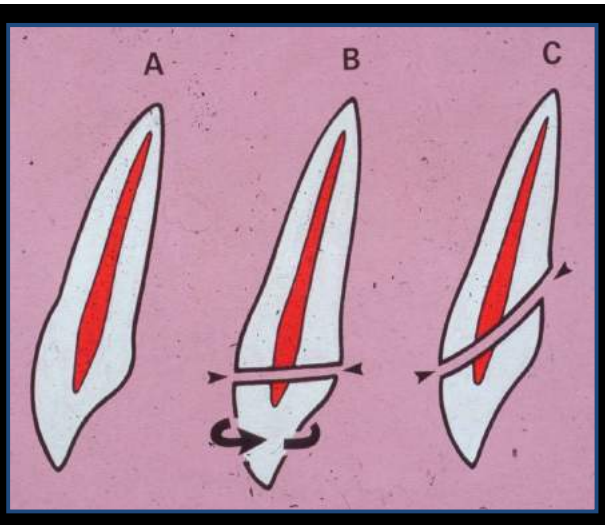
D. F. Murchison,[1] F. J. T. Burke,[2] and R. B. Worthington,[3]

This article presents an overview of the evolution of the incisal edge reattachment procedure. Case reports are described of patients presenting with traumatised teeth in which the reattachment procedure was performed. A review is provided of present in vivo studies detailing long-term success rates in the clinical application of this procedure. Finally, a recommended technique for diagnosis and treatment is offered to improve success in this procedure which may benefit a significant segment of the paediatric and adolescent populations.

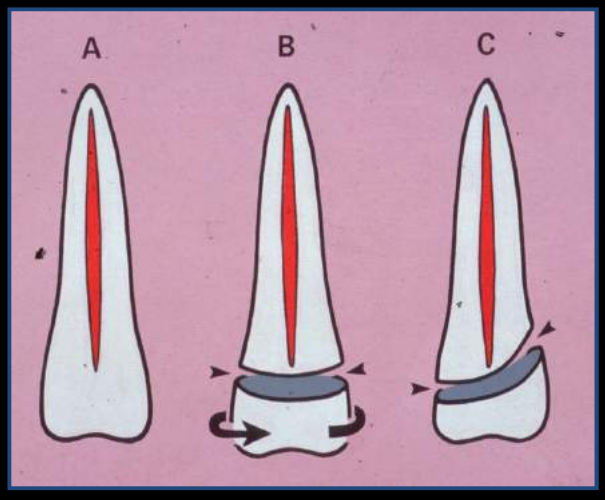
In brief

- Anterior crown fractures are commonplace in children and adolescents and may affect up to 25% of this patient population.
- If an intact tooth fragment is present after trauma, the incisal edge reattachment procedure presents a conservative, simple and aesthetic treatment.
- Clinical trials and long-term follow-up have reported that reattachment using modern dentine bonding agents or adhesive luting systems may achieve functional and aesthetic success for up to 7 years.
- Reattachment failures may occur with new trauma, parafunction, or horizontal traction. Athletic soft mouthguards and patient education may enhance clinical success.

Burke F.J.T. Reattachment of a fractured central incisor tooth fragment. Br.Dent.J. 1991:170: 223-225.



Achieving resistance form in an adhesive preparation should help protect the bond



Long term survival of fragment bonding in the treatment of fractured crowns

Andreasen FM, Noren JG, Andreasen JO, Englehardsen S. et al.,
Quintessence Int.1995:26:669-681

…reattachment of the coronal fragment is a realistic alternative **Andreasen et al**

- Good fragment retention, acceptable aesthetics
- Use of a dentine bonding agent with acid etching provides greater strength
- Fragment loss was usually due to a second blow
- Not a successful means of managing crown-root fractures

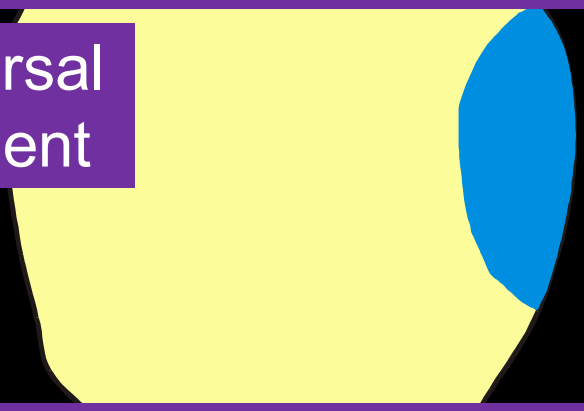
Approx 25% of 334 rebonded fragments were retained at 7 years after bonding

If bonding is as good as this….

We can use a non-retentive cavity design and bond composite to it

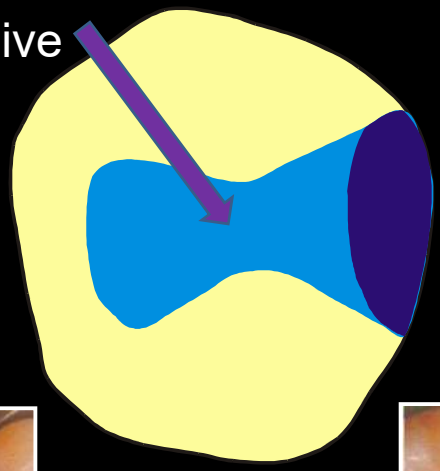
Is this non-retentive adhesive cavity design the cavity of choice for the COVID 19 era?

Use a Universal bonding agent



This can be cut without a turbine

Another advantage:
Massive tooth substance saved by using an adhesive composite restoration



Saucer-shaped cavity preparations for posterior approximal resin composite restorations:Observations up to 10 years.

Nordbo H. et al. Quintessence Int.1998;29;5-11

CONCLUSION: It is concluded that the saucer-shaped resin composite restoration represents a viable treatment modality for small cavities. The time may have come to include it in dental curricula as a routine operative treatment for small class II lesions.

If bonding
is as good as this….

FAQ Do I need to place a lining/base under composite restorations?

HISTORY

- Oldies were taught that a base was always needed
- Bases are used under amalgam for thermal insulation
- In a survey of 500 GDPs in 2017 (in Wales), 83% always placed a lining before placing a composite restoration
- *Supposed* antibacterial effect of Glass Ionomer as a lining
- Bases isolate the pulp from chemical irritants, i.e. pulp protection

TODAY

- A contemporary dentine bonding agent will seal the restoration and the dentinal tubules
- A base limits the surface area for bonding
- Resin composites are insulators, therefore do not need a base for this reason
- Base only needed for therapeutic reasons
- No base = saving in time

Blum IR, Wilson NHF Consequences of no more linings under composite restorations. Br.Dent.J. 2019:226:749-752.

HISTORY TODAY

Von Fraunhofer and colleagues (Gen.Dent.2006) found an increase in microleakage, post-operative sensitivity and potentially secondary caries when a lining is present under a posterior composite restoration

Blum et al (J.Dent.2017) found that prevalence of post-op sensitivity after placement of posterior composite restorations was 20% greater when a lining was placed

Schwendicke et al (Systematic review: J.Dent.2015) concluded that there was insufficient evidence to recommend cavity lining based on their antibacterial effects. Dentists should be aware that the use of cavity liners is not recommended by clinical studies

Blum IR, Wilson NHF Consequences of no more linings under composite restorations. Br.Dent.J. 2019:226:749-752.

Trust your bonding agent to seal the tubules

Use a Universal Adhesive

. . . finally

Why direct-placement restorations are king/queen!


RESEARCH

The ultimate guide to restoration longevity in England and Wales. Part 1: methodology


RESEARCH

The ultimate guide to restoration longevity in England and Wales. Part 10: key findings from a ten million restoration dataset

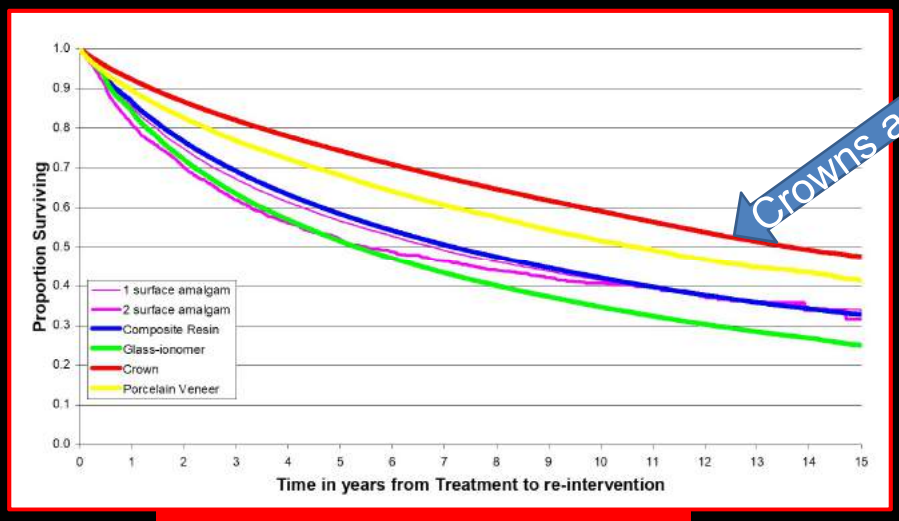
Dataset of 10 million restorations followed for 16 years

Incisors

Incisor teeth: 2,526,575 restorations:
inc. 1,747,379 composite restorations
and 400,230 crowns

Incisor teeth: 2,526,575 restorations:

Restoration survival to next intervention



Crowns perform best!

Incisor teeth: ***Survival of the restored tooth***

Crowns no longer perform best!
Direct-placement restorations are better

Crowns are bad for the survival of teeth

The only crowns that most (thinking) dentists did before COVID were replacements of failed crowns

In the COVID era, given that failure of crowns will be at the margins, there is potential to patch and repair without having to replace the crown

Thoughts on survival

of restorations & teeth

It's only in older patients that crowning a molar tooth is a good idea!

Therefore, direct placement restorations should be employed where there is sufficient tooth substance

47 years of evidence-based publishing!

Advantages of an adhesive approach

- Tooth and patient friendly
- Potentially better aesthetics
- Can be metal-free
- State of the art (practice building)
- There is increasing evidence that it works

BUT……

- Care, time and attention to detail and operator ability paramount

...additionally
adhesive dentistry
makes
minimal intervention possible

Thank you for using these notes

Hope they were useful