

# Successful posterior composites





## Disclosures

"I am not anti-amalgam"

"I am in favour of minimally invasive dentistry"

I am also one of the heavy metal brigade, so have plenty of experience of amalgam restorations!



## Disclosures

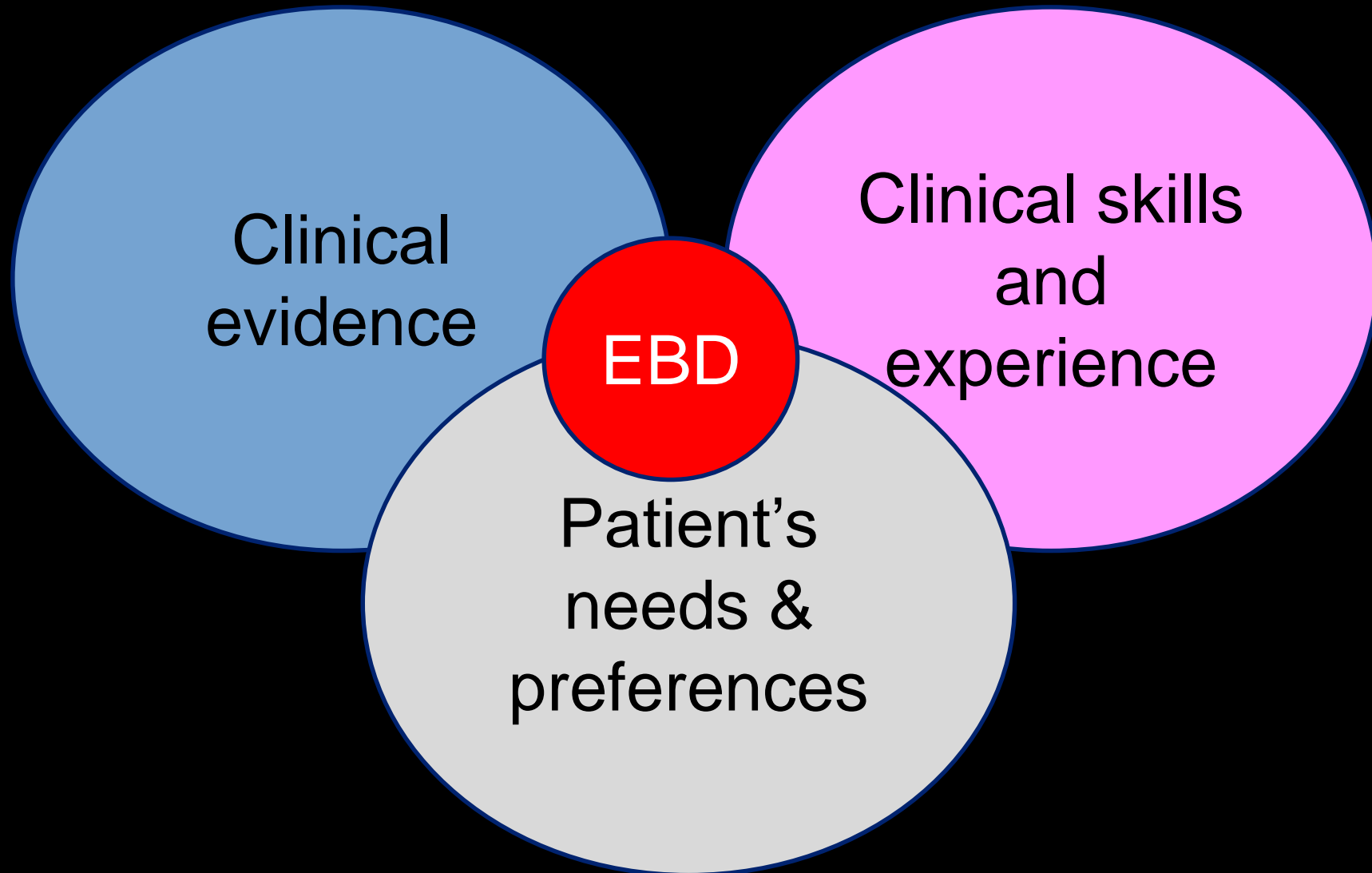
"I am not paid by any company to promote their products"

"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"

# Put simply: What EBD really means



# Choosing a reliable material

# Cost

- Materials' costs in an average practice are 5% to 7% of total expenses
- Always speak to a sales rep before purchasing a material from a major manufacturer, as they know the deals
- While there is variety in pricing, the only materials that are significantly cheaper are the "Own Label" brands

You can  
save £40 by  
buying a  
5ml bottle of  
“own label”  
bonding  
agent,  
but.....

.....the first  
premature  
failure  
negates  
your saving.



FJ Trevor Burke

## Me Too 3

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,<sup>1,2</sup> 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.

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

# There is no evidence base for “own label” Glass Ionomer materials



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**

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

#### Keywords

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

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

### 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 material

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

150 occlusal  
ART GIC  
restorations  
followed for 2  
years



3 materials:  
Fuji IX (GC)  
2 low cost  
GICs

J.Dent.2020:101:  
103446

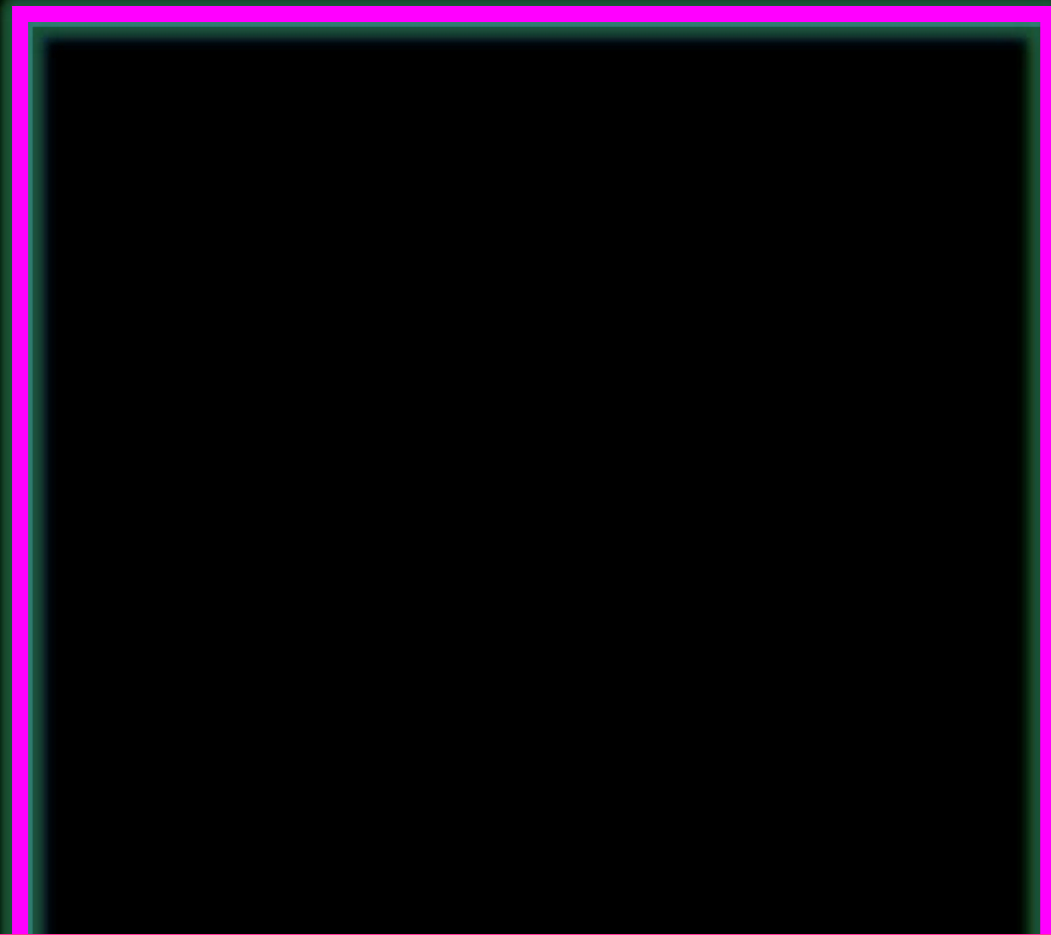
## SHORT ANSWER!

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<sup>a,b</sup>, Nathalia de Miranda Ladewig<sup>b</sup>, Daniela Hesse<sup>c</sup>,  
Clarissa Calil Bonifácio<sup>c</sup>, Mariana Minatel Braga<sup>b</sup>, José Carlos Pettorossi Imparato<sup>b</sup>,  
Fausto Medeiros Mendes<sup>b</sup>, Daniela Prócida Raggio<sup>b,\*</sup>

*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



## Successful posterior composites

- Amalgam & the post-Minamata era
- Bonding to dentine
- Properties of composite materials
- Placing posterior composites and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts



# Digressing slightly, because this is relevant to the present COVID era



what I plan to talk about

- ☞ The viral pandemic/A quick look at UK dental practice today
- ☞ Choosing a reliable material
- ☞ Alternatives to drilling and filling
- ☞ Why adhesive dentistry is more important than ever/GI and dentine bonding
- ☞ What bonding can do
- ☞ Brief results from a 10 million restoration dataset

# Only half of our treatments are “active” (i.e. restorations or scaling/polishing)

VERIFIABLE CPD PAPER

RESEARCH

Patient history as a predictor of future treatment need?  
Considerations from a dataset containing over nine million courses of treatment

**Results** A total of 455,844 patients met the inclusion criteria, namely adults with a full history. They received 9,341,583 courses of treatment, of which 49% were classified as ‘active’ and 51% as ‘not active’. The analysis indicated that both total costs and active treatment costs are positively correlated with their historical values, with the correlation coefficients

on this subject.

Over 9 million courses of treatment were included, with each course of treatment being classified as ‘active’ (e.g. restorations, prostheses, extractions) or ‘non-active’ (e.g. examination, radiographs, prevention).

more important component.

## Abstract

**Aim** It is the aim of this paper to consider whether overall patient treatment history *per se* and what length of patient history, matters in predicting future treatment need.

**Methods** This study used a data set (SN7024, available from UKDataService), consisting of treatment records for General Dental Services’ (GDS) patients, this being obtained from all items of service payment records for patients treated in the

## Therefore, 51% of treatment can be considered low risk

**Results** A total of 455,844 patients met the inclusion criteria, namely adults with a full history. They received 9,341,583 courses of treatment, of which 49% were classified as ‘active’ and 51% as ‘not active’. The analysis indicated that both total costs and active treatment costs are positively correlated with their historical values, with the correlation coefficients increasing from 0.24 and 0.25 with one year of history to 0.42 and 0.44 with ten years of history. Overall, therefore, future treatment cost is correlated with past treatment costs.

**Conclusions** Treatment history may provide an important correlate of future dental treatment needs and the more history the better, at least up to five years. However, active treatment is the important component and should be distinguished from preventive and diagnostic treatments.

For those 49% of treatments, we need, where possible, to adopt non-aerosol, or reduced-aerosol methods for restorative dentistry





FJ Trevor Burke

Louis Mackenzie and Peter Sands

## Suggestions for Non-Aerosol or Reduced-Aerosol Restorative Dentistry (for as Long as is Necessary)

**Abstract:** The advent of coronavirus and the associated disease COVID-19 has led to the closure of dental practices in the UK and, indeed, in many parts of the world. In order to get dental practices operating again, it is suggested that it is necessary to adopt a new way of working. Principal among concerns has been the potential carriage of droplets (from an infected patient) into the aerosols resulting from the use of the turbine handpiece and from ultrasonic and sonic scalers, and other instruments used in restorative dentistry (current terminology being Aerosol Generating Procedures (AGPs)). It is therefore the aim of this paper to review restorative techniques and suggest those which are appropriate to aerosol-free, or reduced-aerosol restorative dentistry.

**CPD/Clinical Relevance:** With anxieties regarding aerosol generating procedures abounding, it may be helpful to review procedures which either reduce or avoid these AGPs.

**Dent Update 2020; 47: 485-493**

The advent of coronavirus and the associated disease COVID-19 has led to the closure of dental practices in the UK and, indeed, in many parts

of the world. However, unlike many countries where practices are re-opening or indeed those in which dental practices did not close, dentists in the UK, at the time of writing, have not had the 'green light' to re-open. In order to get dental practices operating again, the authors suggest that it is necessary to adopt a new way of working. Principal among concerns has been the potential carriage of infected droplets (from an infected patient) into the aerosols resulting from the use of the turbine handpiece and from ultrasonic scalers, and other instruments used in restorative dentistry (current terminology being Aerosol Generating Procedures (AGPs)). It may be of interest to note that the World Health Organization has produced a list of AGPs in healthcare and dentistry is not mentioned. It is therefore the aim of this paper to review restorative techniques and suggest those which are appropriate to aerosol-free, or reduced-aerosol restorative dentistry.

The solution to ultrasonic instrumentation in periodontal treatment is simple – a return to hand scaling and an increased focus on prevention. The solution to the aerosol-generating procedures in restorative dentistry is not quite so straightforward, but the authors suggest that there are a variety of techniques which can be used without the need, or with a significant reduction in the need, for a turbine handpiece.

### The new armamentarium

The authors suggest that the new armamentarium without an aerosol will include the following:

- A speed increasing handpiece attached to an electric motor to be used when absolutely necessary: these offer a considerable reduction in aerosol emission compared to a turbine, and that the aerosol may be proportional to the revolutions per minute of the rotary

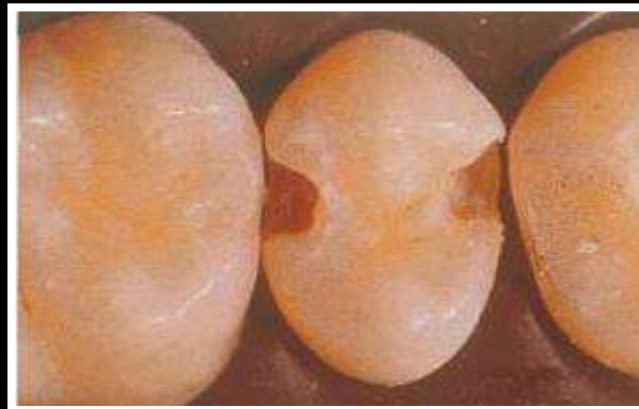
**FJ Trevor Burke**, DDS, MSc, MDS, MGDS, FDS(RCS Edin), FDS RCS(Eng), FFCDP(UK), FADM, Professor of Primary Dental Care, University of Birmingham School of Dentistry, 5 Mill Pool Way, Birmingham B5 7EG. **Louis Mackenzie**, BDS, General Dental Practitioner, Birmingham, Clinical Lecturer, University of Birmingham School of Dentistry and Head Dental Officer, Denplan, Winchester and **Peter Sands**, MSc, BDS, LDS, MFGDP, General Dental Practitioner, Abingdon, England and Part-Time Lecturer University of Birmingham, School of Dentistry, 5 Mill Pool Way, Birmingham B5 7EG, UK.

# June, 2020, issue of Dental Update

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





Blum and Ozcan stated unequivocally that “restoration replacement should be considered as the last resort when there are no other viable alternatives”. “The literature on survival of repaired restorations concluded that numerous longitudinal clinical studies have shown that restoration repairs in permanent teeth are able to significantly increase the lifetime of restorations and the restored tooth unit”.

permanent teeth are able to significantly increase the lifetime of restorations,<sup>22,27-30</sup> and come with reduced treatment time, lower costs, and lower risks of complications than total replacements.<sup>12,31</sup>

The evidence base for repair is building

There is now a body  
of evidence that  
repair should always  
be considered

This can often be done with no tooth  
preparation, other than cleaning – good  
for the COVID era

Blum IR. The management of failing direct composite restorations: replace or repair?

in: Lynch CD, Brunton PA, Wilson NHF, editors. successful posterior composites. London: Quintessence; 2008;101-

Blum IR, Lynch CD, Wilson NHF. Factors influencing repair of dental restorations with resin composite.

Clin Cosmet Investig Dent. 2014; 17;6:81-88.

Blum IR, Schrieffer A, Heidemann D, Mjör IA, Wilson NHF The repair of direct composite restorations:

an international survey of the teaching of operative techniques and materials. Eur J Dent Educ. 2003;7:41-48.

Gordan VV, Mjör IA, Blum IR, Wilson NHF. Teaching students the repair of resin based composite restorations:

a survey of North American dental schools. J.Am.Dent.Assoc. 2003;134:317-323.

# Repairs! A systematic review

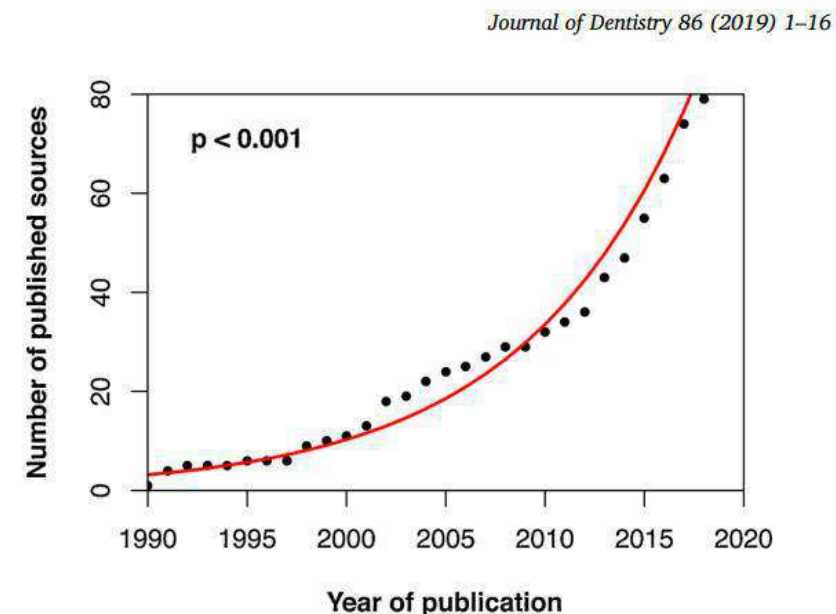
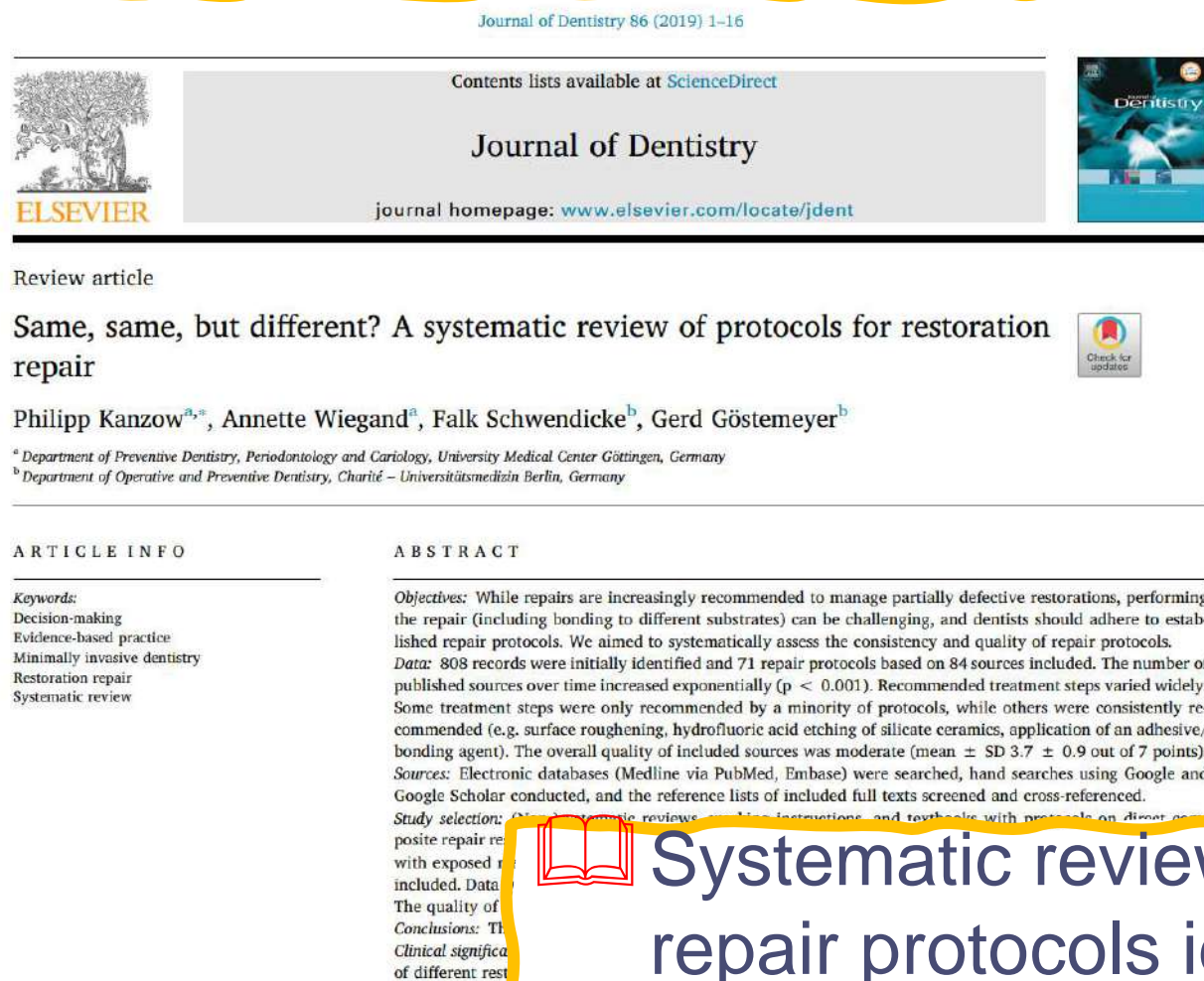


Fig. 1. Number of published sources with recommended repair procedures over time. The number of published sources over time well fitted an exponential model ( $p < 0.001$ ).



Systematic review, 806 articles, 71 repair protocols identified

This paper demonstrates the rise and rise of papers on restoration repair

## A must read paper

RestorativeDentistry



David Green

Louis Mackenzie and Avijit Banerjee

# Minimally Invasive Long-Term Management of Direct Restorations: the '5 Rs'

**Abstract:** The assessment and operative long-term management of direct restorations is a complex and controversial subject in conservative dentistry. Employing a minimally invasive (MI) approach helps preserve natural tooth structure and maintain endodontic health for as long as possible during the restorative cycle. This paper discusses how minimally invasive techniques may be applied practically to reviewing, resealing, refurbishing, repairing or replacing deteriorating/failed direct coronal restorations (the '5 Rs') and provides an update of contemporary MI clinical procedures.

**CPD/Clinical Relevance:** The assessment and long-term clinical management of deteriorating/failing direct restorations is a major component of the general dental practice workload and NHS UK budget expenditure for operative dentistry.

**Dent Update 2015; 42: 413–426**

### What is a 'failing' restoration?

A failing restoration can be described as one that has suffered biomechanical defect or damage resulting in immediate or subsequent detrimental clinical consequences to the patient. This may affect the restoration alone (eg bulk fracture, staining etc), the supporting tooth

structure (eg fractured cusps, new caries at the tooth-restoration surface (CARS) etc) or, more commonly, both, affecting the collective *tooth-restoration complex*. Such failure can present as obvious fractures of this complex, possibly detectable active caries associated with restoration/sealant surface (CARS, previously described as secondary or recurrent caries) or can be more subtle, such as marginal discoloration of an anterior aesthetic resin composite restoration or marginal ditching of a posterior restoration.

A number of clinical indices have

against these criteria and given a score out of five, depending on the clinical findings. This classification has been proposed as a tool to evaluate and standardize new restorative materials, a method to determine if restorations require repair or replacement and a quality assessment tool for reviewing dental restorations. This classification has been shown to be more sensitive at determining differences between restorations than older classifications.<sup>2</sup> There are a number of challenges, which include the universal uptake of the new classification system and how the scoring

## The 5Rs!

Reviewing  
Resealing  
Refurbishment  
Repair

and, where  
necessary,  
Replacement

David Green, BSc(Hons) BDS(Hons)  
MFDS RCS(Ed), StR in Restorative

Dent.Update 2015:42:413-426



# Successful posterior composites

- Amalgam & the post-Minamata era
- Bonding to dentine
- Properties of composite materials
- Placing posterior composites and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts

# Reasons to use aesthetic techniques

- ❑ Patient still need fillings
- ❑ Increasingly patients are requesting aesthetic restorations in their back teeth
- ❑ High-tech practice image



Aesthetics of  
posterior teeth  
is becoming more  
important

Burke F.J.T. Amalgam to tooth-  
coloured materials  
– implications for clinical  
practice and dental education:  
governmental restrictions and  
amalgam-usage survey results.  
J.Dent.2004;**32**:343-350.



...first, a few words  
on amalgam

## Amalgam—Resurrection and redemption. Part 2: The medical mythology of anti-amalgam

Michael J. Wahl, DDS<sup>1</sup>

Mercury-containing amalgam restorative material has come under attack for its alleged harmful effects on systemic health. A literature search revealed that amalgam restorations release small quantities of mercury but apparently not enough to cause systemic health problems. Mercury from dental amalgam restorations cannot be linked to kidney damage, Alzheimer's disease, multiple sclerosis, other central nervous system diseases, "amalgam disease," mental disorders, damage to the immune system, increases in antibiotic resistance, or harmful reproductive effects. Dentists occupationally exposed to mercury have not been shown to suffer harmful reproductive or other systemic health effects, provided proper mercury hygiene is used. There are legitimate health concerns about alternative restorative materials, including resin composite. According to the latest scientific information available, dental amalgam remains a safe and effective restorative material. (*Quintessence Int* 2001;32;696–710)

**Key words:** amalgam, biocompatibility, mercury, resin composite, safety, toxicity

The scientific evidence (170 references):  
Does not support the myth that mercury from dental amalgam causes kidney damage  
Does not support the myth that dental amalgam is associated with MS, Alzheimer's Disease, mental disease or "amalgam illness"  
Does not support the myth that mercury from dental amalgam damages the immune system or causes harmful reproductive effects

# Contemporary UK dental practice 2015

Burke FJT, Brunton PR, Wilson NHF, Creanor S.

- 👉 Questionnaire to 500 UK dentists, 20015/16, useable returns 388 (77.6%)
- 👉 60% male, 51% principals, 25% single-handed
- 👉 Mean of 4.2 dentists per practice
- 👉 50% of patients NHS, 39% private
- 👉 55.4% of respondents had an intra-oral camera, 80.4% used nickel-titanium files, 47.4% used zirconia-based bridgework, and 24.9% used tricalcium silicate



Contemporary UK dental  
practice 2015/16: Comparison  
with previous results: premolars:  
Amalgam for Class II, 2002....86%  
Amalgam for Class II, 2008....59%  
Amalgam for Class II, 2015....40%

25% of respondents stated that  
amalgam should continue to be used freely,  
41% considered that it should be  
phased down or out

# A must read paper, Dent. Update Sept 2021

Perhaps the last paper ever written on amalgam?

Enhanced CPD DO C

RestorativeDentistry



Louis Mackenzie

## Dental Amalgam: A Practical Guide

**Abstract:** Historically, dental amalgam is the world's most commonly used restorative material. Its use is declining due to patient demand for tooth-coloured restorations that are adhesive and promote minimally invasive tooth preparation. Significant reduction has also resulted from environmental concerns relating to dental amalgam's ~50% mercury content. This paper provides a comprehensive review of the status of dental amalgam including its advantages and disadvantages, regulations and legislation and a comparison with alternative restorative materials. As the use of amalgam has progressively declined, this paper also provides an illustrated step-by-step review of techniques that will optimize the restoration of challenging, complex cavities.

**CPD/Clinical Relevance:** Amalgam remains an excellent choice for restorations in areas where moisture control presents challenges.  
**Dent Update 2021; 48: 607-618**

Dental amalgam is still widely considered as the material of choice for specific procedures, such as the replacement of existing amalgam restorations in complex cavities (replacing one or more cusps; Figure 1), and in deep cavities where moisture control is challenging. Having demonstrated unparalleled long-term clinical success, amalgam's most commonly cited disadvantages relate to its aesthetic properties, the need for more invasive cavity preparations and environmental concerns relating to its mercury content (Table 3).

Amalgam is a safe, durable, cost-effective restorative material with excellent mechanical properties. Its use is declining for a range of reasons (Table 1).<sup>1-6</sup> As dental amalgam contains approximately 50% mercury it has always been the subject of controversy. If presented as a new material today, it would not be licensed for patient use.<sup>7</sup>

### Advantages and disadvantages of amalgam

Although the use of dental amalgam is decreasing worldwide, it is still used in

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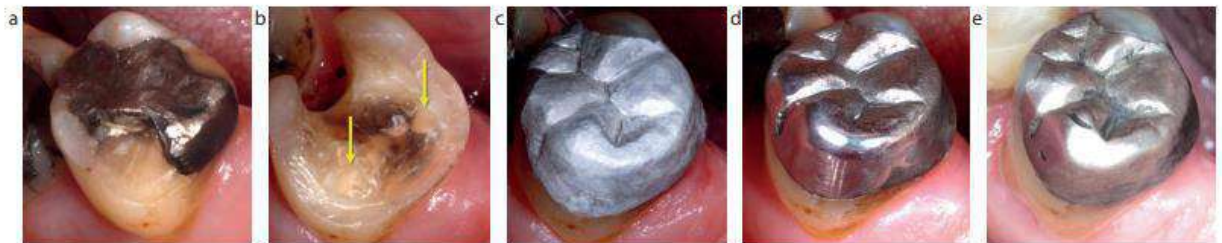
September 2021

Dental Update 607

restorative materials<sup>2,3</sup>

- Corrosion over time enhances the marginal seal
- Heavy metal ionic breakdown products are antibacterial, resulting in slow progression of secondary caries compared to composite, which has been demonstrated to attract higher levels of more cariogenic bacteria<sup>4</sup>
- Does not significantly affect subgingival biofilm<sup>5</sup>
- Suitable for use in posterior teeth
- Useful in deep cavities where moisture control can be diminished<sup>6</sup>
- Historically, amalgam has been considered as a cost-effective material<sup>7</sup> (reduced surgery time more than offsets the high price of silver)

**Table 2.** Advantages of amalgam.



**Figure 1.** (a) MOD amalgam in a previously repaired mandibular first permanent molar, with a fractured mesio-buccal cusp. (b) Cavity preparation with resistance form augmented with pits for 'amalgapins'. (c) MODLB Bonded amalgam (immediate post-op). (d) Restoration at 6 years. (e) Restoration at 12 years.

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# The database

- SN7024, available from UKDataService.ac.uk contains anonymized longitudinal data on patients attending the General Dental Services in England and Wales (UK)
- Over three million different patients
- Over 25 million courses of treatment, between 1990 & 2006
- Modified version of Kaplan-Meier methodology used to plot survival curves for different sub-groups

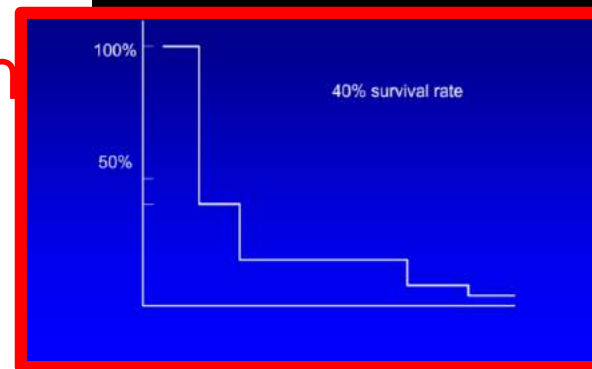
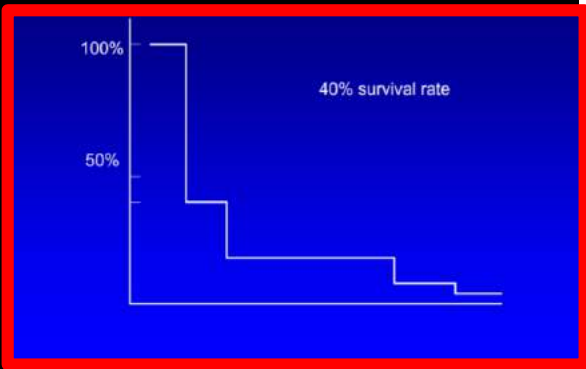
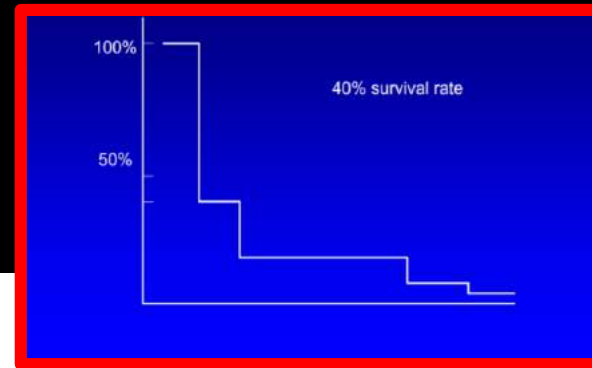
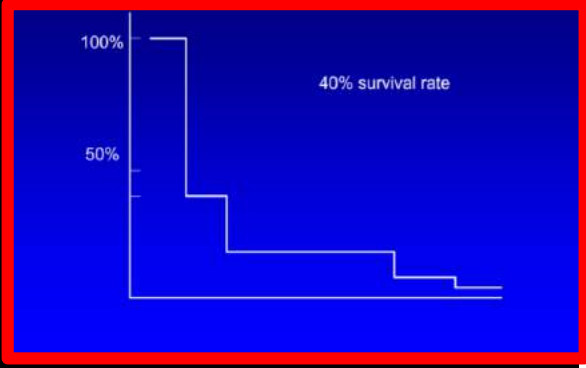
Because of the vast size of the dataset, we can  
now look at the effect of the restoration on  
*survival of the tooth*

# First, a brief lesson in Kaplan Meier

The goal is to estimate a population survival curve from a sample. If every patient is followed until death, the curve may be estimated simply by computing the fraction surviving at each time.

However, in most studies patients tend to drop out, become lost to follow up, move away, etc.

A Kaplan-Meier analysis allows estimation of survival over time, even when patients drop out or are studied for different periods of time.



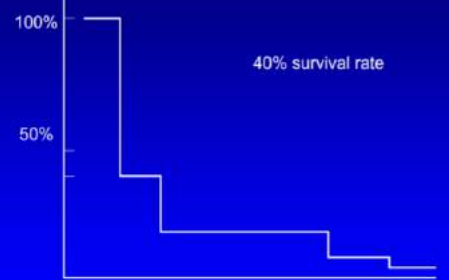
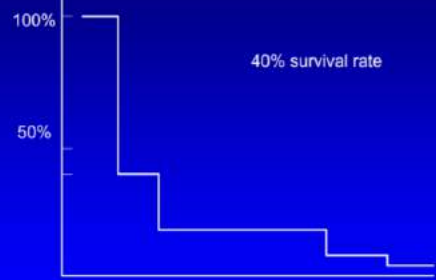
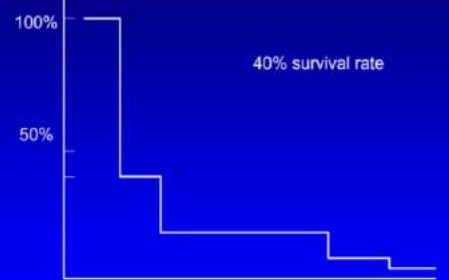
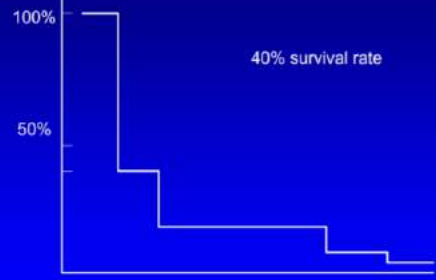
# First, a brief lesson in Kaplan Meier

For restorations, the observation time starts at time 0 in the graph.

Restorations that fail result in a drop in the graph.

Restorations that have not failed by the end of the study are called *censored* observations and these are included for only as long as they are observed.

Since information of both failed and non-failed restorations is used, the Kaplan Meier method is considered the gold standard in longevity assessment.



# Experts consider Kaplan Meier best for restoration longevity!



## Age of failed restorations: A deceptive longevity parameter

Nishikawa, G. et al. / Journal of Dentistry 39 (2011) 225–230

**Conclusion:** In absence of all dates of placement and failure for a series of restorations a reliable measure of restoration longevity is not yet available. Kaplan–Meier statistics remains the preferred method of calculating longevity of a group of dental restorations.

Received in revised form  
8 December 2010  
Accepted 10 December 2010

**Keywords:**  
Longevity  
Survival  
Median  
Dental restoration  
Cross-sectional

of failed restorations as compared to gold standard Kaplan–Meier statistics.

**Objectives:** This study was undertaken to compare and contrast longevity data for a number of data sets. It investigated if restoration longevity, as calculated by the Kaplan–Meier method, is different from longevity according to the median survival time of failed restorations.

**Methods:** Existing clinical datasets of dental restorations and an artificial dataset were used to calculate longevity according to Kaplan–Meier statistics and by means of calculation of median age of failed restorations.

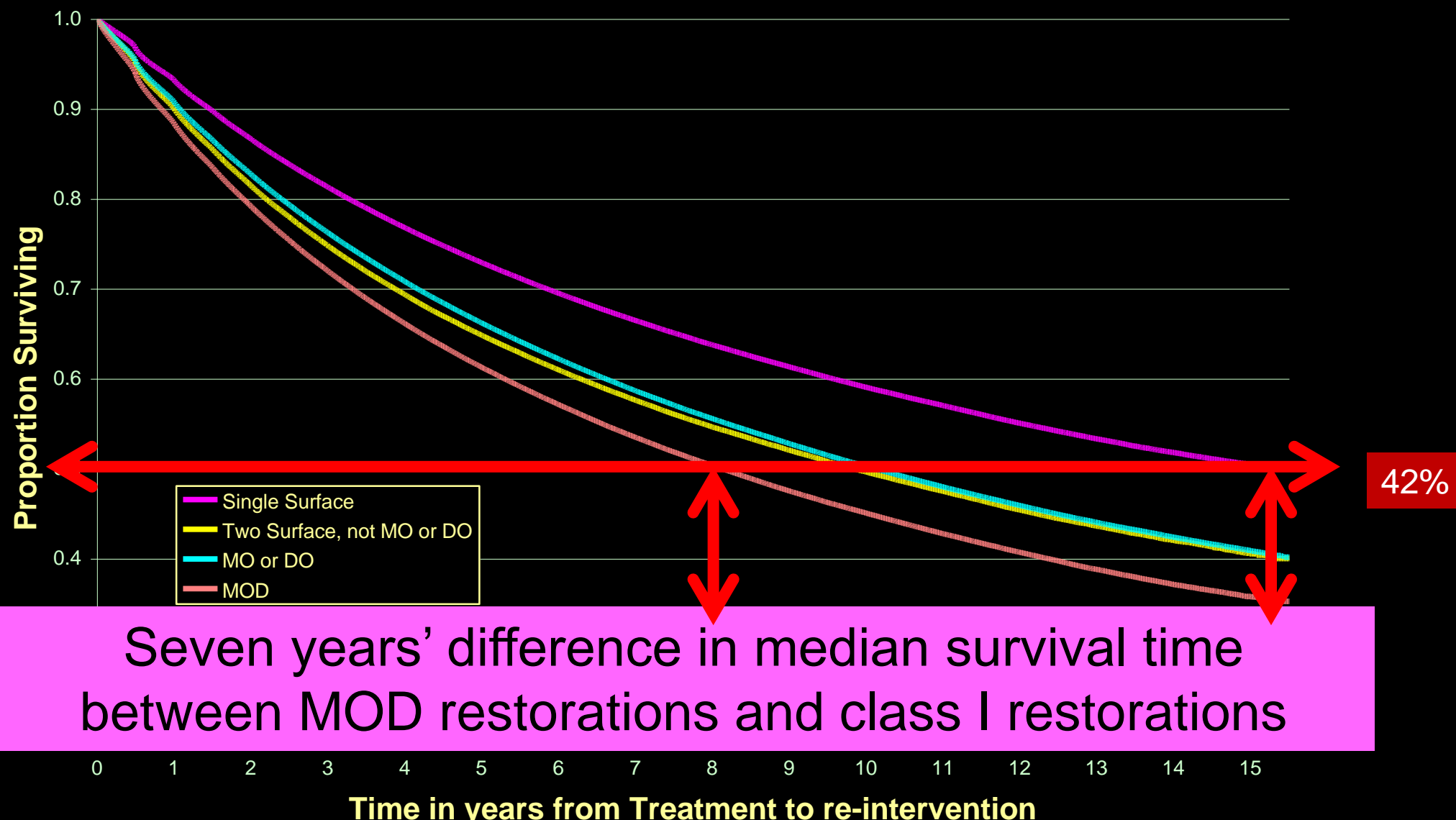
**Results:** The findings indicate that median age of failed restorations may be considered as a deceptive measure of restoration longevity. Specially extending the duration of longitudinal studies of restorations apparently leads to higher values for median age of failed restorations. Restorations of materials that tend to exhibit early failures may have lower values for median age of failed restorations, compared to restorations of different materials which tend to exhibit failures later in clinical service, and thereby not giving a true measure of overall restoration longevity.

**Conclusion:** In absence of all dates of placement and failure for a series of restorations a reliable measure of restoration longevity is not yet available. Kaplan–Meier statistics remains the preferred method of calculating longevity of a group of dental restorations.

# Direct placement restorations: amalgam

7,425,049 amalgam cases  
included, of which 2,537,331,  
of which had a re-intervention

# Amalgam Restoration Survival by Type of Cavity



# Take home message

Size matters - keeping restorations as small as possible is therefore important

We can only do this with adhesive dentistry



# Norway banned amalgam!

## How?

1991, Directorate to reduce amalgam use

2003, National clinical guidelines - encouragement to reduce amalgam use. Amalgam no longer the material of choice for posterior teeth, informed consent needed from the patient if amalgam used

2007, Restrictions on mercury vapour emissions from crematoria

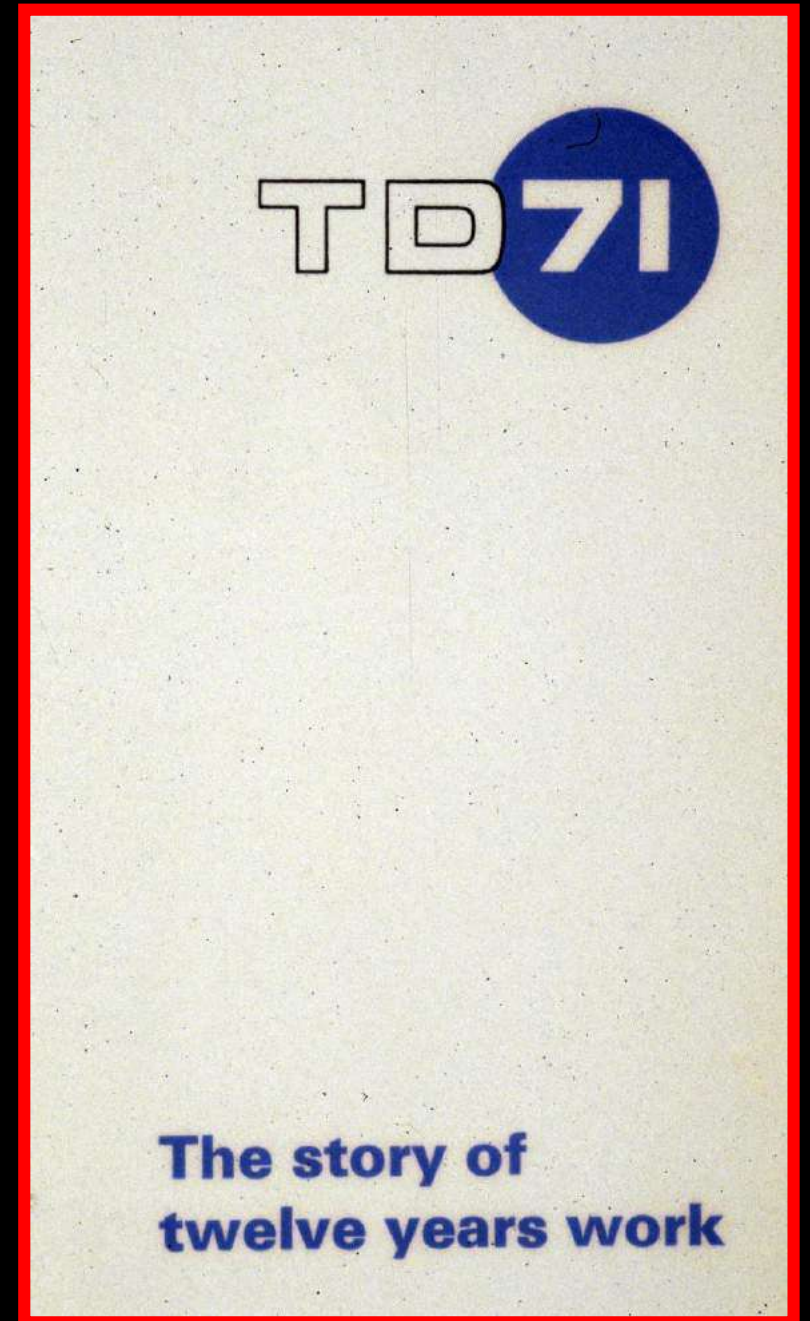
2008, Partial ban on amalgam use

2011, Complete ban, although dentists can apply for exemptions

Lynch CD,  
Wilson NHF.  
Br.Dent.J.2013  
:215:159-162

# A brief history of composite

Filler not  
well bonded  
to resin, therefore  
wear resistance suboptimal



# Composite filler particles today



FJ Trevor Burke

Louis Mackenzie and Peter Sands

## Dental Materials – What Goes Where? Class I and II Cavities

**Abstract:** Dental amalgam has helped maintain dental public health in the developed world for over a century. However, its days appear to be numbered. Notwithstanding the environmental consideration, there is an ever increasing demand from dental patients for non-metallic and tooth-coloured restorations in their posterior teeth. This paper gives a brief history of dental amalgam and critically appraises the alternative materials, the principal of these being resin-based composite.

**Clinical Relevance:** The majority of practitioners carry out large numbers of Class I and II restorations, so an appraisal of the pros and cons of the alternatives may assist in decision-making.

*Dent Update* 2013; 40: xxx-xxx

The first issue of *Dental Update* contained a paper on pinned retention for amalgam and, while the current status of pins is also discussed in this issue, this paper aims to examine the current status of dental amalgam and alternatives for directly placed Class I and II restorations.

### The current status of dental amalgam

#### A brief history of dental amalgam

The history of amalgam is uncertain; however, there is a report of the use of a silver paste being used as early as

659AD in China,<sup>1</sup> with its first use as a dental material being reported in France in 1826.<sup>2</sup> The years passed, with many other metals being combined with mercury, until GV Black produced a formula, in 1895, for a dental amalgam which provided reasonable clinical performance. This remained unchanged for circa 70 years<sup>3</sup> until Eames<sup>4</sup> recognized the benefit of a 1 to 1 ratio of mercury to alloy, thus allowing a substantial reduction from the levels previously recommended (as high as 8 to 5). High copper content alloys followed, with these creating a copper-tin phase which was less susceptible to corrosion than the tin-mercury gamma 2 phase present in low copper content alloys.<sup>2</sup>

The content of amalgam alloys in

of which has differing handling properties, with spherical being considered to be the easiest to condense.<sup>2</sup> The alloy is then mixed with mercury (up to 50% by weight) to form the dental amalgam.

Alloys in which the mercury was completely or partially replaced by gallium, a metal which is liquid at room temperature in the same group of the periodic table as mercury, were introduced in the 1960s, becoming popular in the 1980s and 1990s after adverse publicity regarding mercury. One such material (Galloy, SDI, Melbourne, Australia) received the American Dental Association's Seal of Approval, but this was withdrawn when published research indicated that materials

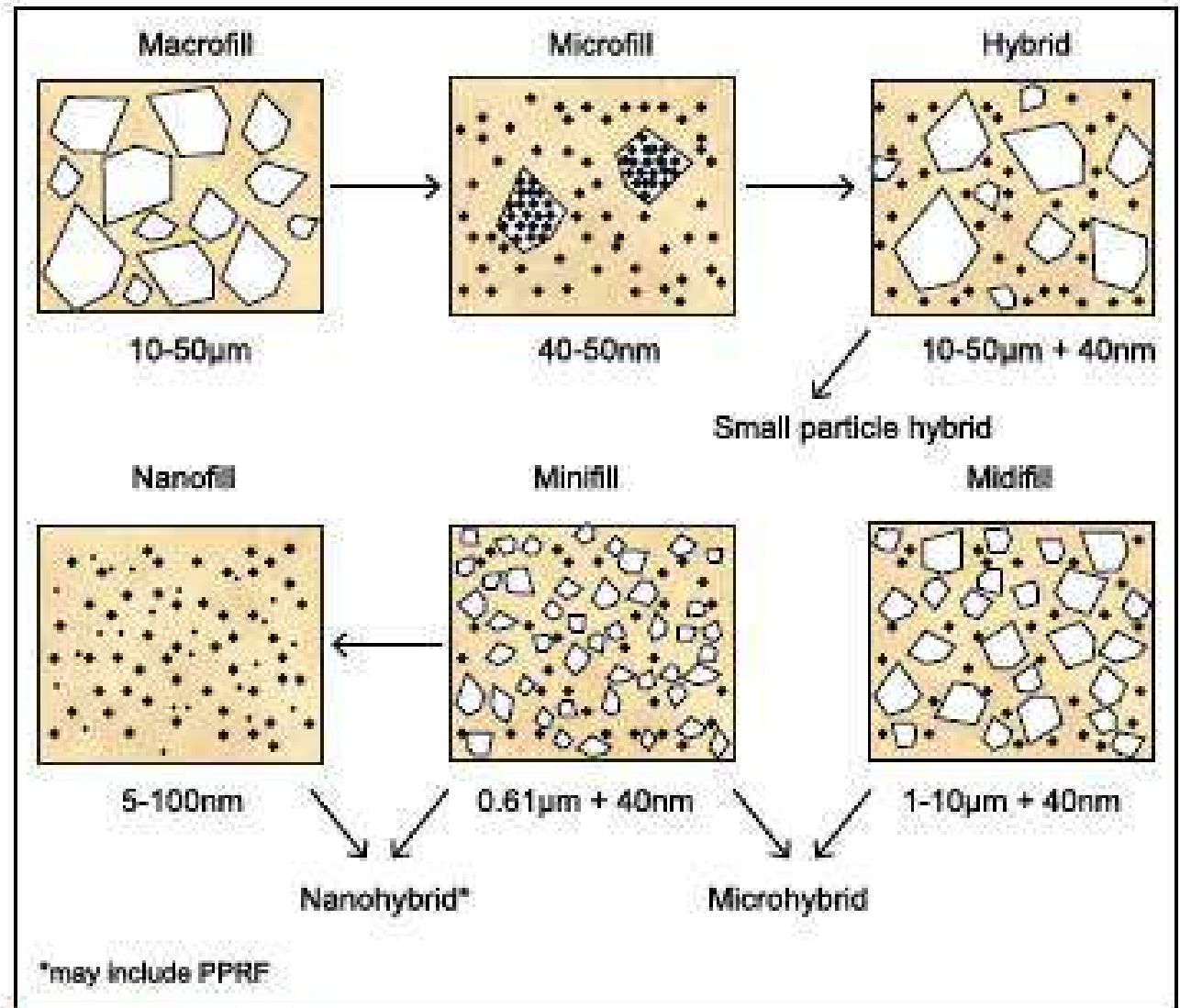


Figure 1. Hybrid composites

# A recently-published meta-analysis comparing different types of composite

Journal of Dentistry 99 (2020) 103407



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journal homepage: [www.elsevier.com/locate/jdent](http://www.elsevier.com/locate/jdent)



Review article

Nanofilled/nanohybrid and hybrid resin-based composite in patients with direct restorations in posterior teeth: A systematic review and meta-analysis



Bianca Medeiros Maran<sup>a,b</sup>, Juliana Larocca de Geus<sup>c,d</sup>, Mario Felipe Gutiérrez<sup>e,f</sup>,  
Siegward Heintze<sup>g</sup>, Chane Tardem<sup>h</sup>, Marcos O. Barceleiro<sup>h</sup>, Alessandra Reis<sup>i</sup>,  
Alessandro D. Loguercio<sup>j,\*</sup>

<sup>a</sup> Department of Restorative Dentistry, School of Dentistry, State University of West Paraná, Cascavel, Paraná, Brazil

<sup>b</sup> Postgraduate Program in Dentistry, School of Dentistry, North Paraná University, Londrina, Paraná, Brazil

<sup>c</sup> Department of Restorative Dentistry, School of Dentistry, Guaracá Faculty, Guarapuava, Paraná, Brazil

<sup>d</sup> Department of Restorative Dentistry, School of Dentistry, Paulo Picanço Faculty, Fortaleza, Ceará, Brazil

<sup>e</sup> Department of Restorative Dentistry, School of Dentistry, Paulo Picanço Faculty, Fortaleza, Ceará, Brazil

<sup>f</sup> Department of Restorative Dentistry, School of Dentistry, Paulo Picanço Faculty, Fortaleza, Ceará, Brazil

<sup>g</sup> Department of Restorative Dentistry, School of Dentistry, Paulo Picanço Faculty, Fortaleza, Ceará, Brazil

<sup>h</sup> Department of Restorative Dentistry, School of Dentistry, Paulo Picanço Faculty, Fortaleza, Ceará, Brazil

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**Study selection:** 28 studies remained. No study was considered to be at low RoB; four studies were judged to have high RoB, and the remaining were judged to have unclear RoB.

**Results:** For the primary and secondary outcomes variables no significant differences were detected between nanofilled/nanohybrid restorations and hybrid composite restorations in any of the study follow-ups ( $p > 0.08$ ).

The body of evidence for surface texture and color match was classified as moderate or low.

**Conclusion:** No evidence of difference was found between nanofilled/nanohybrid and hybrid composite in any of the clinical parameters evaluated.

Nanofilled/nanohybrid and hybrid resin-based composite in patients with direct restorations in posterior teeth: A systematic review and meta-analysis.  
The body of evidence for surface texture and color match was classified as moderate or low.  
Conclusion: No evidence of difference was found between nanofilled/nanohybrid and hybrid composite in any of the clinical parameters evaluated.



# Successful posterior composites

- Amalgam & the post-Minamata era
- Bonding to dentine
- Properties of composite materials
  - Wear resistance
- Placing posterior composites and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts

... the investigated ultrafine compact-filled composites can be considered as amalgam alternatives as far as wear resistance is concerned

Willems G, Lambrechts P, Lesaffre E, Braem M, Vanherle G.  
Three-year follow-up of five posterior composites: SEM study of differential wear. J.Dent.1993;21:79-86.

## Trevor's view:

There are no problems with the physical properties of today's composites.

But, they don't bond to the tooth, therefore an intermediate bonding agent is needed!

# Why do dentists need adhesion?

- 👄 Cervical restorations
- 👄 Build up of fractured or worn anterior and posterior teeth
- 👄 Short clinical crown for full or partial coverage restorations
- 👄 Resin retained bridges

ALSO.....

- Seals dentinal tubules to reduce post operative sensitivity

- Seals restoration margins to reduce the risk of marginal staining and recurrent caries (and also, post-operative sensitivity).

0099-2399/86/1210-0453/\$02.00/0  
JOURNAL OF ENDODONTICS  
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Printed in U.S.A.  
Vol. 12, No. 10, OCTOBER 1986

# **The Hydrodynamic Theory of Dentinal Pain: Sensation in Preparations, Caries, and the Dentinal Crack Syndrome**

Martin Brännström, DDS, Dr. Odont.

# Problems in bonding to dentine

## COMPOSITION OF DENTINE

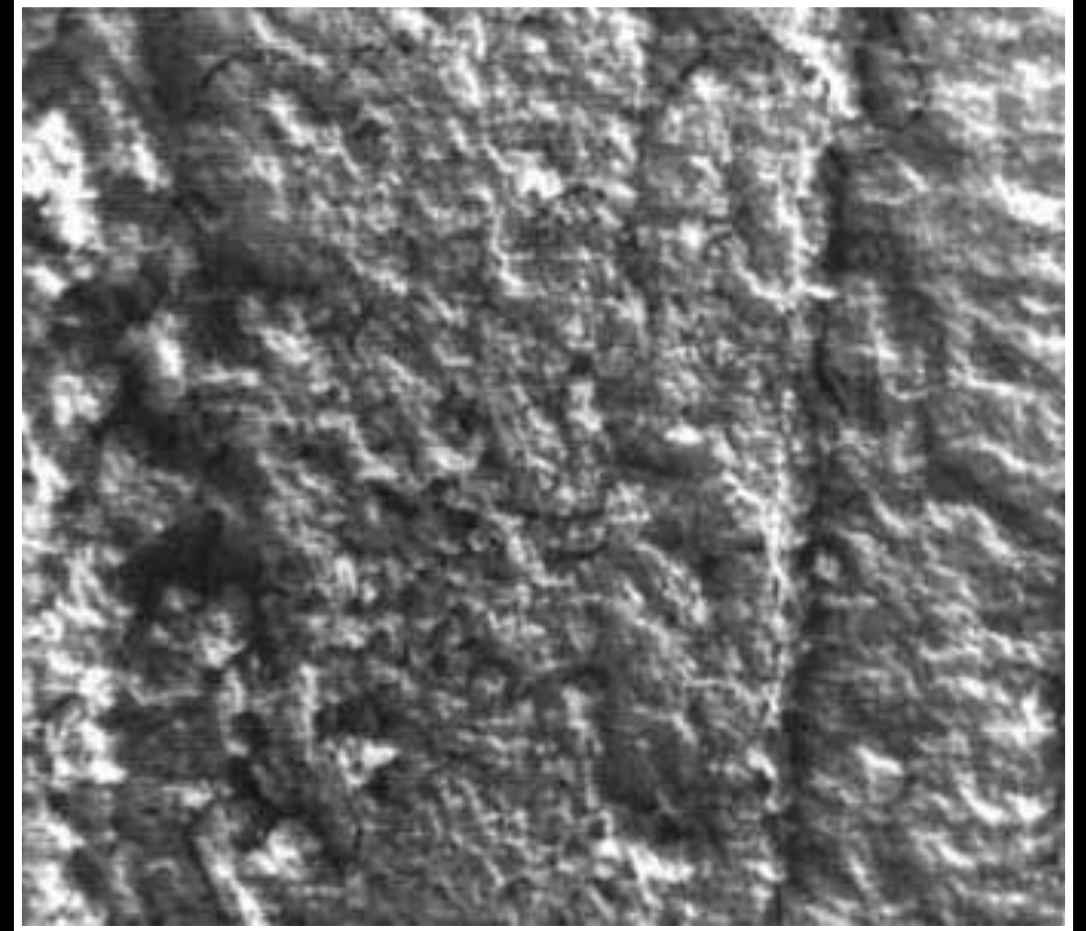
70% Inorganic

Bonding to dentine is  
therefore more difficult

It is a vital substrate

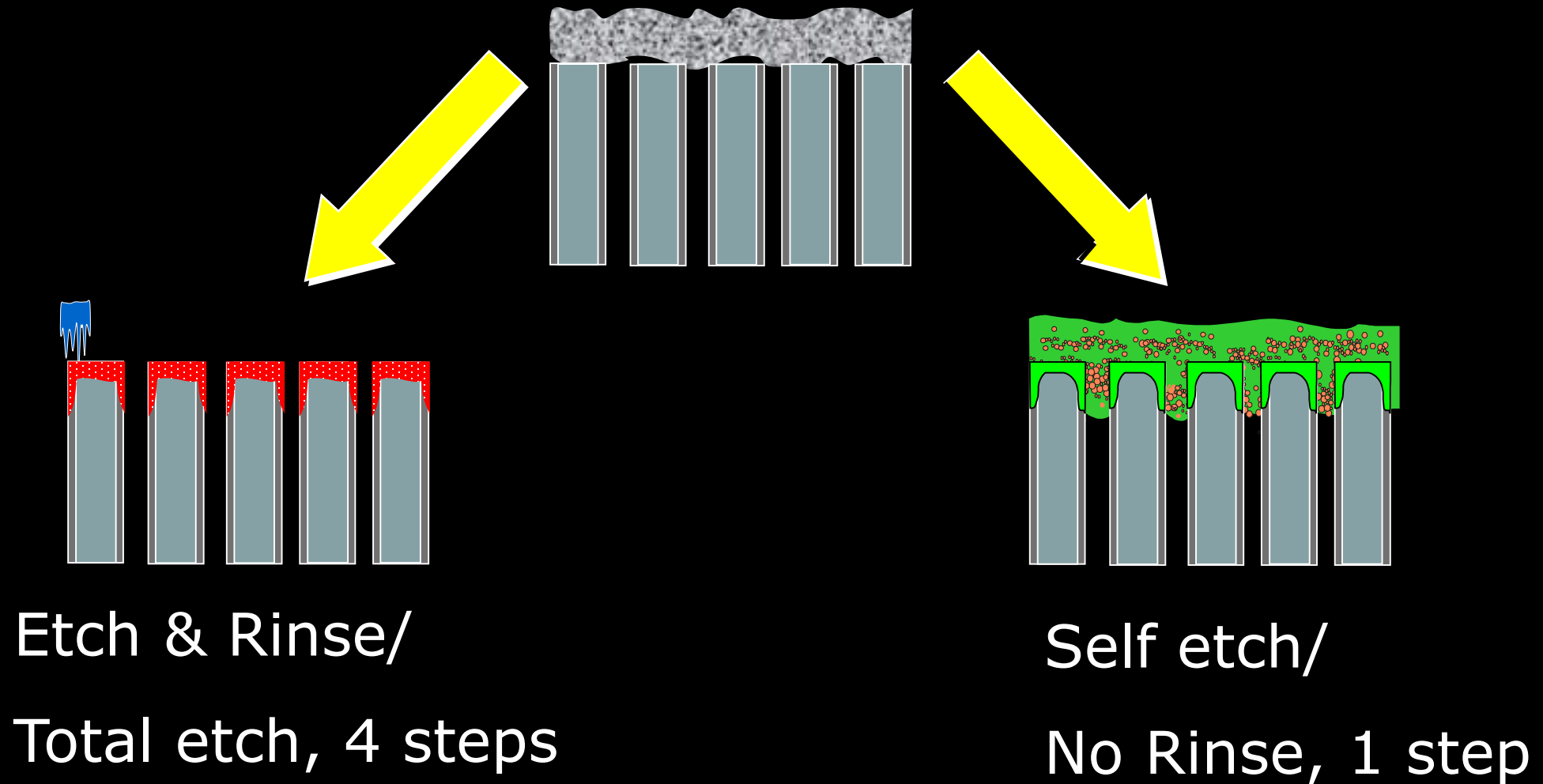
# Another consideration: The smear Layer

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

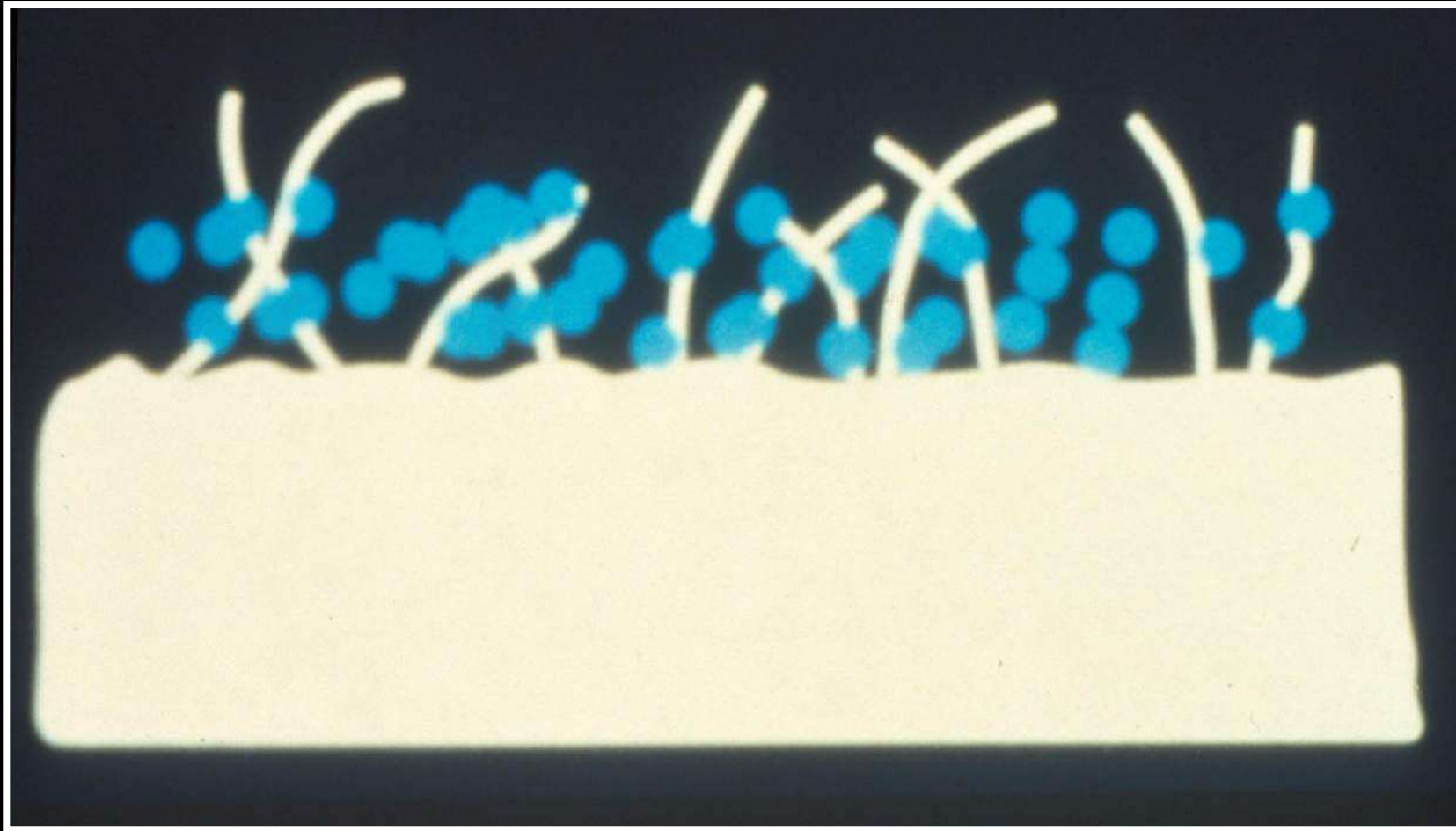


B. Van Meerbeek in: Summitt Fund. Oper. Dent. 2001,  
Enamel and Dentin Adhesives, Col Kraig S. Vandewalle, USAF Dental  
Investigation Service,

# *Previous* strategies to treat the smear layer

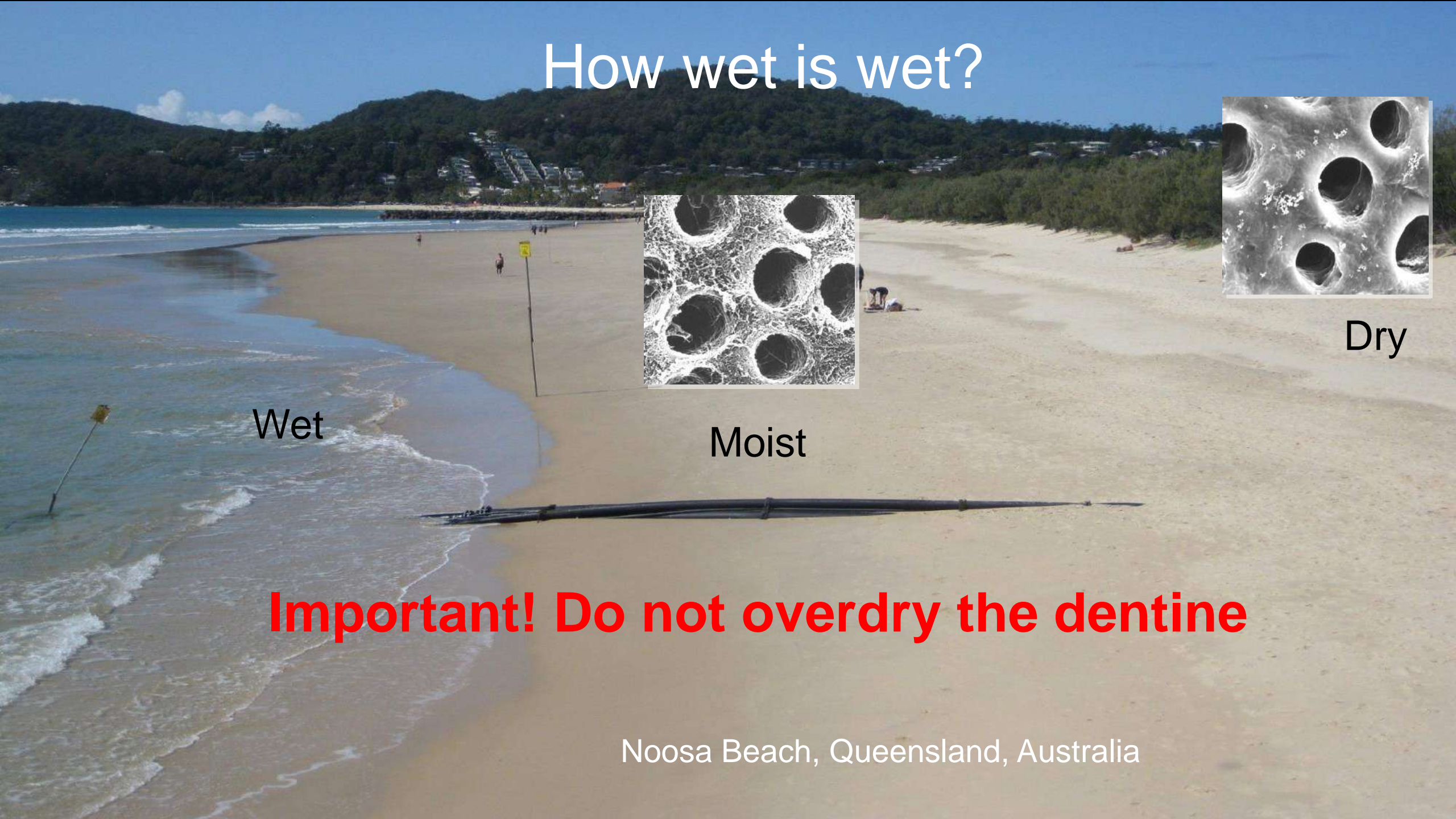


# The hybrid layer (micromechanical)



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.

# How wet is wet?



Wet

Moist

Dry

**Important! Do not overdry the dentine**

Noosa Beach, Queensland, Australia

*....NOW*

The Universal bonding agents

# 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

# The first Universal: Scotchbond Universal Adhesive: Composition

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



# Handling evaluation of **3M** Scotchbond Universal by the **PREP** Panel

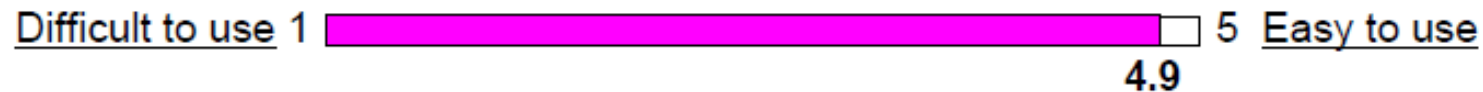
- 👉 12 evaluators
- 👉 Variety of bonding agents used pre-study
- 👉 875 restorations placed (Class 1:172, Class II:189, Class III:134, Class IV:178, Class V:182, Other:20)  
Also used for dentinal hypersensitivity, repair of fractured porcelain, bonding of posts.
- 👉 Rated material on visual analogue 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** Scotchbond Universal by the **PREP** Panel

Ease of use of previous bonding agent

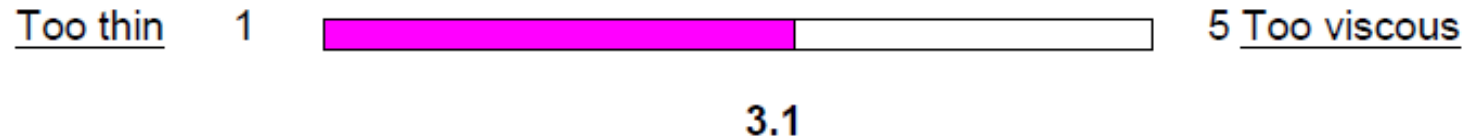


Ease of use of Scotchbond Universal



Viscosity of Scotchbond Universal

The viscosity of the bonding liquid was rated by the evaluators as follows:



# Handling evaluation of Scotchbond Universal by the **PREP** Panel: Comments

📖 All the evaluators stated that they would purchase if available at average price.

📖 “Extremely useful to have a material that bonds both to indirect restorations as well as the tooth structure. No need for multiple kits of materials. So far has worked well.”

# Universal bonding agents: new additions have arrived!



## Most contain the resin 10-MDP

*Structure of  
Adhesive monomer MDP*



*Polymerizable group*

*Hydrophobic group*

*Hydrophilic group*

*Forming the chemical bond  
with calcium and hydroxy apatite*



10-MDP is  
important  
for the  
reaction  
with HAP

# SUMMARY: Universal bonding agents:

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)



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 generation, the Universal Bonding Agents. These materials may be considered 'Universal' insofar as they can be used for direct and indirect dentistry, as well as being suitable for a variety of clinical applications, namely self-etch, etch and rinse or selective etch. This paper will discuss the history of dentine bonding agents, the Universal Bonding Agents, and the clinical application of these materials. **CPD/Clinical Relevance: 20 minutes. Dent Update 2017:44:328-340.**

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.<sup>1</sup> 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.<sup>2</sup>

**FJ Trevor Burke**, DDS, MSc, MDS, MGDS, FDS(RCS Edin), FDS RCS(Eng), FFGDP (UK), FADM, Primary Dental Care Research Group, University of Birmingham School of Dentistry, **Anna Lawson**, BDS, MSc, MPDC(RCS Edin), General Dental Practitioner, Nottingham, **David JB Green**, BDS(Hons), BSc, MFDS RCS(Edin), StR 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.

April 2017

A dentine-bonding agent should perform the following functions:<sup>3</sup>

- 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<sup>3</sup> 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,<sup>2</sup> Green, Mackenzie and Banerjee<sup>4</sup> and others.<sup>5,6</sup>

### A brief history of bonding to dentine

In the past, dentine-bonding agents were classified into generations.<sup>7</sup> 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.<sup>8</sup>

There are two principal means by which a bond to dentine may be achieved:<sup>9</sup>

- First, glass ionomer materials (GIC – glass-ionomer cements) which were developed in the 1970s, initially being derived 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

Dental Update 275

# Conclusion from this publication?

## Anything new since this 2017 publication?

# New Universal bonding agents are an advance in bonding

Dent.Update.2017:44:328-340



FJ Trevor Burke

Louis Mackenzie

# Bonding to Dentine: An Update on Universal Adhesives

**Abstract:** The ability to successfully bond restorations to dentine is central to minimally invasive restorative dentistry. While dentine bonding agents have gone through a variety of 'generations', it is the purpose of this article to describe the latest clinical and laboratory research on universal adhesives. Results from the latest laboratory and clinical research indicates that universal adhesives are a step forward in the quest for the ultimate bond to tooth substance and ease of use of the adhesive. The wide variety of studies that indicates the effectiveness of universal adhesives are discussed, along with research that indicates that selective enamel etching is a beneficial procedure when using these materials.

**CPD/Clinical Relevance:** Universal adhesives appear to hold promise in the quest for a reliable bond to dentine.

**Dent Update 2021; 48: 620-631**

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

A dentine adhesive should perform the following functions:<sup>3</sup>

- Provide an immediate, strong and definitive 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 article to trace the history of dentine adhesives since that is relevant to the performance of the latest group of adhesives, the universal adhesives (UAs), and thereby to update readers on the progress of UAs since a previous *Dental Update* paper in 2017,<sup>4</sup> and to compliment other *Dental Update* publications on the subject, which readers may wish to read as background, such as those by Green and Banerjee,<sup>2</sup> and Green *et al.*<sup>5</sup>

## A brief history of bonding to dentine

In the past, dentine bonding agents were

bonding agents generally fell into disarray because of confusion regarding which 'generation' each type of bonding agent fitted into. Until recently, the classification has therefore been to simply subdivide resin-based dentine bonding agents into etch and rinse materials (also known as total etch materials) and self-etch materials, with some workers classifying these according to the number of steps involved in their placement (one or two), or by their pH.<sup>3,7</sup>

The year 1955 heralded what we now realize to be a game-changing breakthrough in restorative dentistry, namely the genesis of adhesive (and, therefore, more minimally invasive) dentistry by enabling clinicians to bond to enamel, when this was first described by Buonocore.<sup>8</sup> This also has facilitated the development of resin composite materials, with these materials becoming increasingly used worldwide,<sup>1</sup> principally because of patient concerns regarding mercury in dental amalgam, the Minamata Agreement of 2013 that recommended reduction in the use of dental amalgam, and increasing

# Hot off the press!

## 10 laboratory studies included

Finally, recent laboratory studies include the work by Lago and co-workers<sup>39</sup> who compared the shear bond strength of six UAs to dentine, using Clearfil SE Bond (Kuraray) as control. The results indicated highest bond strength values for Scotchbond Universal (3M) (33.9MPa), but this was not significantly different to Clearfil Universal (Kuraray) and Tetric N-Bond (Ivoclar-Vivadent). All six UAs provided superior bond strength values to the Clearfil SE control.

In summary, therefore, laboratory studies appear to confirm that the bond strengths obtained by UAs are generally an improvement over those previously attained, with a selective enamel etch strategy being preferred.



FJ Trevor Burke

Louis Mackenzie

# Bonding to Dentine: An Update on Universal Adhesives

**Abstract:** The ability to successfully bond restorations to dentine is central to minimally invasive restorative dentistry. While dentine bonding agents have gone through a variety of 'generations', it is the purpose of this article to describe the latest clinical and laboratory research on universal adhesives. Results from the latest laboratory and clinical research indicates that universal adhesives are a step forward in the quest for the ultimate bond to tooth substance and ease of use of the adhesive. The wide variety of studies that indicates the effectiveness of universal adhesives are discussed, along with research that indicates that selective enamel etching is a beneficial procedure when using these materials.

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It is the intention of this article to trace the history of dentine adhesives since that is relevant to the performance of the latest group of adhesives, the universal adhesives (UAs), and thereby to update readers on the progress of UAs since a previous *Dental Update* paper in 2017,<sup>4</sup> and to compliment other *Dental Update* publications on the subject, which readers may wish to read as background, such as those by Green and Banerjee,<sup>2</sup> and Green *et al.*<sup>5</sup>

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# Hot off the press!

## 11 clinical studies included

In summary therefore, there is a strong body of evidence that indicates that recently developed UAs provide clinical effectiveness as good as, or better, than previous 'gold standard' adhesives, and that selective etching of the enamel is desirable, given that the results presented above indicate improved retention rates of class V restorations when the margins are etched, and reduced levels of discolouration around the margins of all restorations. The present authors therefore strongly recommend this procedure. Does that statement apply to all UAs? It is the authors' view that, in view of the similarities between many of the UAs (Table 1<sup>21,22</sup>), and the fact that their pH values tend to lie between 1.5 and 3, it is prudent to suggest that this is carried out if the clinician wishes to limit marginal staining over time.

**FJ Trevor Burke**, DDS, MSc, MDS, MGDS, FDS (RCS Edin), FDS RCS (Eng), FFGDP (UK), FADM, Emeritus Professor, University of Birmingham School of Dentistry, UK.  
**Louis Mackenzie**, BDS, FDS RCPS, Head Dental Officer, Denplan UK, Winchester and Clinical Lecturer, University of



## Bonding to Dentine: An Update on Universal Adhesives

**Abstract:** The ability to successfully bond restorations to dentine is central to minimally invasive restorative dentistry. While dentine bonding agents have gone through a variety of generations, it is the purpose of this article to describe the latest clinical and laboratory research on universal adhesives. Results from the latest laboratory and clinical research indicate that universal adhesives are a step forward in the quest for the ultimate bond to tooth substance and ease of use of the adhesive. The wide variety of studies that indicate the effectiveness of universal adhesives are discussed, along with research that indicates that selective enamel etching is a beneficial procedure when using these materials.

**Conclusion:** Universal adhesives appear to hold promise in the quest for a reliable bond to dentine.

Dent.Update.2021:  
620-631

## Conclusions

In summary, universal adhesives hold promise and:

- Can be used in total etch, self-etch, selective enamel etch modes, depending on the clinician's choice. The need to selectively etch the enamel has been demonstrated to be beneficial in many of the studies quoted in this review, both from the point of view of retaining class V restorations, but also because marginal staining and defects will be reduced;
- In addition, in view of the potential to cause post-operative sensitivity as a result of (over) etching dentine, particularly in posterior teeth, it is the authors' view that this is not necessary or desirable and that selective enamel etching is the method of choice;

# Hot off the press!

## Conclusions

- Some are compatible with direct and indirect procedures, when used with a designated resin luting material from the same manufacturer as the bonding agent because this will contain a separate activator;
- May be suitable primers for silica and zirconia;
- Can bond to different substrates, such as metal.

However, as with any new material or technique, more long-term clinical evaluations (alongside those referenced above) are needed to adequately demonstrate the value of these universal adhesives.

## Trevor's view:

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

...this is good  
because....

# An easy to use material may allow us to produce better results

Special Report

## Ease of use versus clinical effectiveness of restorative materials

F. J. T. Burke, DDS, MSc, MDS<sup>1</sup>/ M. Liebler, DDS<sup>2</sup>/ G. Eliades, DDS, Dr Odont<sup>3</sup>/  
R. C. Randall, M Phil, BChD<sup>4</sup>

"Ease of use," as applied to dental materials and techniques, means different things to different people. Factors that may contribute to ease of use include a minimum number of application stages, easy application and shaping ability, quickness of use, lack of stick, and moisture sensitivity. Ease of use may also imply that a material or technique does not cause stress for the dentist and patient, is cost effective, is easy to learn, and should provide the operators with a sense of satisfaction with their work. Similarly, "clinical effectiveness" of the treatments prescribed for patients is not always capable of being accurately defined. Suggested factors that may contribute to clinical effectiveness include a lack of patient complaints with respect to longevity and/or cost, no secondary caries, and preservation of the remaining tooth structure during functional loading. Ease of use and clinical effectiveness are not necessarily related, but they must be combined for a technique to be successful. The achievement of this demands a partnership between clinicians, manufacturers, and patients. (*Quintessence Int* 2001;32:239-242)

# 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

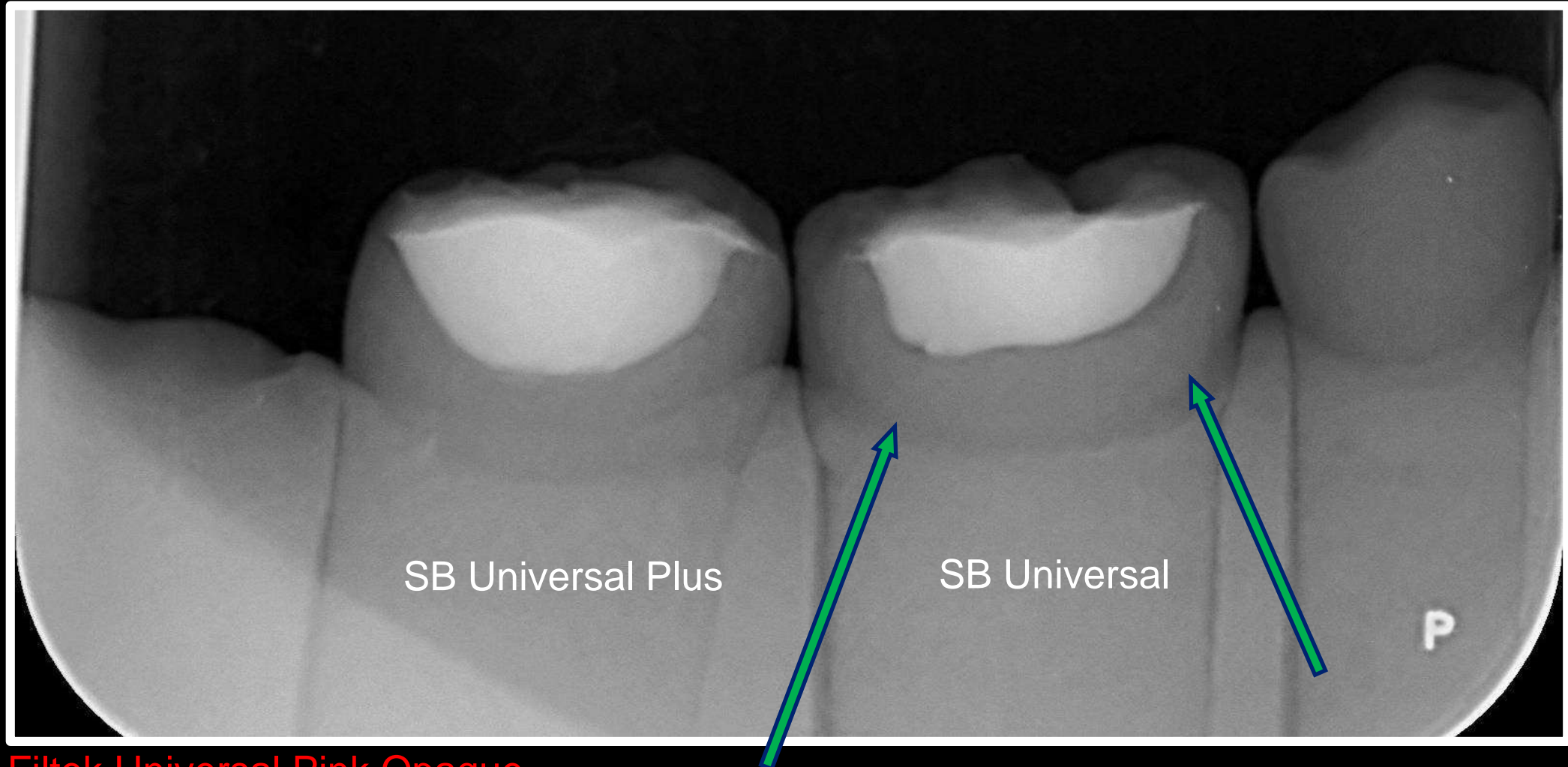
BPA free

The gamechanger



A longstanding  
question

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



Filtek Universal Pink Opaque

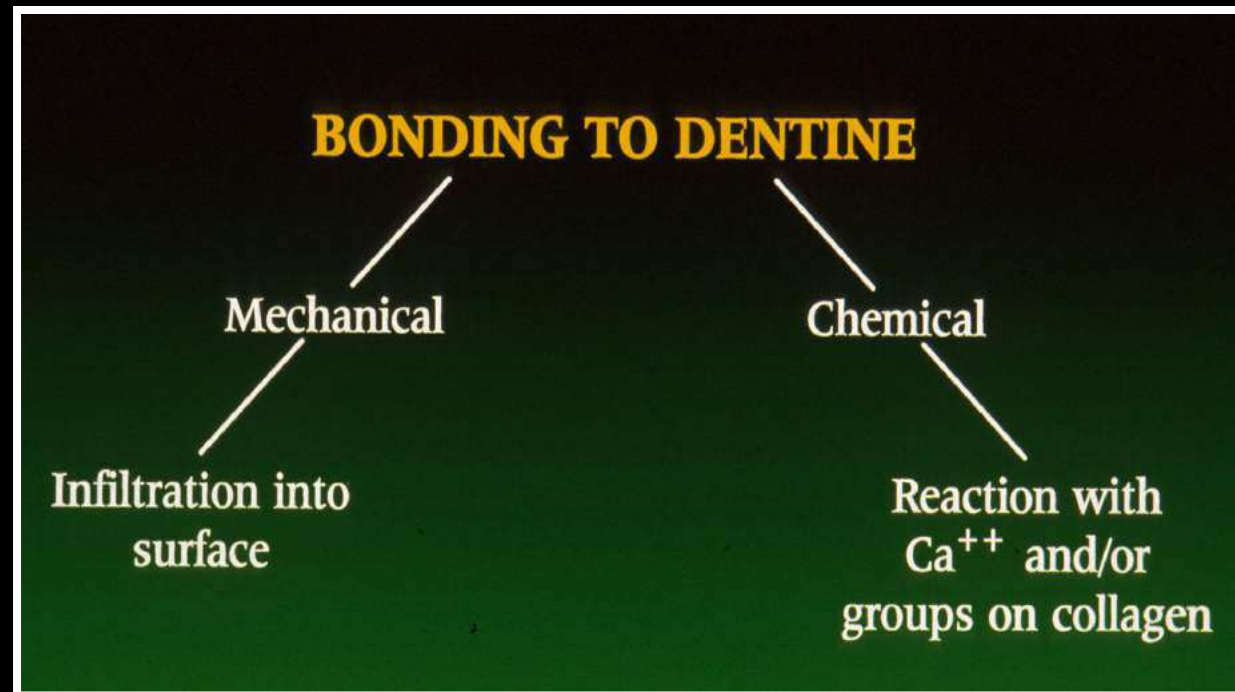
...for more on bonding, please see  
Adhere today lecture notes.....



# Bonding to dentine

Chemical = Glass ionomer

Micromechanical = Dentine bonding systems



# Maximising class V effectiveness

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

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

### 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

**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 analysed using the Kaplan-Meier method, log-rank tests and Cox regressions models to identify significant associations between the time to restoration failure and different clinical factors. **Results** After five years 275/989 restorations had failed (27.8%), with 116 (11.7%) lost to follow-up. Cox regression analysis identified that, in combination, the practitioner, patient age, cavity size, moisture contamination and cavity preparation were found to influence the survival of the restorations. **Conclusions** At least 60.5% of the restorations survived for five years. The time to failure of Class V restorations placed by this group of dentists was reduced in association with the individual practitioner, smaller cavities, glass ionomer restorations, cavities which had not been prepared with a bur, moisture contamination, increasing patient age, cavities confined to dentine and non-carious cavities.

# 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”



# Examples of Resin Modified Glass Ionomer (RMGI) filling materials



Bond strength for glass ionomers is improved by application of 20% polyacrylic acid



Gwinnett AJ, Kanca J. Interfacial morphology of resin composite and shiny erosion lesions. Am.J.Dent.1992;5:315-317.

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

**How to bond to  
sclerotic dentine** = **Minimal removal of  
the shiny surface**

# A landmark paper

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

Marleen Peumans<sup>a</sup>/Jan De Munck<sup>b</sup>/Kirsten Van Landuyt<sup>c</sup>/Paul Lambrechts<sup>a</sup>/  
Bart Van Meerbeek<sup>a</sup>

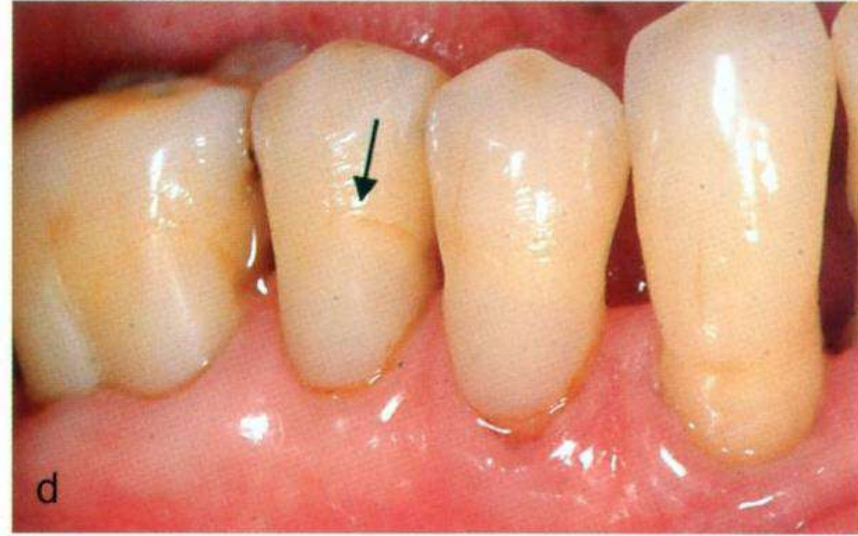
**Purpose:** The purpose of this prospective randomized controlled clinical study was to evaluate the clinical performance of a "mild" two-step self-etching adhesive, Clearfil SE, in Class V restorations after 5 years of clinical functioning.

**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.

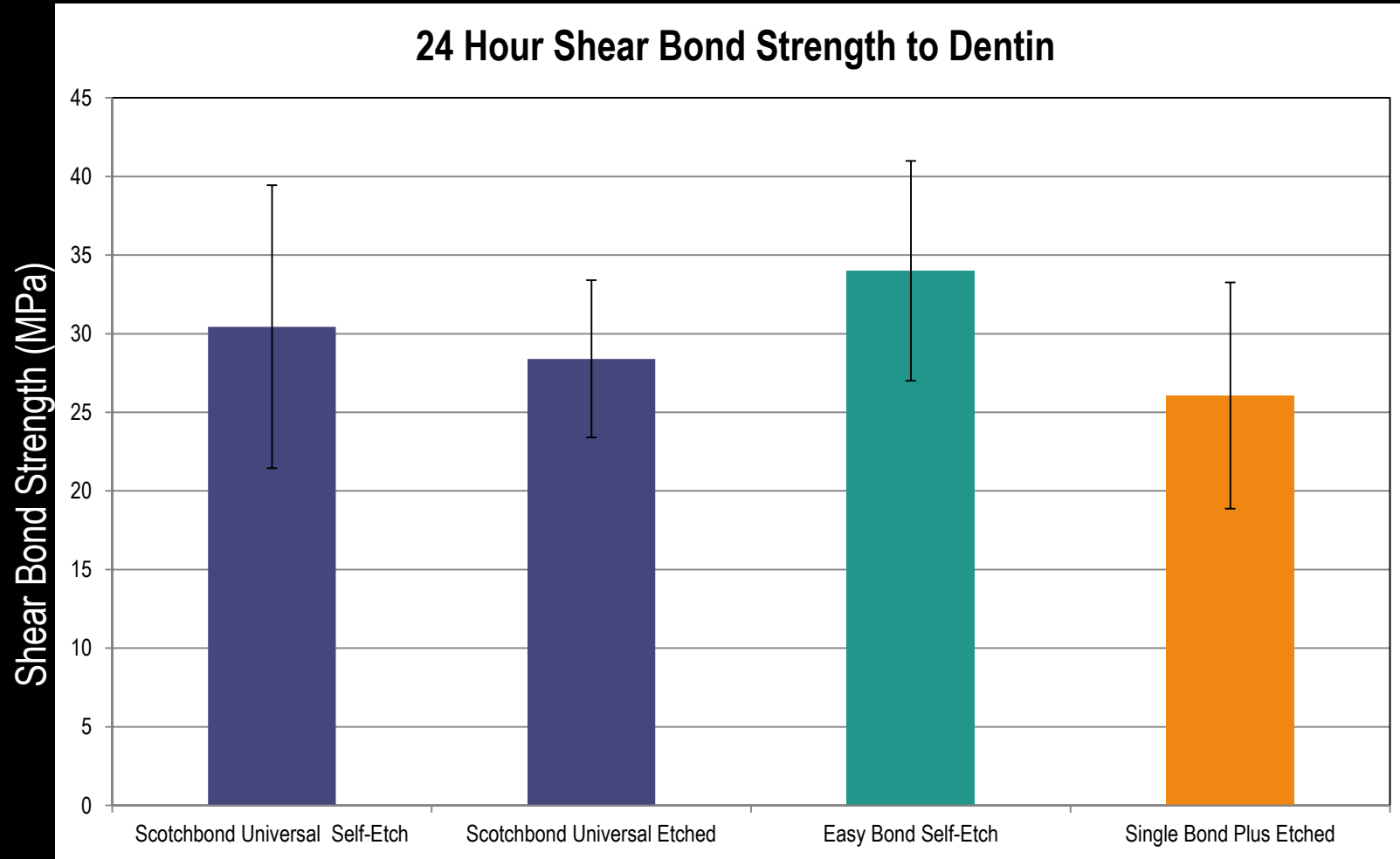
**Keywords:** adhesives, clinical trial, cervical lesions, composite restoration.



## CONCLUSION

From the results of this study, we may conclude that intra-orally, Clearfil SE performs reliably and stably after 5 years of clinical functioning. Selective enamel etching with phosphoric acid resulted in an improved marginal adaptation, but has no influence on the overall clinical performance of the Class V restorations.

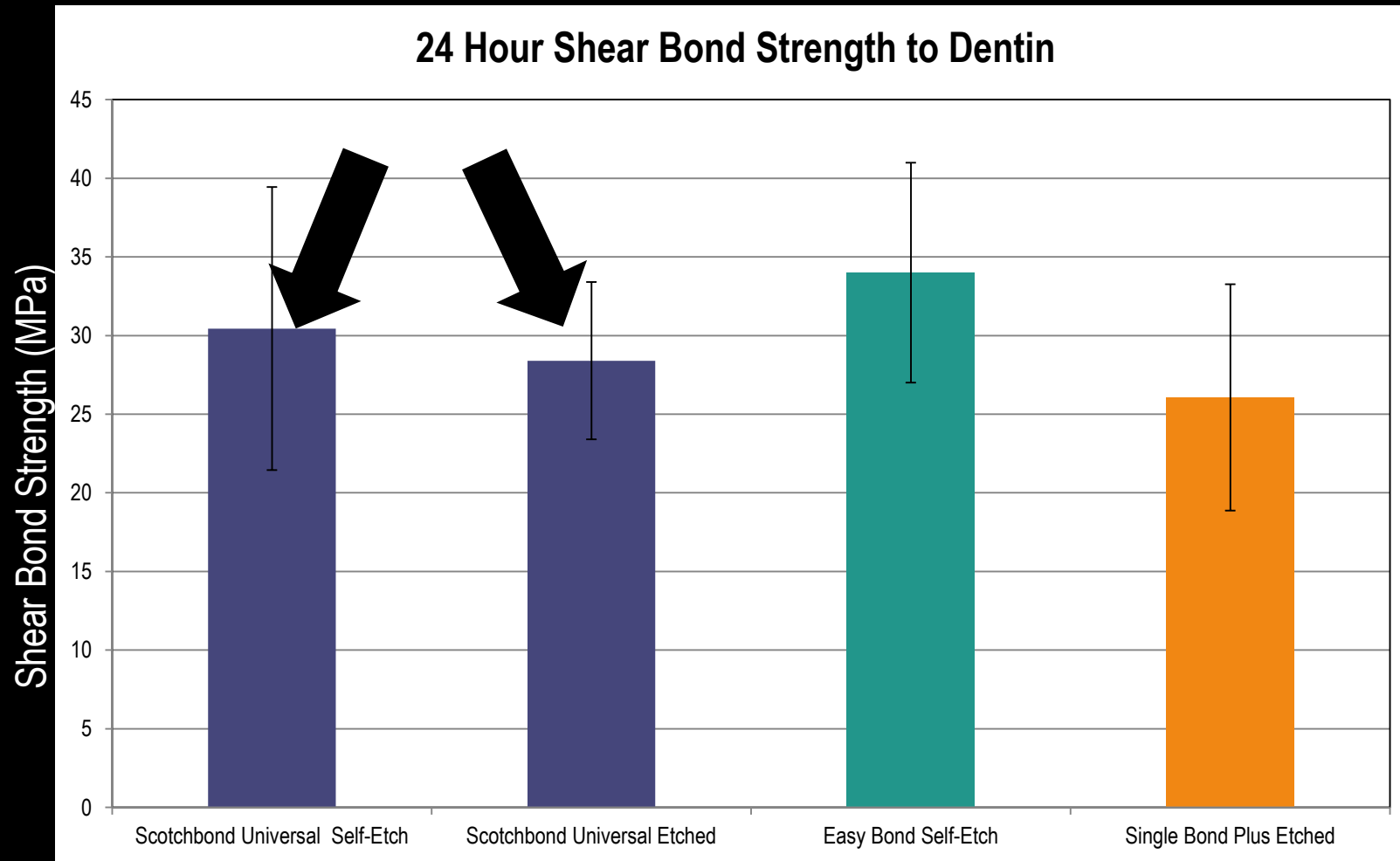
# Dentine Shear Bond Strength – Etched and Unetched



\*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

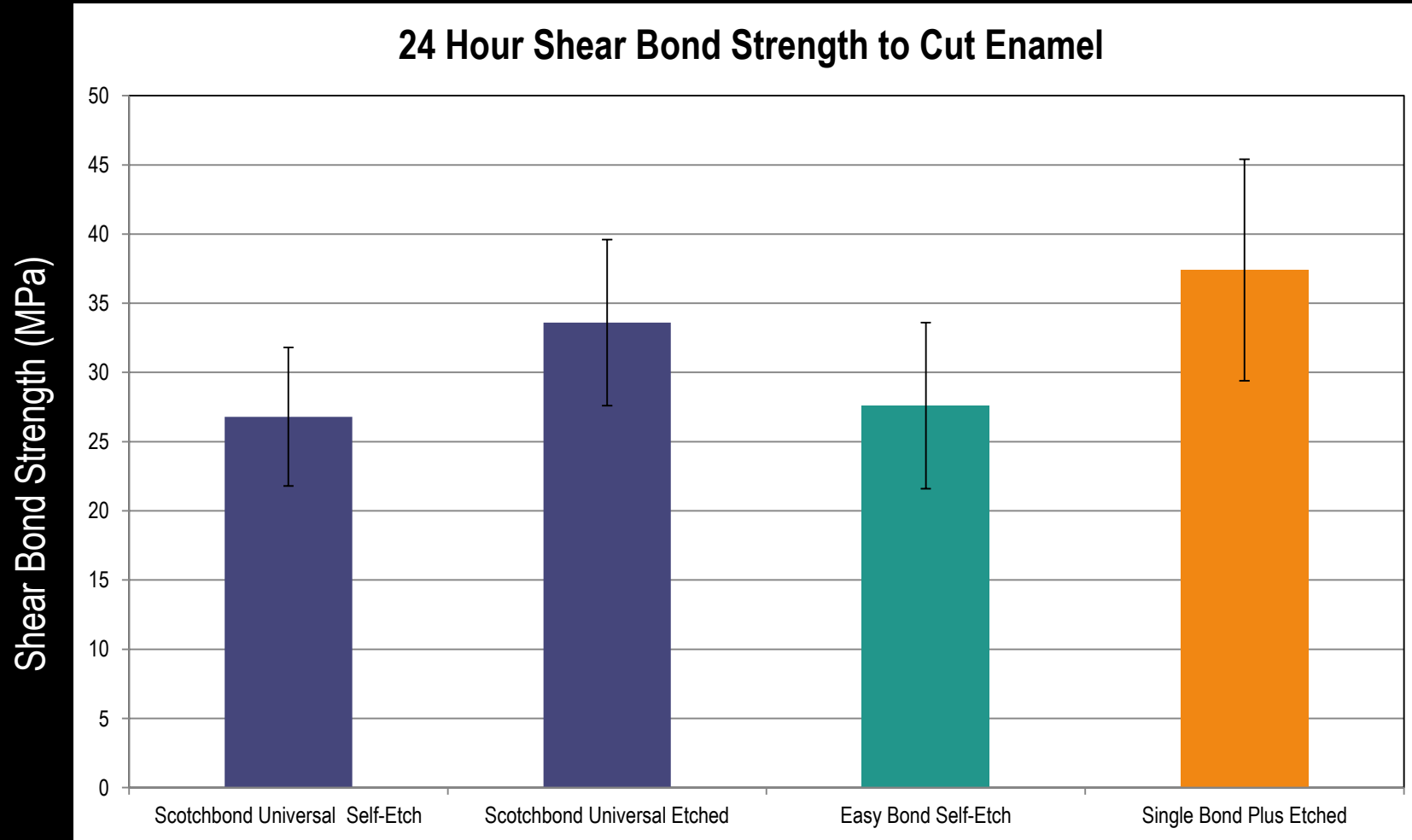
# Dentine Shear Bond Strength – Etched and Unetched



\*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

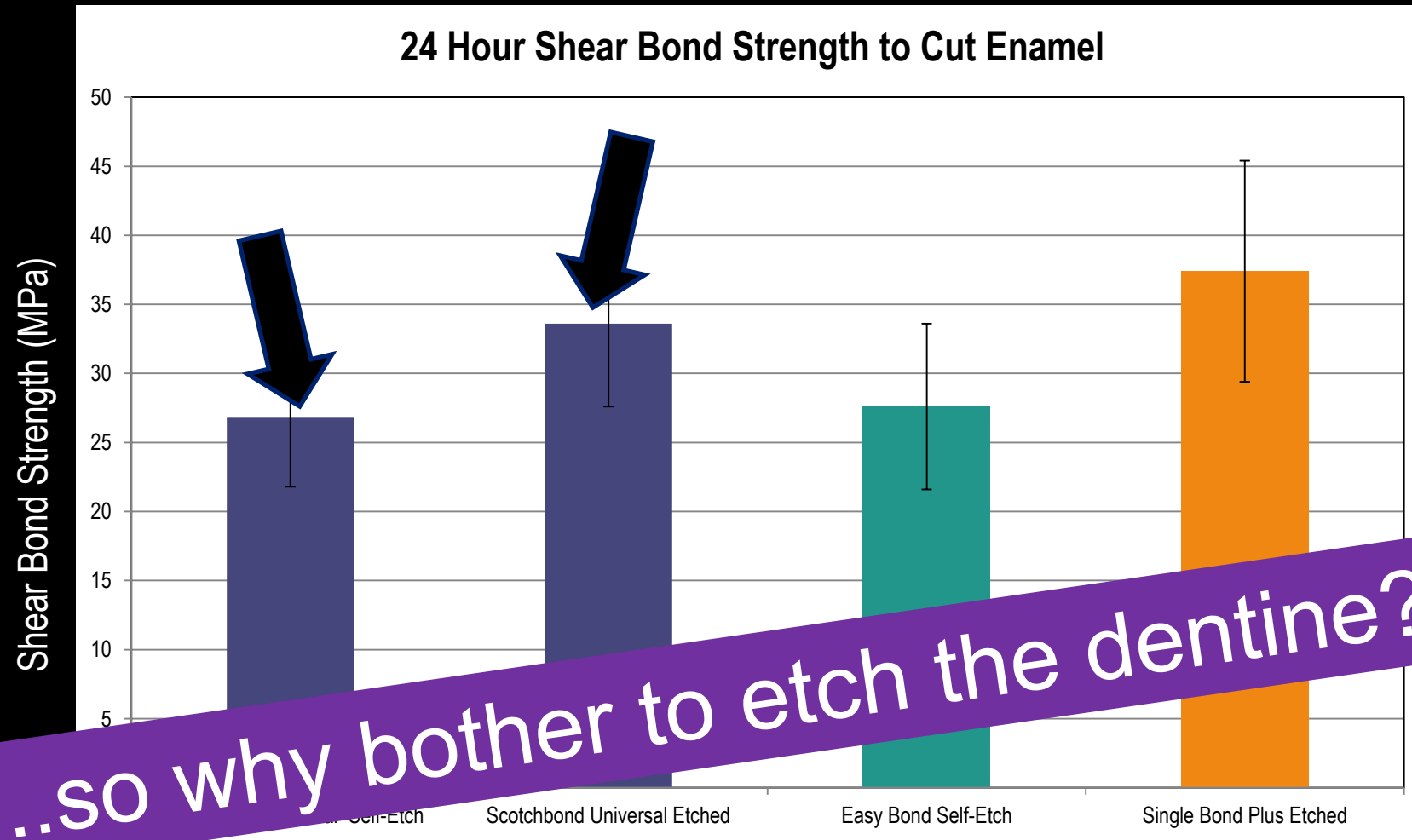
# Cut Enamel Shear Bond Strength – Etched and Unetched



\*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

# Cut Enamel Shear Bond Strength – Etched and Unetched



\*Study will also examine 11 month aged adhesion

Burgess J. et al, University of Alabama

# SUGGESTION



For Scotchbond Universal, the  
concept of  
selective enamel etching should  
be employed



My guess is that this applies to all Universals

# Take home message: Avoiding adhesive failures

Use a material from a manufacturer with experience in the field and follow the instructions!!

One bottle bonding (reduced risk of error) – new Universal materials are a significant advance

Effective light curing (check your light regularly!)  
Think seriously about selective enamel etching

# Universal adhesives



**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

Article history:  
Received 1 December 2014  
Received in revised form  
14 March 2015  
Accepted 5 April 2015

## ABSTRACT

**Objectives:** A systematic review was conducted to determine the effect of self-etching mode on the bond strength of composite resin to dentin.

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

These adhesives

# The first three year SBU evaluation



8 restorations, from 200 placed, lost after 36 months

Clinical behaviour of new multi-mode adhesive is reliable in NCCLs at 36 months

Signs of degradation when adhesive applied in SE mode

...other tips for  
optimal bonding..



Effects of moisture degree  
and rubbing action on the  
immediate resin-dentin bond strength  
Dal-Bianco K, Pellizzaro A, et al.  
Dent.Mater.2006

**Conclusion:**

High bond strength to dentine can  
be obtained under dry conditions  
when ethanol/H<sub>2</sub>O and acetone based  
systems are vigorously rubbed on  
the dentine surface. On wet surfaces,  
light rubbing may suffice.

# Agitation helps with 7 Universals!

ELSEVIER

journal homepage: [www.intl.elsevierhealth.com/journals/jden](http://www.intl.elsevierhealth.com/journals/jden)

## Does active application of universal adhesives to enamel in self-etch mode improve their performance?

Alessandro D. Loguercio<sup>a</sup>, Miguel Angel Muñoz<sup>b</sup>, Issis Luque-Martinez<sup>a,b</sup>,  
Viviane Hass<sup>a</sup>, Alessandra Reis<sup>a</sup>, Jorge Perdigão<sup>a,\*</sup>

<sup>a</sup>Department of Restorative Dentistry, School of Dentistry, State University of Ponta Grossa, Ponta Grossa, Paraná, Brazil

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### ARTICLE INFO

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Accepted 7 April 2015

#### Keywords:

Microshear bond strength

Degree of conversion

Enamel

Etch-and-rinse

Self-etch

Universal adhesive systems

### ABSTRACT

**Objectives:** To evaluate the effect of adhesion strategy on the enamel microshear bond strengths ( $\mu$ SBS), etching pattern, and in situ degree of conversion (DC) of seven universal adhesives.

**Methods:** 84 extracted third molars were sectioned in four parts (buccal, lingual, proximal) and divided into 21 groups, according to the combination of the main factors adhesive (AdheSE Universal [ADU], All-Bond Universal [ABU], Clearfil Universal [CFU], Futurabond U [FBU], G-Bond Plus [GBP], Prime&Bond Elect (PBE), and Scotchbond Universal Adhesive [SBU]), and adhesion strategy (etch-and-rinse, active self-etch, and passive self-etch). Specimens were stored in water (37 °C/24 h) and tested at 1.0 mm/min ( $\mu$ SBS). Enamel-resin interfaces were evaluated for DC using micro-Raman spectroscopy. The enamel-etching pattern was evaluated under a field-emission scanning electron microscope (direct and replica techniques). Data were analyzed with two-way ANOVA and Tukey's test ( $\alpha = 0.05$ ).

**Results:** Active self-etch application increased  $\mu$ SBS and DC for five out of the seven universal adhesives when compared to passive application ( $p < 0.001$ ). A deeper enamel-etching pattern was observed for all universal adhesives in the etch-and-rinse strategy. A slight improvement in etching ability was observed in active self-etch application compared to that of passive self-etch application. Replicas of GBP and PBE applied in active self-etch mode displayed morphological features compatible with water droplets. The DC of GBP and PBE were not affected by the application/strategy mode.

**Conclusions:** In light of the improved performance of universal adhesives when applied actively in SE mode, selective enamel etching with phosphoric acid may not be crucial for their adhesion to enamel.

# Rules for bonding

**Do not overdry the surface**

**Etch according to manufacturers' instructions**

**Try to avoid etching the dentine.**

**Do not overblow resin layer**

**Rub in the adhesive**

# Do amalgam substitutes exist?

## Indirect

Cast alloys

Ceramics

Resin-based materials

All of these are more than X4  
as expensive as amalgam

# Do amalgam substitutes exist?

Direct – small cavities

Resin composite

Glass Ionomer

Does GI require more  
development for this indication?

# Reinforced Glass ionomer materials

- ✧ Smaller particle size leads to faster reaction
- ✧ Higher loading brings improved physical properties
- ✧ Exhibits plastic features – can be condensed and packed
- ✧ Still a need for improved wear resistance
- ✧ Typical glass ionomer features

# Reinforced (Packable) Glass Ionomers



## Ketac™ Universal Glass Ionomer Restorative



# Clinical performance of reinforced GIC materials in loadbearing situations



FJ Trevor Burke

# Dental Materials- What Goes Where? The Current Status of Glass Ionomer as a Material for Loadbearing Restorations in Posterior Teeth

**Abstract:** Glass ionomer materials have been available for 40 years, but have not been indicated for loadbearing restorations, other than when used in the ART concept. However, there is anecdotal evidence that dentists are using the reinforced versions of this material in posterior teeth, possibly as a result of demands from patients to provide them with tooth-coloured restorations in posterior teeth at a lower cost than resin composite. This paper reviews the existing literature on reinforced glass ionomer restorations in posterior teeth, concluding that, under certain circumstances (which are not fully elucidated) these materials may provide reasonable service. However, the patient receiving such restorations should be made aware of the minimal amount of evidence for the success of these restorations and the potential need for the restorations to be re-surfaced in due course.

8 papers on GI in posterior teeth included

# Conclusions

In clinical situations where there are no adverse situations at work (such as high occlusal loading or an acidogenic plaque), certain restorations in reinforced GI materials (such as Fuji IX) may provide reasonable longevity.

However, the conditions for longevity are not readily identified.

Two of the studies (Scholtanus and Huysmans, 2007; Basso, 2013) demonstrate higher than desirable failure rates for GI restorations in posterior teeth, especially in the longer term.

# GIs in posterior teeth – a medicolegal perspective

- 💋 Tell the patient that it *is* a glass ionomer that the evidence base is variable and limited
- 💋 Definitive restoration or long term provisional?
- 💋 The restorations may need re-surfacing with composite
- 💋 Alternatives are more expensive
- 💋 May not do harm

Possibly OK in class I cavities?

# GC Equia doing well at 4 years

100% success  
of GC Equia at  
4 years,  
40 Class I,  
30 Class II

*Operative Dentistry, 2015, 40-2, 134-143*

## Four-year Randomized Clinical Trial to Evaluate the Clinical Performance of a Glass Ionomer Restorative System

S Gurgan • ZB Kutuk • E Ergin  
SS Oztas • FY Cakir

### Clinical Relevance

The clinical effectiveness of Equia and Gradia Direct Posterior was acceptable in Class 1 and Class 2 cavities subsequent to four-year evaluation.

### SUMMARY

**Objective:** The aim of this study was to evaluate the clinical performance of a glass ionomer restorative system compared with a microfilled hybrid posterior composite in a four-year randomized clinical trial.

**Methods:** A total of 140 (80 Class 1 and 60 Class 2) lesions in 59 patients were either restored with a glass ionomer restorative system

(Equia, GC, Tokyo, Japan), which was a combination of a packable glass ionomer (Equia Fil, GC) and a self-adhesive nanofilled coating (Equia Coat, GC), or with a microfilled hybrid composite (Gradia Direct Posterior, GC) in combination with a self-etch adhesive (G-Bond, GC) by two experienced operators according to the manufacturer's instructions. Two independent examiners evaluated the restorations at baseline and at one, two, three, and four years postrestoration according to

Seril Gurgan, DDS, PhD, professor, Hacettepe University

...there is now some  
new positive  
information on GLC  
in posterior teeth



J Adhes Dent 22 (2020), No. 3 29. May 2020

J Adhes Dent 22 (2020), No. 3 (29.05.2020)

Page 235-247, doi:10.3290/j.jad.a44547, PubMed:32435764

## **Clinical Performance of a Glass-Hybrid System Compared with a Resin Composite in the Posterior Region: Results of a 2-year Multicenter Study**

Miletić, Ivana / Baraba, Anja / Basso, Matteo / Pulcini, Maria Giulia / Marković, Dejan / Perić, Tamara / Ozkaya, Cigdem Atalayin / Turkun, Lenize Sobrosa

Positive  
short term findings!

Long-term, split-mouth, randomized, prospective, multicentre clinical study enrolled 180 patients (mean age 34.6 years) identified as in need of two Class II, two-surface restorations in the molar region of the same jaw.

The estimated survival rates at the 2-year recall were 93.6% (EQUIA Forte) and 94.5% (Tetric EvoCeram), showing no significant differences between the two materials.

# EQUIA Forte: Differences from Fuji IX

New ultrafine highly reactive glass particles added

Higher molecular weight polyacrylic acid

20% improved flexural strength, 21% improvement  
in acid resistance, 40% wear resistance

Improved fluoride release

Needs confirmation by independent testing

The logo for GC data, featuring the letters 'GC' in a stylized green font followed by the word 'data' in a green sans-serif font.

*CONCLUSION:* EQUIA Forte (GC)  
seems to holds promise

...but, more research needed

There is a need for an improved  
Glass Ionomer: if we get that,  
it could be our amalgam substitute

I might soon have to rewrite my 2013 paper!



# Successful posterior composites

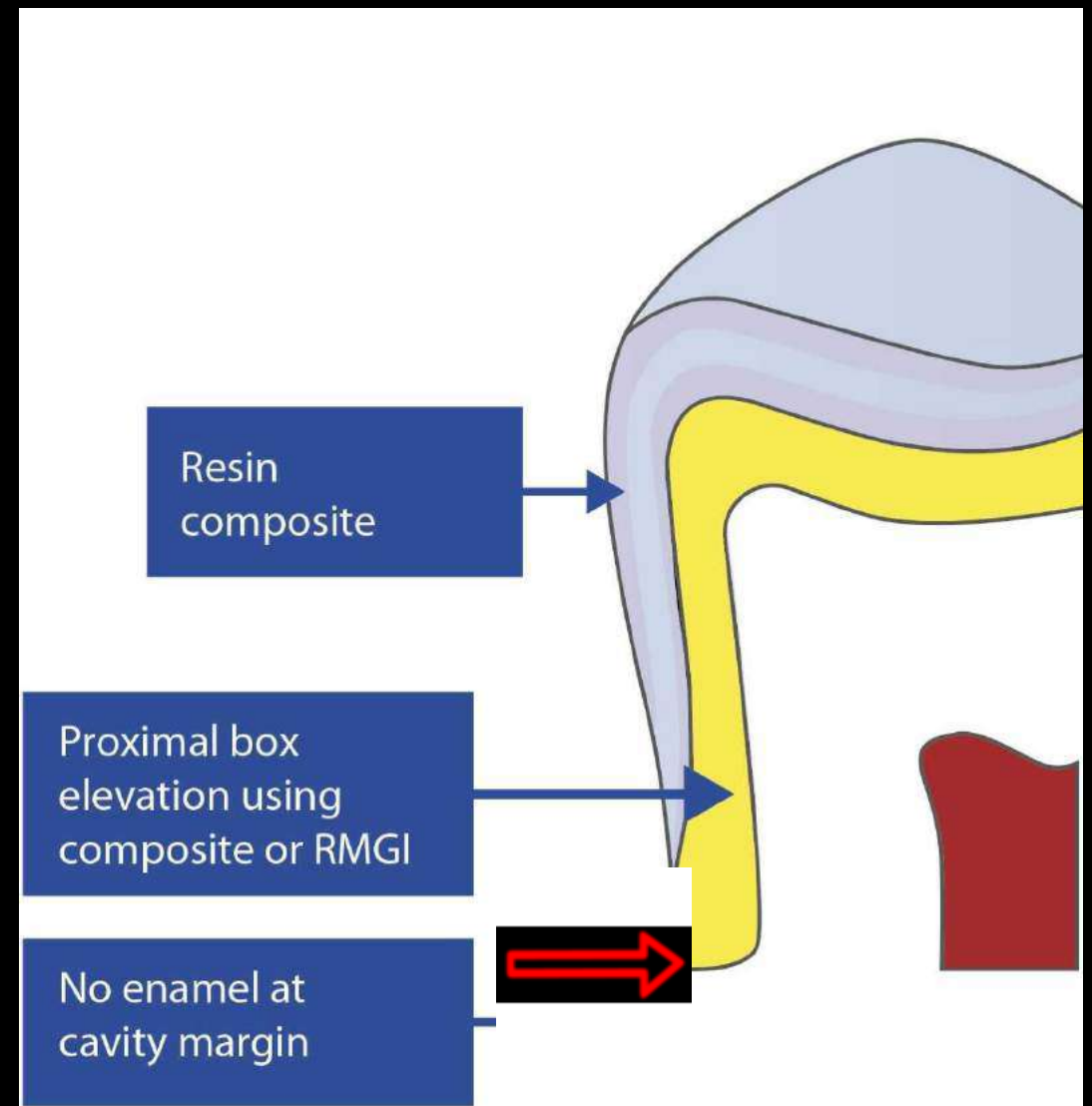
- Amalgam & the post-Minamata era
- Bonding to dentine
- Properties of composite materials
- Placing p **Margin quality** tes and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts

...how to manage  
the deep  
interproximal box

Don't say, use amalgam:  
it doesn't work well covered with blood  
and/or saliva

# Proximal box elevation

Deep class II box  
No enamel at  
the margin



First, the patient requires counselling  
regarding their high caries activity

# Proximal box elevation

I suggest a chemically-cured RMGI – it is insoluble, will bond quickly and doesn't require separate bonding step

We need a material that will bond quickly, before isolation fails (in my hands, that is!)

# Resin Modified Glass Ionomers

- † Better bond strength than conventional GICs
- † Better aesthetics than conventional GICs
- † Better physical properties (reduced solubility)
- † Typical characteristics of a GIC



Aftab Butt

# Cervical Margin Relocation and Indirect Restorations: Case Report and Literature Review

**Abstract:** Coronal margin relocation (CMR) is a technique that is being increasingly used to manage subgingival defects in cavities in posterior teeth. The aim of this case report and literature review is to arm the dental practitioner with up-to-date scientific literature on this topic, such that they can appropriately incorporate CMR into their practice. Inclusion criteria for the literature review were the use of composite as the material used for CMR and a subsequent indirect restoration. Medline was searched and manual search of bibliographies was carried out. This yielded nine *in vitro* studies and 12 clinical reports that were considered in this review.

**CPD/Clinical Relevance:** The CMR technique is being used more widely in dental practice and it is important for dental practitioners to be aware of the evidence base on which to guide their practice.

**Dent Update 2021; 48: 93-97**

The management of subgingivally extending carious lesions in posterior teeth poses a common clinical scenario faced in dental practice. Traditionally, surgical and orthodontic crown lengthening has been used to increase crown height in such situations, although it may be considered that additional training would be needed for such techniques.<sup>1,2</sup> The evolution of dental adhesive systems and restorative materials however, has led to the increased use of an alternative technique that first appeared in the literature in 1998: cervical margin relocation (CMR).<sup>3</sup> It has since also been referred to as 'deep margin elevation' (DME) and 'proximal box elevation' (PBE), among other names. The technique advocates the direct addition of composite resin onto the cavity floors of posterior proximal subgingival defects to produce a supragingivally displaced margin,<sup>4</sup>

which can then be used as the margin for a further indirect or, less commonly, direct restoration.<sup>4,5</sup> The rationale for this technique includes the improved ease of impression taking and isolation of the relocated margin, while being less invasive and more affordable than surgical crown lengthening options.<sup>4</sup>

The aim of this article is to present case reports using this technique and to provide a review of the existing literature. Medline was searched using the terms 'cervical margin elevation', 'proximal box elevation', 'deep margin elevation' and 'coronal margin relocation'. A further manual search of the bibliographies of all selected articles was carried out. The search concluded on 1 April 2020. Inclusion criteria were the use of composite for the elevation of margins of posterior teeth, with subsequent use of an indirect restoration.

## Case examples

In 2010, Veneziani proposed a useful classification of cervical cavities into three

with rubber dam and on the distance of the cavity margin to the supracrestal connective tissue attachment (Table 1).<sup>6</sup> The first case is an example of a grade 1 case according to Veneziani's classification because it could be isolated with rubber dam.

## Case 1. CMR procedure

A 38-year-old male patient presented complaining of a 3 month history of a broken, but otherwise asymptomatic, LR5. On examination, a large disto-occlusal cavity was present with a subgingival distal extent involving some element of gingival overgrowth (Figure 1a). Disto-buccal, disto-lingual and mid-distal probing depths of 2 mm were present and there was no bleeding on probing. The tooth provided a negative response to sensibility testing. Radiographically, the cavity was deemed to be extending past the cemento-enamel junction (CEJ) with no enamel present distally. The presence of peri-apical pathology was noted (Figure 1b).

Following local anaesthesia, a rubber

# Others suggest bonding and composite

Butt A. Dent.Update.2021:48:93-37

# However, patients must be warned that this will always be a compromise situation!

Research Article

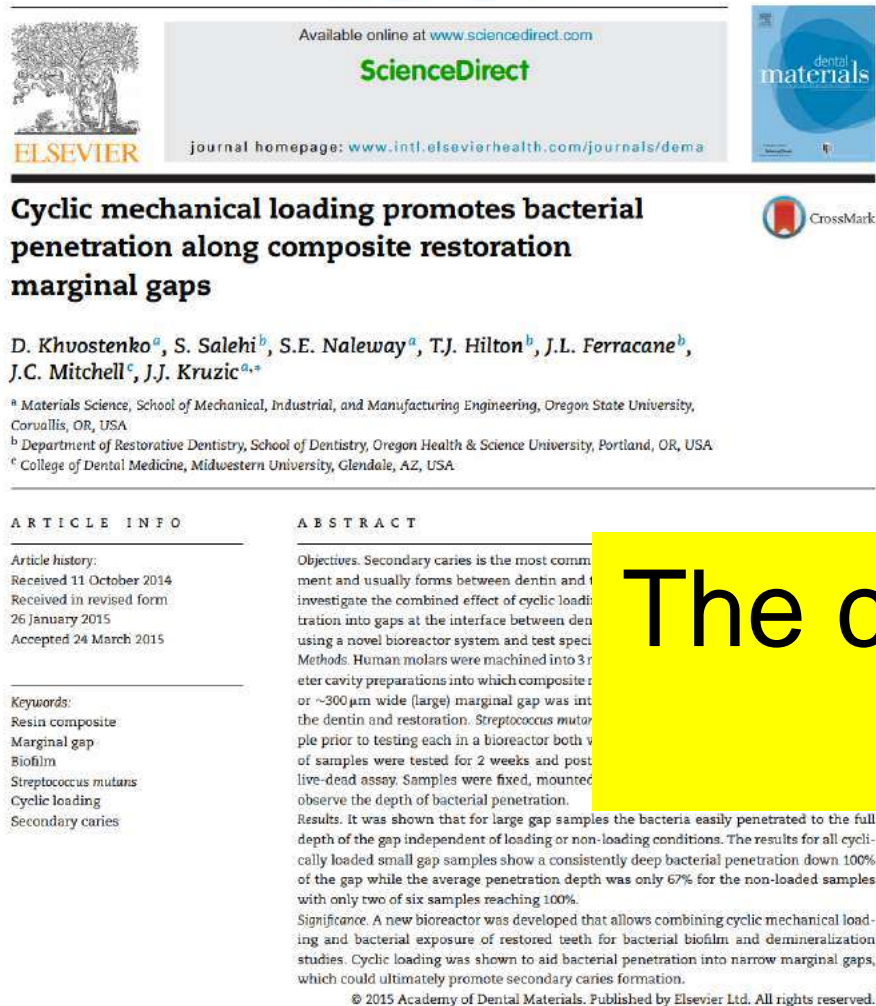
## Gingival seal of deep Class II direct and indirect composite restorations

BRIAN J. KENYON, DMD, DANIEL FREDERICKSON, DDS, MS & MARK S. HAGGE, DMD

**ABSTRACT: Purpose:** To evaluate *in vitro* the gingival microleakage of Class II direct and indirect composite restorations with cervical margins 0.5 mm apical to the cemento-enamel junction (CEJ). **Methods:** Mesial-occusal (MO) preparations of similar size were made in 10 homologous pairs of caries-free extracted human third molars. One specimen for each pair was prepared for a direct composite restoration and the other for an indirect composite restoration. Direct preparations were restored per manufacturer's instructions. Indirect preparations were impressed, and composite restorations were fabricated and cemented with a dual-cure cement. A total-etch technique was used for all restorations. Restorations were finished, polished, stored for 1 week in distilled water at 37°C, thermocycled (5°-55°C x 1000), sealed with fingernail polish (leaving a 1.5 mm open periphery adjacent to the gingival margin), and placed in 0.5% basic fuchsin dye for 24 hours. Teeth were sectioned longitudinally (mesio-distally) within the restoration in two cuts and the four resulting surfaces (two inner cut surfaces, two outer cut surfaces) were evaluated for dye penetration with a x10 stereoscope using a scale of 0 (no penetration) to 4 (dye penetration involving more than half the axial wall). **Results:** All 20 specimens had at least one score of three (dye penetration involving less than half of the axial wall) or four. Statistical analysis (Wilcoxon paired-sample test) disclosed a significant decrease in the indirect composite microleakage scores for the two outer cuts ( $P=0.006$ ,  $P=0.002$ ). No significant differences in microleakage scores were found between materials for the inner cut surfaces of the specimens. Overall, the results of dye penetration showed no sta-

The irony is that they will have to pay more for this compromise situation

**FIRST:**  
**CHECK** where the your cavity margin is with  
regard to the occlusion!

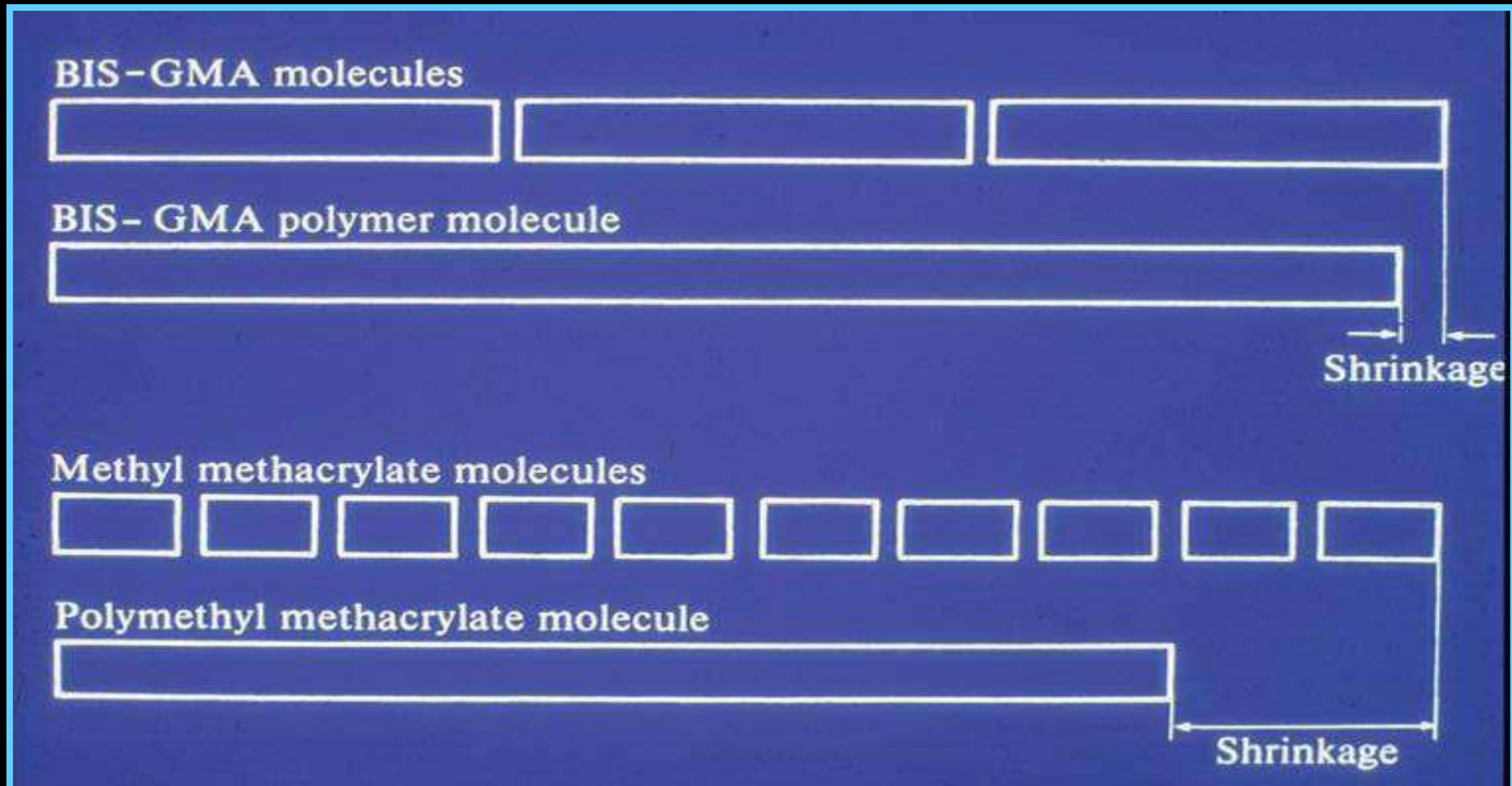


The cavity margin should not be under  
high occlusal loading

## Trevor's view:

RMGI seems a good idea as the base layer in deep class II boxes, but always a compromise situation – patients must be told!

# Composites shrink on polymerisation



# Take home message

Shrinkage **stress** is a function,  
not only of % volumetric shrinkage,  
but also the stiffness (modulus) of  
the material

**Important!**

Clinical factors influencing

**shrinkage stress:**

Cavity geometry/application technique

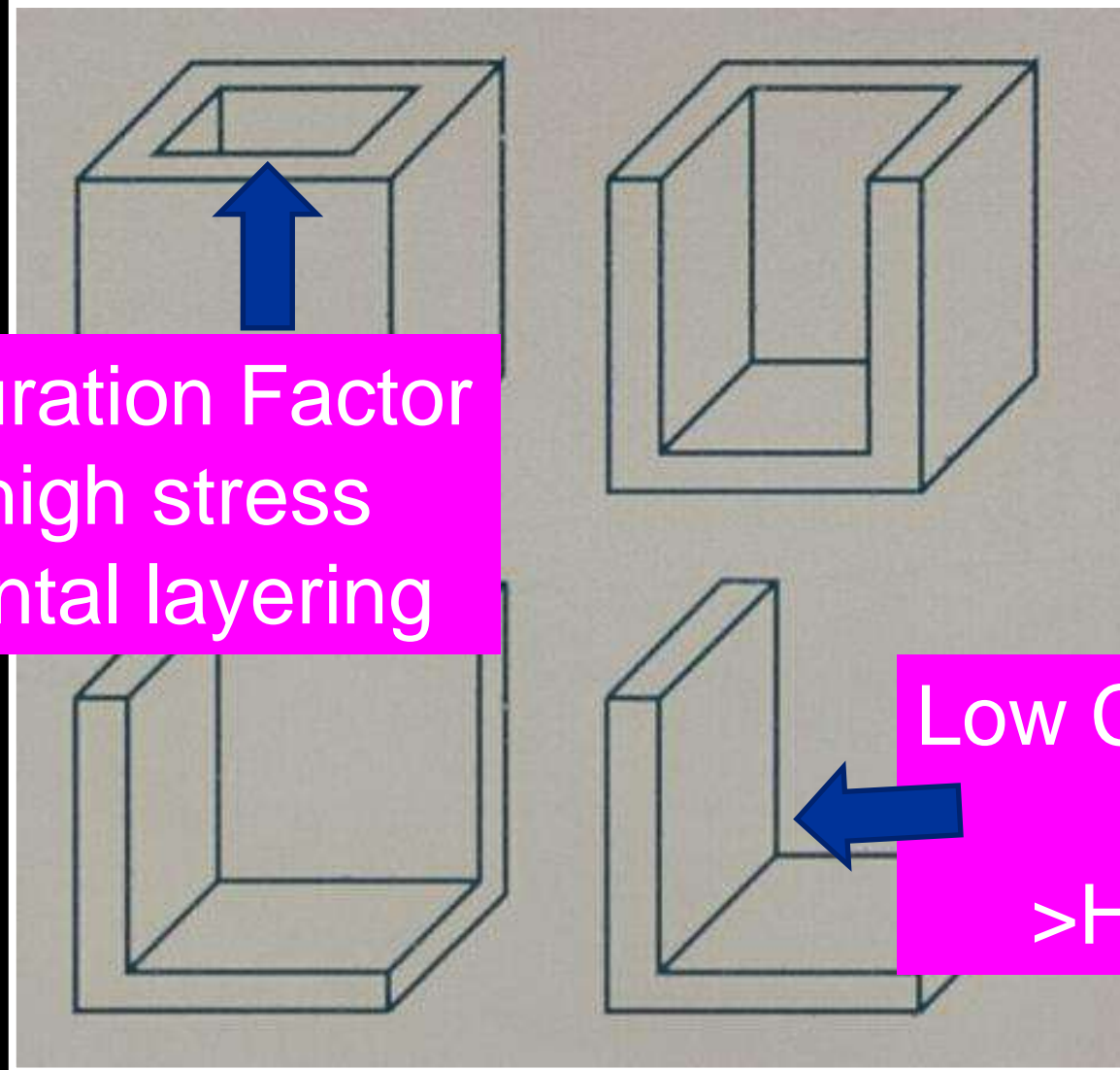
Physical properties of material used

Light intensity

# The Configuration Factor



High Configuration Factor  
= high stress  
> incremental layering



Low Configuration Factor  
= low stress  
> Horizontal layering

# Clinical ways of countering polymerisation shrinkage stresses

- *Incremental curing*
  - Ramped curing
  - Macro fillers
  - Flowable composite base layer
  - Low shrink (1% shrinkage) resins
  - **All of these!!**

All of these are a source of  
operator stress



A low *STRESS* composite  
should be an advantage  
to the clinician

Regarding materials, five ways  
of reducing shrinkage stress:

1. Increase the filler loading
2. Reduce resin shrinkage
3. Reduce % resin conversion
4. Bulk fill low stress material
5. Use a high molecular wt. resin

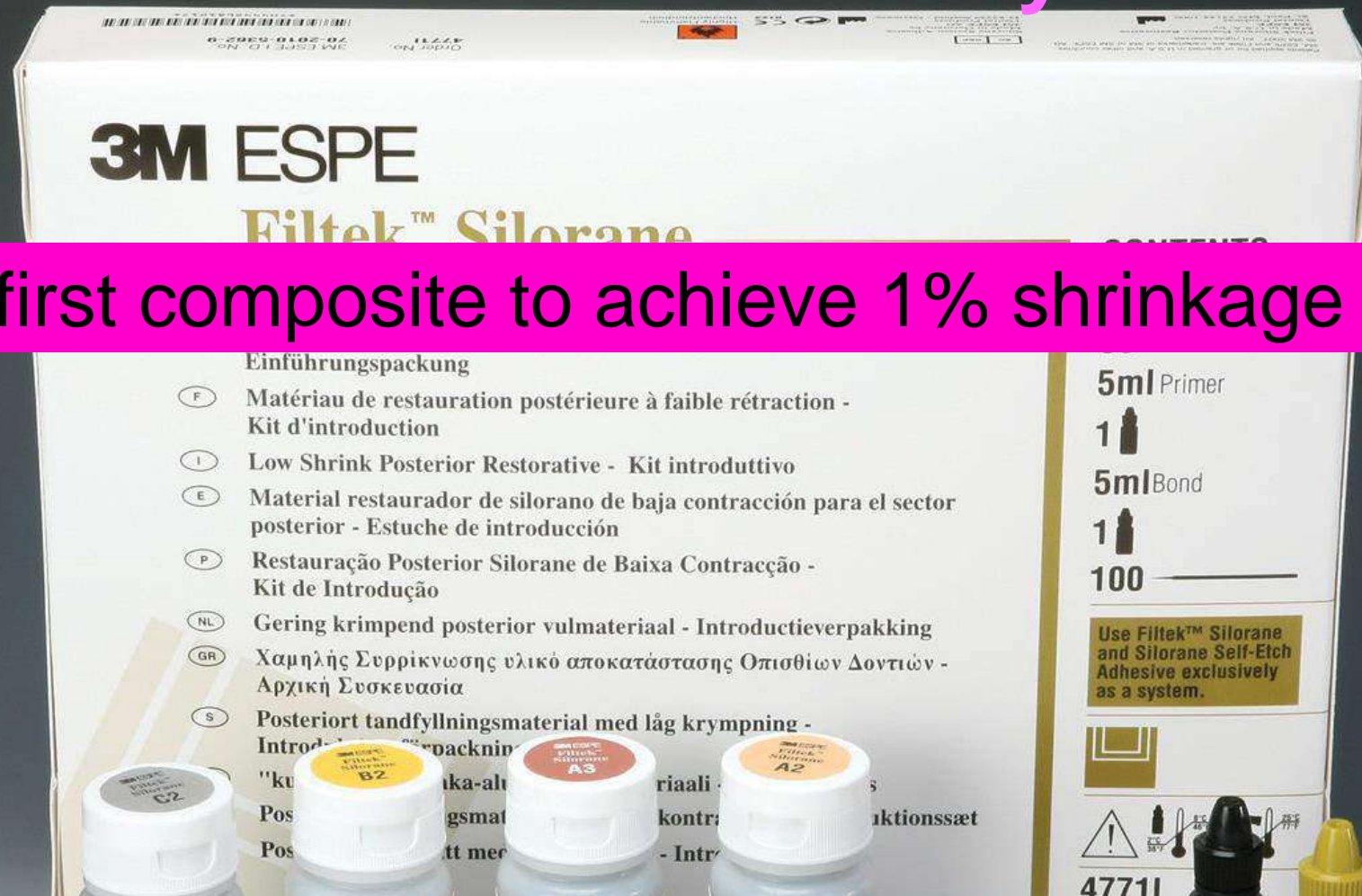
...a way of reducing  
shrinkage stress –  
a composite with a low  
shrinkage/ low shrinkage  
stress

Now history!

Now history!

# The Filtek™ Silorane System

The first composite to achieve 1% shrinkage



Weinmann W, Thalacker C, Guggenberger R. Siloranes in dental composites. Dent.Mater. 2005;21:68-74

# Why no post-op sensitivity?

Reported post-op sensitivity in evaluations of “conventional” posterior composite:

- Burrow and colleagues<sup>2</sup> - 4% of restorations exhibited sensitivity in daily function
- Zero post-operative sensitivity reported by Opdam and co-workers<sup>3</sup>, although 19% of the teeth were sensitive to loading.
- Other studies reported 10% to 20% incidence of post-operative sensitivity at one week and one month recalls<sup>4,5</sup>
- Auschill and colleagues reported 6% overall post-operative sensitivity in a study of 600 teeth restored with resin composite with cavity depth being significantly associated with the occurrence of post-operative sensitivity<sup>6</sup>

No post-operative sensitivity because of its low shrinkage stress

4..Akpata ES, Sadiq W. Post-operative sensitivity in glass-ionomer versus adhesive resin-lined posterior composites. Am.J.Dent.2001;14:34-38.

5..Akpata ES, Behbehani J. Effect of bonding systems on post-operative sensitivity from posterior composites. Am.J.Dent.2006;19:151-154.

6.Auschill TM, Koch CA, Wolkewitz M, Hellwig E, Arweiler NB. Occurrence and causing stimuli of postoperative sensitivity in composite restorations. Oper. Dent.2009;34:3-10.

## Trevor's view:

What we learnt was that low shrinkage stress is important in reducing post-operative sensitivity.

# Filtek Bulk Fill Posterior Restorative: Advantages over Silorane

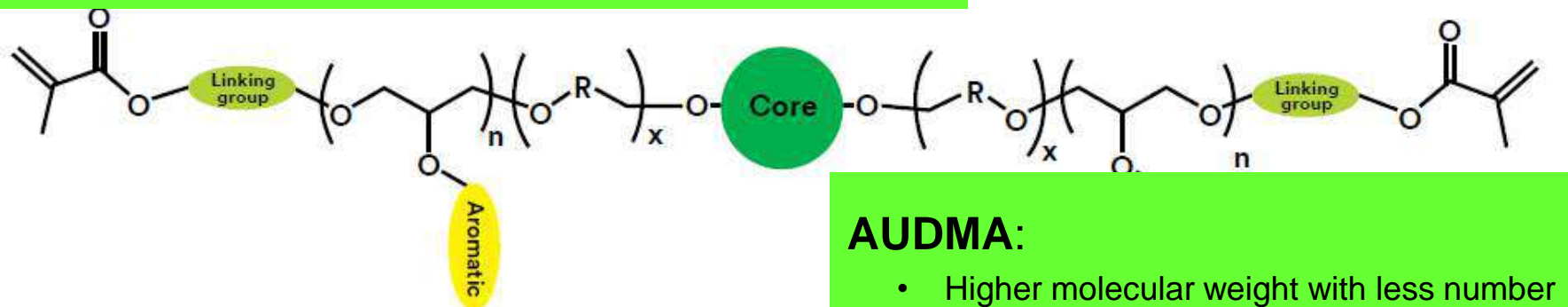
- One-step placement
  - 5 mm depth of cure
  - Can use dentine bonding agent of choice
  - Therefore, faster than Silorane Bond
  - Easier polishing due to nanofiller
  - Potentially better aesthetics
- BUT***
- Still excellent stress relief
  - Still excellent handling and sculptability



...another way of reducing  
shrinkage stress –  
a composite with a low  
shrinkage stress resin

# New Methacrylate Monomers for Lower Shrinkage and Stress Relief

## AUDMA: Aromatic urethane dimethacrylate



## AUDMA:

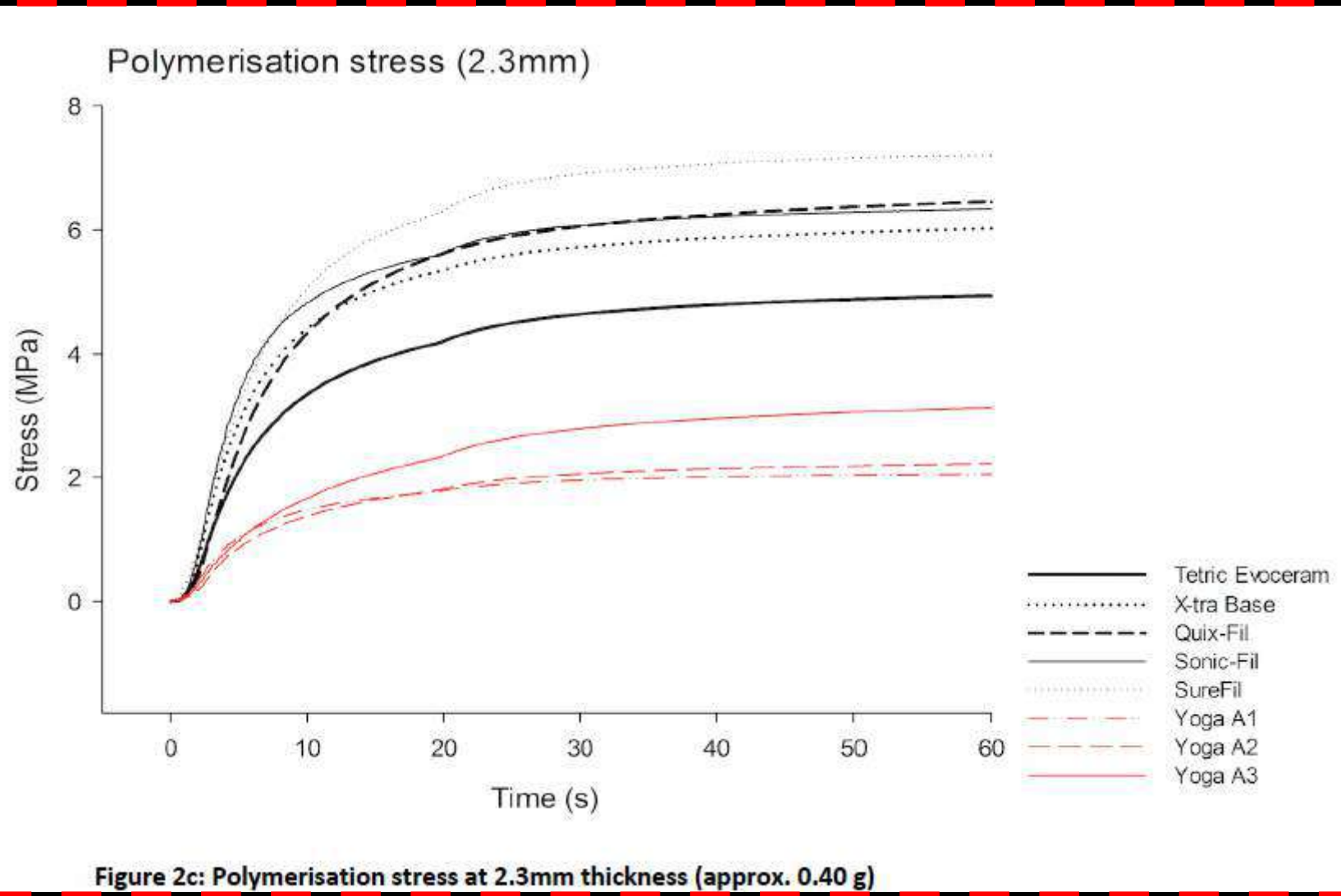
- Higher molecular weight with less number of reactive groups
- Moderates volumetric shrinkage
- Contributes to stress reduction

## AFM: Addition-fragmentation (AF) monomer



# 3M Filtek Bulk Fill/Filtek One show low shrinkage stress

Palin W, Watts D 2014



If you are using a conventional composite (i.e. not low shrinkage stress).....:  
a way of reducing marginal leakage in the class II *box*

## Effect of accelerated restorative techniques on the microleakage of Class II composites

SADULLAH UCTASLI, BDS, PhD, ADRIAN C. SHORTALL, BDS, DDS, FADM & FREDERICK J. T. BURKE, BDS, DDS, MSC, FADM

**ABSTRACT:** *Purpose:* To assess the marginal seal of Class II resin-based composite restorations cured by a high intensity halogen light or a plasma arc light. *Materials and Methods:* Class II cavities were prepared in extracted molar teeth with cervical margins located apical to the cemento-enamel junction. Cavities were restored with a posterior resin-based composite (Tetric Ceram) using either a two-increment or a bulk placement and cure restorative technique after appli

...use a flowable base layer, e.g. SDR

enamel margin of any restoration. Median gingival leakage values for the different test groups ranged from 0.02-2.51 mm. Light unit type had a highly significant effect on leakage ( $P=0.0002$ ). The highest leakage scores were recorded with the plasma arc light used in standard curing mode and the lowest with the halogen light in turbo-boost mode. (*Am J Dent* 2002;15:153-158).

**CLINICAL SIGNIFICANCE:** A combination of flowable composite lining and an incremental placement technique produced the best marginal seal at the gingival margin of Class II composite restorations. Accelerated curing, using a plasma arc light led to a high incidence of gingival margin leakage under the conditions of this study.

Not necessary when using  
low shrinkage stress composites

# Avoiding post-op sensitivity with posterior composites

- ✎ Use a so-called self etch or Universal Bonding Agent, AND do not etch the dentine
- ✎ Do not overdry the dentine
- ✎ Use a flowable base layer with “conventional” composites
- ✎ Use a low shrinkage stress composite
- ✎ Be aware of the Configuration Factor (especially large occlusal cavities)

# Avoiding post-op sensitivity with posterior composites

- ✎ Ensure good adaptation at the gingival margin (indeed, all margins)
- ✎ Use a reliable manufacturer's material
- ✎ Ensure adequate light curing

# Read more if you wish!

Enhanced CPD DO C

RestorativeDentistry



FJ Trevor Burke

Louis Mackenzie, Peter Sands and Adrian CC Shortall

## Ten Tips for Avoiding Post-operative Sensitivity with Posterior Composite Restorations

**Abstract:** Patients increasingly seek tooth-coloured restorations in their posterior dentition, and with the anticipated decline in the use of amalgam as a result of the Minamata Agreement, this will increase. However, the incidence of post-operative sensitivity has been variously assessed as being between 0% and 51%, therefore information on its avoidance is essential. This article reviews the reasons for such sensitivity by examining the potential materials' factors, plus clinical aspects, such as the configuration factor and bonding to tooth substance.

**CPD/Clinical Relevance:** There is a significant incidence of post-operative sensitivity after placement of a posterior composite restoration, so information on how to avoid this may be of value.

**Dent Update 2021; 48: 823-832**

The use of composite as a restorative material for loadbearing situations in posterior teeth has increased in recent years,<sup>1</sup> with this potentially being a result of a combination of factors, such as:

- Increasing patient demand for aesthetic restorations in their posterior, as well as anterior, teeth (Figures 1 and 2),<sup>2</sup> with this having been evident as long ago as 1990;
- Increasing patient anxiety with regard to a mercury-containing material being used in their teeth;<sup>3</sup> and
- The increasing impetus away from dental amalgam as a result of the Minamata Agreement in 2013.<sup>4</sup>

It is therefore desirable that resin composite restorations in posterior teeth may be placed successfully, including the ability to form a tight, naturally contoured contact point when interproximal surfaces are involved, this having been described previously.<sup>5</sup> However, there appears to be a demonstrable incidence of post-operative sensitivity reported to two of the authors (FTB and LM) when they conduct postgraduate education courses on placement of resin composite restorations in loadbearing situations in posterior teeth, also known as 'posterior composites', this being the term that will be used forthwith in this article. Moreover, Jack Ferracane, in his 2008

Buonocore Memorial Lecture, which reviewed the subject, stated that concerns over the problems associated with polymerization contraction of dental composite restorations made their placement a 'stressful situation for many practitioners'.<sup>6</sup>

It is therefore the aim of this article to explore the causes of post-operative sensitivity (POS) and its management.

### The problem

Determination of the extent of the problem of POS with posterior composites is difficult to quantify because of the heterogeneity of methods used for its determination. For example, researchers may:

- Report incidental findings in a cohort study, this methodology having been used in circa 50% of studies.<sup>7</sup> This was criticized by Browning *et al*<sup>8</sup> because it gives equal weight to the patients who have experienced different levels of tooth sensitivity.
- Recall patients specifically to test restored

**FJ Trevor Burke**, DDS, MSc, MDS, MGDs, FDS (RCS Edin.), FDS RCS (Eng.), FFGDP (UK), FADM, Emeritus Professor, University of Birmingham School of Dentistry. **Louis Mackenzie**, BDS, FDS RCPS, Head Dental Officer, Denplan UK, Winchester; Part-time Clinical Lecturer, University of Birmingham School of Dentistry. **Peter Sands**, MSc, BDS, LDS, MFGDP, MCGD, General Dental Practitioner, Abingdon; Part-time Lecturer, University of Birmingham School of Dentistry. **Adrian CC Shortall**, DDS, BDS4, Retired staff/External seconded, University of Birmingham School of Dentistry. email: f.j.t.burke@bham.ac.uk

Dent.Update.  
2021: 48: 823-832

# BULK FILL IS IN!

My classification for **BULK FILL** materials:

**BULK FILL BASE MATERIALS**

(which need a capping because their wear resistance isn't good enough)

**BULK FILL RESTORATIVE MATERIALS**

(satisfactory wear resistance)

# BULK FILL IS IN!

My classification for **BULK FILL** materials:

**BULK FILL BASE MATERIALS**  
(which need a capping because their wear resistance isn't good enough)

# BULK FILL IS IN!

My classification for **BULK FILL** materials:

## BULK FILL RESTORATIVE MATERIALS (satisfactory wear resistance)



*Faster **posterior** composites  
without compromise!*



**Tetric EvoCeram® Bulk Fill**  
Nano-Hybrid Composite with Ivocerin™



## A Practice-Based Clinical Evaluation of a Bulk Fill Restorative Material

### ABSTRACT

**Objective:** To evaluate the handling, by a group of practice-based researchers, of a recently introduced bulk fill resin-based composite restorative material, Filtek Bulk Fill Restorative (3M ESPE). **Methods:** The twelve selected evaluators were sent explanatory letters, a pack of the material under investigation to use for 8 weeks, and a questionnaire. **Results:** The evaluators rated the ease of use of the bulk fill restorative the same as the previously used posterior composite material. The provision of a vesicle density for evaluation may have compromised the score for aesthetic quality. No post-operative sensitivity was reported. **Conclusions:** The bulk fill material was well received as indicated by the high number of evaluators who would both purchase the material and recommend it to colleagues. **Clinical relevance:** A recently introduced bulk fill restorative material achieved a rating for handling which was similar to the evaluators' previously

The new Filtek™ One Bulk Fill Restorative handles similarly

### Keywords

Evaluation  
Composite Resins  
Bulk-Fill  
Handling Properties

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## FBFR assessment Conclusions

75% of evaluators would purchase  
92% (n=11) would recommend to colleagues

Today there are several bulk fills  
which do not need a “topping”

.. more are appearing!

# Advantages of Bulk Fill *Restorative* materials

- Time saving, no need for complex layering technique
- Easy handling
- Fewer increments, fewer voids
- Simpler shade selection, due to fewer shades

**BULK FILL IS IN!**

# Are new bulk fill composites quicker to place?

**Title:** 1407 - Clinical-time and Postoperative-sensitivity When Using Bulk-Fill Composites With Universal Adhesives

**Authors:**

Chane Tardem Pereira (**Presenter**)  
Fluminense Federal University

Elisa Albuquerque, Federal Fluminense University  
Sthefane Barbosa, Fluminense Federal University  
Leticia Lopes, Fluminense Federal University  
Fernanda Calazans, Fluminense Federal University  
Stella Marins, Fluminense Federal University  
Luiz Augusto Poubel, Fluminense Federal University  
Roberta Barcelos, Fluminense Federal University  
Marcos Barcelheiro, Fluminense Federal University

**Abstract:**

**Objectives:** The first objective of this double-blind randomized clinical trial was to compare the different clinical-time using Scotchbond Universal adhesive (3M ESPE), in self-etch or selective enamel-etching strategy, associated with incremental or bulk-fill composite in posterior restorations. The second objective was to compare the postoperative sensitivity, 24h and 48h after the restorations.

**Methods:** A total of 196 restorations were placed in 43 patients according to the following groups: SETB- Self-etch/bulk fill; SETI- Self-etch/incremental; SEEB- Selective enamel-etching/bulk-fill and; SEEI- Selective enamel-etching/incremental. Filtek Z350XT composite (3M ESPE) was incrementally placed and Filtek Bulk Fill (3M ESPE) was placed using Bulk-fill technique. The adhesive system was used according to manufacturer's instructions. Postoperative-sensitivity was evaluated using two scales (NRS and VAS).

196 restorations  
in 43 patients

Filtek Z350 vs  
Filtek Bulk Fill, both  
placed with SB  
Universal

“Less time consuming”

Fluminense University, Brazil

**Conclusions:** The simultaneous use of the tested Universal adhesive using the self-etching strategy with the tested Bulk-fill composite is less time consuming and does not increase the postoperative risk or intensity when compared with traditional incremental technique.

# How do manufacturers do it?

## SUMMARY

More potent/efficient initiator systems

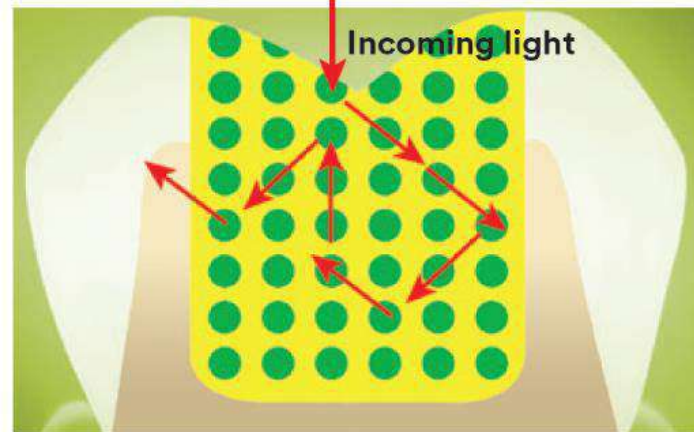
Increasing the translucency of the filler

For some, improved resin systems

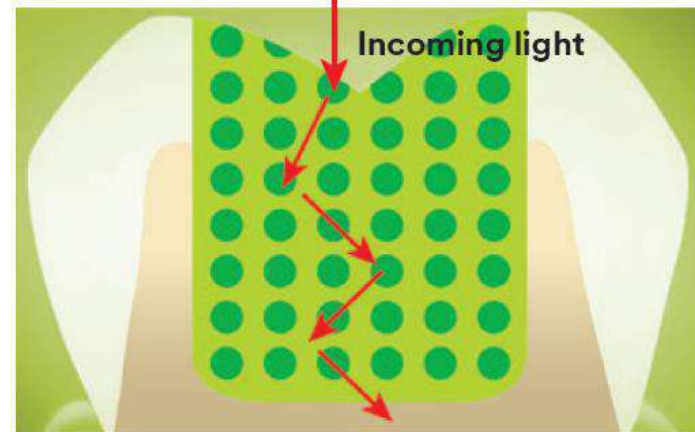
# All have a translucent filler, with matching filler and resin refractive indices

Curing light transmission and depth of cure are influenced by matrix reactivity and a relative refractive index mismatch.  
**Shortall et al., 2008**

Refractive index does not match



Refractive index does match



Refractive index match

Refractive index mismatch

● = Potential Scattering  
= Potential Scattering site  
→ = Light Ray

interaction. Composites became more opaque or translucent on curing. Optimizing filler/resin refractive index mismatch provides increased curing depth and assists shade-matching.

## RESEARCH REPORTS

Biomaterials & Bioengineering  
A.C. Shortall<sup>1</sup>\*, W.M. Palin<sup>1</sup>,  
and P. Burtcher<sup>2</sup>

<sup>1</sup>The University of Birmingham, School of Dentistry, St. Charles' Quadrant, Birmingham B4 6NN, England; and  
<sup>2</sup>Novartis Consumer Health, Lichfield, UK; \*Corresponding  
author, a.c.shortall@bham.ac.uk

J Dent Res 87(1):84-90, 2008

## Refractive Index Mismatch and Monomer Reactivity Influence Composite Curing Depth

### ABSTRACT

Limited cure depth is a drawback of light-activated composites. We hypothesize that curing light transmission and cure depth are influenced by monomer reactivity and filler/resin refractive index mismatch. Light transmission throughout cure was recorded for composites based on strontium (refractive index 1.51) or barium (refractive index 1.53) glass fillers. Fillers were mixed (70 wt%) with 4-hydroxyethyl methacrylate (bis-GMA)/triethylene glycol dimethacrylate (TEGDMA) formulations with refractive indices ranging from 1.470 to 1.530. Following polymerization, cure depth and pre- and post-cure translucency parameters were determined. Transmission changes and cure depths related to monomer reactivity and filler/resin refractive index mismatch with significant interaction. Composites became more opaque or translucent on curing. Optimizing filler/resin refractive index mismatch provides increased curing depth and assists shade-matching.

**KEY WORDS:** resin composite, refractive index, monomer reactivity, depth of cure.

### INTRODUCTION

Direct placement resin-based composites are replacing amalgam and gold for extensive posterior restorations (Lutz and Krejci, 1999; Duke, 2004). This trend will continue as clinicians seek to satisfy the expectations of patients who request affordable, aesthetic, minimally invasive restorations (Lieberberg, 2006; Rovers et al., 2005). There is a need for materials and techniques that accommodate the variable demands of clinical practice, while allowing for the successful utilization of posterior resin composites in extensive cavities (Lieberberg, 2006). A limitation of light-activated composites is their finite cure depth relating to insufficiency in light transmission, coupled with polymerization termination reactions of highly cross-linked immobile networks. Apart from surface reflection, light attenuation with depth relates to absorption and scattering of light within the material (Trembl et al., 2005; Musajic and Davell, 2005; Arikawa et al., 2007). A significantly lower survival rate has been reported for deep cavities in endodontically treated posterior teeth restored with light-activated resin composites in comparison with chemically activated materials (Hansen and Asmussen, 1990).

The composition of a composite influences its direct transmittance (Masotti et al., 2007). Harrington et al. (1999) reported that the intensity of light transmitted through commercial composites increased during oxidation. Ogata et al. (2007) reported decreasing transmission during polymerization of experimental composite formulations.

This study tested the hypothesis that light transmission during polymerization and the resultant cure depth of model composites relate both to monomer reactivity and refractive index mismatch between matrix and filler.

### MATERIALS & METHODS

Experimental resins contained 4-hydroxyethyl methacrylate

# Some bulk fill worries!

Bulk fill might lead to high stress!

It is therefore important that the material that we use has demonstrable low shrinkage stress

# Trevor's view

Bulk fill restorative materials  
may be our amalgam alternative  
in the short to medium term

... but

another alternative  
for stress reduction  
– a glass ionomer  
base

Longevity and reasons for failure of sandwich and total-etch posterior composite resin restorations.

Opdam NJM, Bronkhorst EM et al.

J.Adhes.Dent.2007;9:469-475.

**METHODS:** Retrospective assessment of practice records. 376 total etch, 82 closed sandwich (Vitrebond) post comp restorations identified. Cox regression used to rule out selection bias.

**CONCLUSIONS:** Total etch restorations showed a higher survival rate than closed-sandwich restorations using a RMGIC lining. Failures occurred after more than 3 years. Doubt must be cast on the alleged advantages of the “elastic” layer under a resin composite restoration.



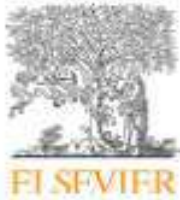
# Successful posterior composites

- Amalgam & the post-Minamata era
- Bonding to dentine
- Properties of composite materials
- Placing posterior composites and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts

Are success rates  
for posterior composite  
as good as for amalgam?

A summary of studies  
from primary dental care

Four noteworthy papers



Contents lists available at ScienceDirect

Journal of Dentistry

journal homepage: [www.intl.elsevierhealth.com/journals/jden](http://www.intl.elsevierhealth.com/journals/jden)



## Longevity of direct restorations in Dutch dental practices. Descriptive study out of a practice based research network



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Marie Charlotte D.N.J.M Huysmans

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### ARTICLE INFO

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#### Keywords:

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Longevity

Survival

### ABSTRACT

**Objectives:** The aim of this retrospective practice-based study was to investigate the longevity of direct restorations placed by a group of general dental practitioners (GDPs) and to explore the effect of practice/operator, patient, and tooth/restoration related factors on restoration survival.

**Methods:** Electronic Patient Files of 24 general dental practices were used for collecting the data for this study. From the patient files, longevity of 359,548 composite, amalgam, glass-ionomer and compomer placed in 75,556 patients by 67 GDPs between 1996 and 2011 were analyzed. Survival was calculated from Kaplan-Meier statistics.

**Results:** A wide variation in annual failure rate (AFR) exists between the different dental practices varying between 2.3% and 79%. Restorations in elderly people (65 years and older, AFR 6.9%) showed a shorter

Laske M et al. Longevity of Class II restorations placed in Dutch general dental practices. IADR Boston, Abstract 1937

Electronic patient files from 24 dental practices

358,548 restorations in 75,556 patients, 67 gdps

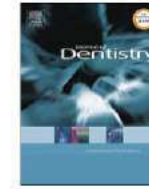
AFR varied between 2.3% and 7.9%, mean 4.6%  
@10 years

Restorations in molars had higher AFR

AFR of composites was 4.4%, amalgam 5.1%,  
and GI 11.1%

- 10 year failure rate was 3.8%, but varied between practices (2% to 5%)
- Composite showed higher survival than amalgam
- Age of patient, gender, number of surfaces, operator, tooth type and endodontically treated teeth significantly influenced survival.

Laske M et al. Longevity of Class II restorations placed in Dutch general dental practices.  
IADR Boston, Abstract 1937



## Longevity of 2- and 3-surface restorations in posterior teeth of 25- to 30-year-olds attending Public Dental Service—A 13-year observation



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**Methods:** Data were extracted from electronic patient files of the Helsinki City Public Dental Service (PDS), Finland. A total of 5542 2- and 3-surface posterior composite and amalgam restorations were followed indirectly from 2002 to 2015. Longevity of restorations was illustrated using Kaplan-Meier curves. Annual failure rates (AFRs) of the restorations were calculated separately by type of tooth, size, and material. Differences in longevity were statistically tested with log-rank tests.

**Results:** Composite restorations formed the majority (93%). The longest median survival times and the smallest failure rates were found for teeth in the upper jaw, for premolars, and for 2-surface restorations. Median survival time of all restorations was 9.9 years (95% CI 9.6, 10.2) and re-intervention of restorations occurred less often in the maxilla (AFR 4.0%) than in the mandible (AFR 4.7%). Median survival time of composite restorations was greater for 2-surface than for 3-surface restorations: in premolars 12.3 vs. 9.6 years ( $p < 0.001$ ) and in molars, 9.2 vs. 6.3 years ( $p < 0.001$ ); for molar amalgams the difference (8.0 vs. 6.3 years) was non-significant ( $p = 0.38$ ). Median survival time of 2- and 3-surface restorations in premolars exceeded that in molars (12.0 vs. 8.7 years;  $p < 0.001$ ).

**Conclusions:** Longevity of posterior composite multisurface restoration is comparable to amalgam longevity.

**Clinical significance:** Regarding material choices for posterior multisurface restorations, composite and amalgam perform quite similarly in molars, 3-surface restoration being challenge for both materials.

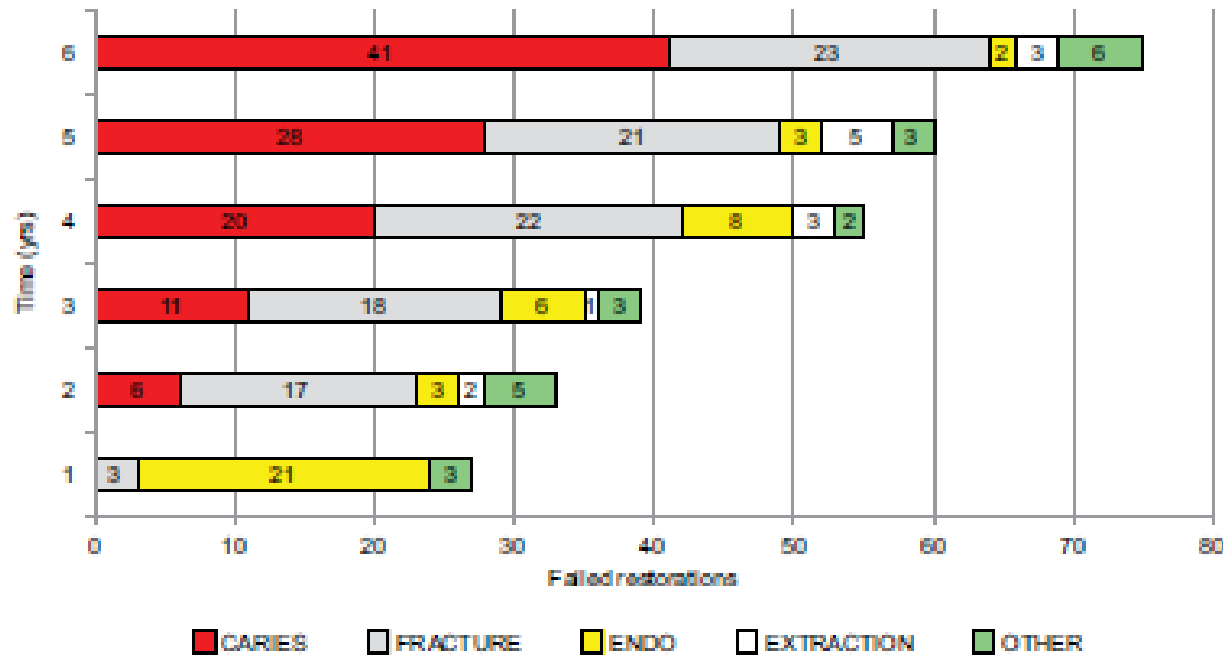
Results  
from a  
large  
database  
in  
Finland

....finally

The ultimate evidence

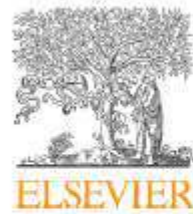
# Longevity of Posterior Composite Restorations: A Systematic Review and Meta-analysis

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**Figure 1.** Number of failed restorations with type of failure during the first six-year observation time.

Short term studies are of limited relevance for clinical durability as most acceptable materials remain failure free in the first years



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## Longevity of posterior composite restorations: Not only a matter of materials

Flávio F. Demarco<sup>a,\*</sup>, Marcos B. Corrêa<sup>a</sup>, Maximiliano S. Cenci<sup>a</sup>,  
Rafael R. Moraes<sup>a</sup>, Niek J.M. Opdam<sup>b</sup>

<sup>a</sup> Graduate Program in Dentistry, School of Dentistry, Federal University of Pelotas, RS, Brazil

<sup>b</sup> Department of Restorative and Preventive Dentistry, Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands

“due to their aesthetic properties and good clinical service, composites have become the preferred standard for direct posterior restorations”.

34 papers, each with evaluation periods of >5 years.

#### RESULTS:

Poorer survival rates in molar teeth than in premolars

Multiple surface fillings more likely to fail than class I

CONCLUSION: “composite restorations have been found to perform favourably in posterior teeth, with annual failure rates of 1-3%”.



F J Trevor Burke

Louis Mackenzie and Adrian CC Shorthall

# Survival Rates of Resin Composite Restorations in Loadbearing Situations in Posterior Teeth

**Abstract:** The use of resin composite for routine restoration of cavities in posterior teeth is now commonplace, and will increase further following the Minamata Agreement and patient requests for tooth-coloured restorations in their posterior teeth. It is therefore relevant to evaluate the published survival rates of such restorations. A Medline search identified 144 possible studies, this being reduced to 24 when inclusion criteria were introduced. Of these, ten directly compared amalgam and composite, eight were cohort studies, and six were systematic reviews. It was concluded that posterior composites may provide restorations of satisfactory longevity and with survival rates generally similar to those published on amalgam restorations. However, the ability of the operator in placing the restoration may have a profound effect.

**CPD/Clinical Relevance:** With the increasing use of composite for restorations in posterior teeth, it is relevant to note that these may provide good rates for survival.

**Dent Update 2019; 46: 523-535**

Resin composite has been an alternative material to dental amalgam since the first

use of resin composite materials in posterior teeth (hitherto termed 'posterior composites')

need for high-quality evidence from primary dental care'. It has also been noted that RCCTs

Do you want  
to read  
more?

144 studies  
identified, 24  
included

Dent.Update.  
2019:46:  
523-535

The conclusion gleaned from the above cohort studies is that resin composite restorations have acceptable survival rates when placed in loadbearing situations in posterior teeth, with AFRs generally within the range 2% to 3%, which the authors consider to

The conclusion gleaned from the above systematic reviews is that resin composite restorations have acceptable survival rates when placed in loadbearing situations in posterior teeth, with AFRs generally within the range 2% to 3%. Risk factors for premature failure include patients at high risk of caries and the presence of a liner or base beneath the resin composite restoration.

# Do you want to read more?

144 studies  
identified, 24  
included

Dent.Update.  
2019;46:  
523-535

Are success rates  
for posterior  
composite as good  
as for amalgam?

YES - and we aren't  
even comparing composite  
in its best situation

Amalgam has been our “gold” standard for 100 years!



# Successful posterior composites

- Amalgam & the post-Minamata era
- Bonding to dentine
- Cost effectiveness
- Placing posterior composites and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts

# Time taken for posterior composites =X2.5 time for amalgam

Burke F.J.T.

Attitudes to posterior composite  
filling materials: A survey of 80 patients.

Dent. Update. 1989;16:114-120.

*Patients no longer simply require the restoration of their teeth but may also want their restorations to be as aesthetically pleasing as possible. Composite materials have been developed for use in posterior teeth, but how do patients assess these restorations? A questionnaire was designed to obtain patients' opinions, and the results are given here.*

COMPOSITE FILLING materials were introduced to the dental profession by Bowen<sup>1</sup> in 1963. First reports of the use of such materials for restorations in load-bearing situations in posterior teeth were favourable,<sup>2</sup> but later reports<sup>3-5</sup> indicated that excessive wear was occurring, not only occlusally, but also at contact areas, leading Leinfelder to state, in 1975, that these materials should be eliminated as a material for use in Class I and Class II restorations.<sup>6</sup>

Changes in the formulation of composite materials for anterior use have led to microfilled materials, with a filler particle size of 0.4 µm giving a highly polishable surface but having an increased risk of incisal fracture,<sup>7</sup> and 'hybrid' materials (with particles from 1 to 5 µm mixed with 0.04 µm) which offer good polishability and strengths sufficient to withstand incisal stresses. Fine-particle composites are also available with 1-8 µm particles which allow a filler content similar to or greater than the hybrids together with reasonable finishing properties. Materials suitable for use in posterior load-bearing situations have also been developed by increasing the filler/resin ratio, altering the resin formulation, improving the bonding of

filler particles to the resin matrix, and the use of light-activation.

## POSTERIOR COMPOSITES

Problems associated with early composites in Class I and Class II situations have now largely been overcome. The excessive wear of early materials has led to the development of stringent criteria for materials for use in posterior teeth. To fulfil the ADA Provisional Acceptance criteria, wear no greater than 150 µm must occur in a three year period.<sup>8</sup> Four materials have, so far, gained provisional acceptance and two materials, Occlusin (ICI Dental, Macclesfield, Cheshire, UK) and Fulfil (L.D. Caulk Company, Milford, Delaware, USA) have met the criteria for full ADA acceptance after five years.

Studies are available which show satisfactory behaviour of these materials in clinical use.<sup>9-11</sup> From further studies, it can be seen that Occlusin restorations performed their intended purpose satisfactorily for periods of at least five years.<sup>12</sup>

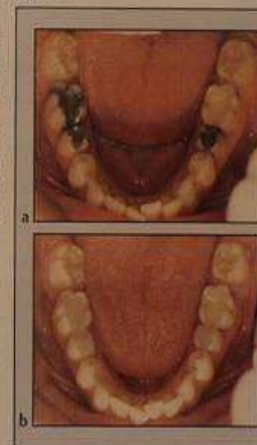
Technique problems have also largely been overcome by the development of new instruments, accessories such as burnishable matrices and transparent matrices used in conjunction with light-conducting wedges,<sup>13</sup> alongside the realization that incremental curing is necessary to prevent cuspal movement,<sup>14-16</sup> and that meticulous moisture isolation and dentine insulation is important. And so, as the clinical technique has evolved, patients have become interested in aesthetic posterior restorations.<sup>17</sup> However, as with any new procedure, it is necessary to inform them of the advantages — and possible disadvantages — of the new technique. Indeed, such is the media interest in new ideas in Medicine and Dentistry, that such new techniques may be given press coverage before clinical trials have been completed, with the result that patients may request new techniques

before they are readily available and before the dentist has undergone the necessary re-education.<sup>17</sup>

## PATIENT AWARENESS OF DENTAL AESTHETICS

Patient concern about appearance may be more important than health concerns,<sup>18</sup> and attractive persons may be considered more qualified and reliable than their unattractive peers.<sup>19,20</sup> Moreover, the appearance of a patient's teeth has been shown not only to have an effect on that patient's self-esteem,<sup>21</sup> but also to change that person's social attractiveness when judged by their peers and others.<sup>22-24</sup> In this respect, the advent of a tooth-coloured restorative for posterior teeth may offer

Figure 1. (a) Lower arch where several amalgams require replacement. (b) Amalgams in Figure 1a replaced with posterior composite.



F.J.T. Burke, BDS, MSc, FDS, MClinDent, RCSEd, Part-Time Lecturer, Department of Conservative Dentistry, University of Manchester Dental School and General Practitioner, Manchester.

# Alternatives for the restoration of posterior teeth

Christensen, 1989

**COST**

Amalgam	1X
Cast gold	6X
Direct-placement composite	2.5X
Direct resin inlay	5X
Composite inlay	6X
Ceramic inlay	8X
Metal-ceramic crown	8X

Liebler M, Devigus A, Randall RC, Burke FJT Pallesen U, Cerutti A, Putignano A, Cauchie D, Kanzler R, Koskinen KP, Skjerven H, Strand GV, Vermaas RWA.  
Ethics of esthetic dentistry. Quintessence Int.2004;35:456-465.

The Class I molar  
composite  
restoration  
required 35%  
more time than  
the amalgam

Time required for placement of  
composite vs amalgam restorations

Dilley DC, Vann WF et al

J.Dent.Child 1990:May-June:177-

181

# Indications for posterior composite:

Primary lesions of caries

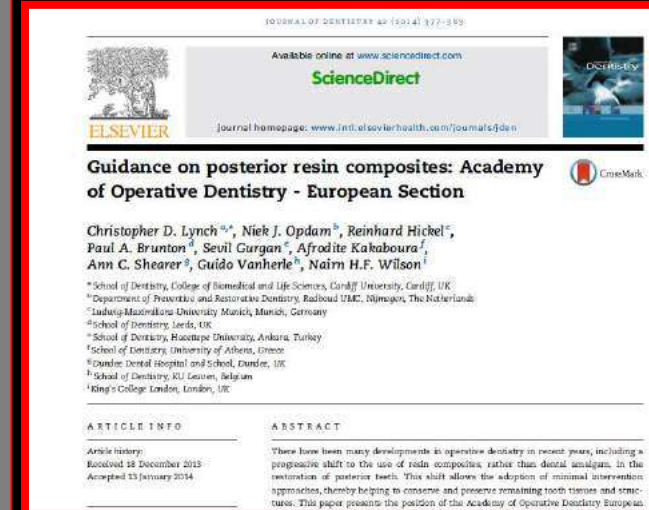
Replacement of defective restorations

Repair of existing restorations

Restoration of endodontically treated teeth which do not need protection afforded by a crown

Restoration of cracked/fractured teeth

Restoration of teeth affected by tooth wear



## Trevor's view:

Posterior composites perform as well as amalgams, but cannot be cost effective because they take longer to place *at present*. Perhaps bulk fills are the answer.



## Successful posterior composites: Other factors influencing choice of restorative material

- 👄 Physical properties ✓
- 👄 Clinical performance ✓
- 👄 Cost effectiveness ✓
- 👄 Patient preference ✓



## Successful posterior composites: Other factors influencing choice of restorative material

- Operator preference
- Aesthetic requirements
- Patient factors
- Environmental factors

# Successful posterior composites: Before use...

- Become familiar with clinical procedures
- Know clinical conditions for longevity of restorations
- Acquire a basic understanding of the material

# Successful posterior composites: During use...

- Obtain good isolation
- Use meticulous technique
- Be aware that resin-based techniques cannot be rushed

# ***FIRST!*** Check the occlusion



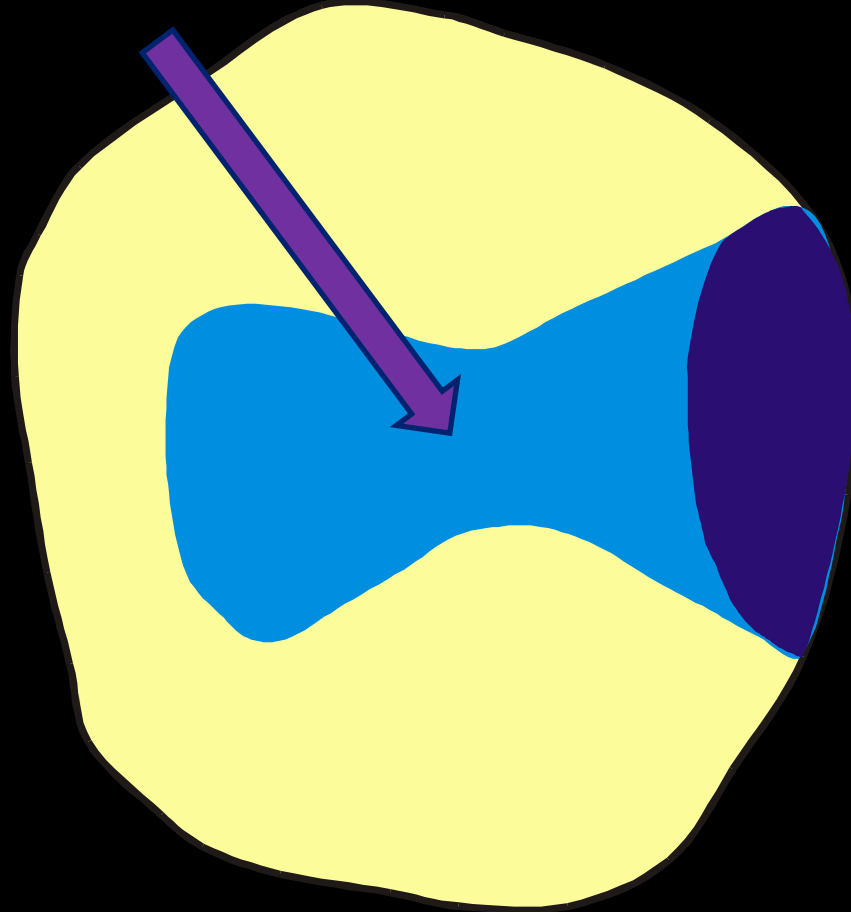
The cavity margin should not be under heavy occlusal loading

# Cavity preparation

Traditional forms of dentistry have often resulted in massive destruction of teeth in order to comply with past teaching, based on the use of non-adhesive materials

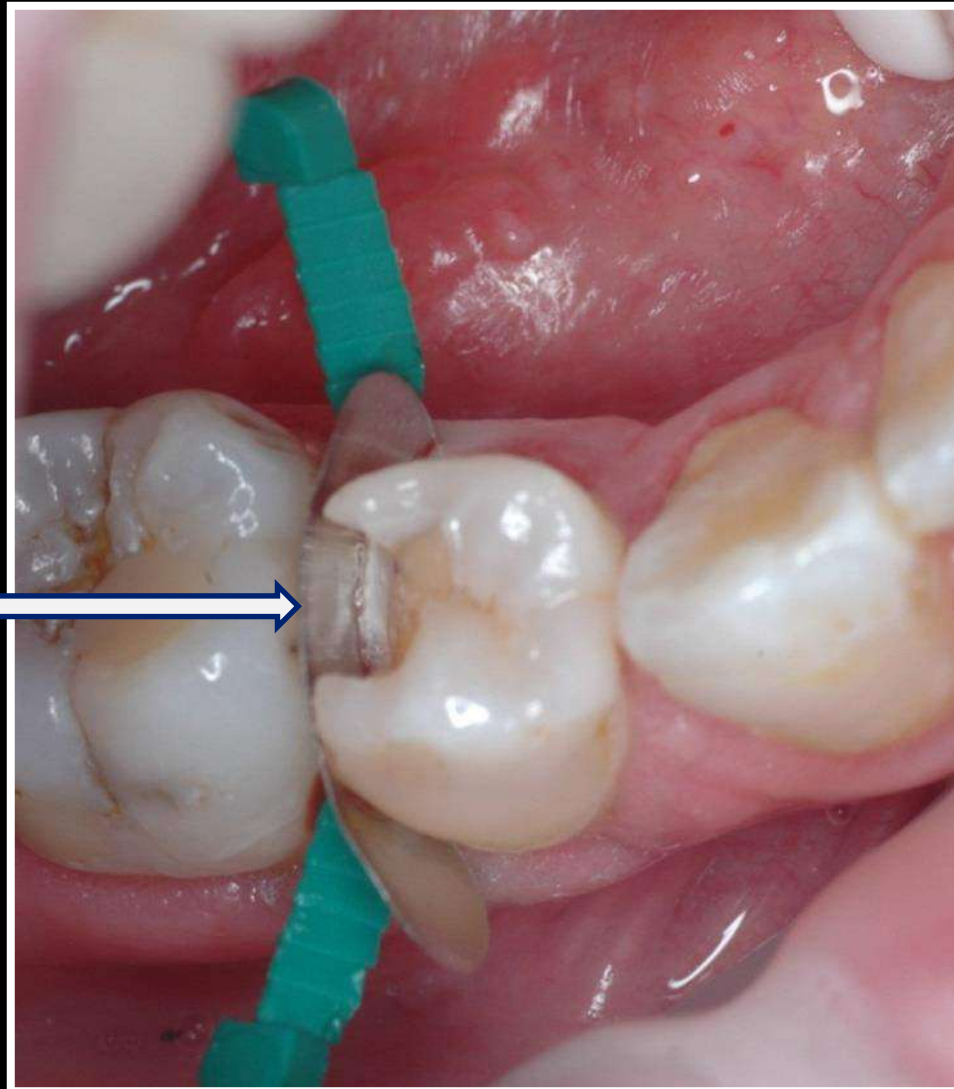
Wilson & McLean, 1988

Massive tooth substance saved  
by using adhesive  
composite  
restoration



# Cavity design for the initial class II lesion

Sectional matrix



Flexiwedge (from Optident)

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.

Amalgam vs  
composite in terms of  
cavity area

Amalgam restorations  
occupied 25% of the  
occlusal surface

Composite restorations  
occupied 5% of the  
occlusal surface

Welbury et al., Br.Dent.J.  
1990;165:361

# To bevel or not to bevel occlusal margins?

**YES:** Wilson et al., 1991

**NO:** Manechika et al. 1984,  
Cheung, 1990,  
Dietschi et al., 1995,  
Holan, Edelman &  
Wright, 1997,  
Opdam et al., 1998

# Extension for prevention: Is it relevant today?

Osborne & Summitt, 1998

- Tooth preparations that minimise removal of tooth substance should be used
- Traditional concepts of extension for prevention are passe
- Treat caries as a disease rather than extending preparations

The cavity must be extended gingivally through the contact point, or caries will occur (and, anyway, the matrix band won't go through!)

1896:Black GV.  
Extension for prevention

**TODAY!**  
**Prevention of  
extension**

Clinical tips:Contemporary ideas on  
isolation



Optiview:Kerr



Optragate: Ivoclar Vivadent

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

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

# HISTORY

- Oldies were taught that a base was always needed
- Bases are used under amalgam for thermal insulation
- In a survey of 500 GPs 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

## Trevor's view:

Trust your bonding agent  
to seal the tubules:  
The evidence base for  
***no base*** is now  
extensive.



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

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

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### 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-Set: 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 SEt 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.

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39 patients, 200 Class V restorations, 4 groups

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

Dent.Mater 2020;36:1474-1485

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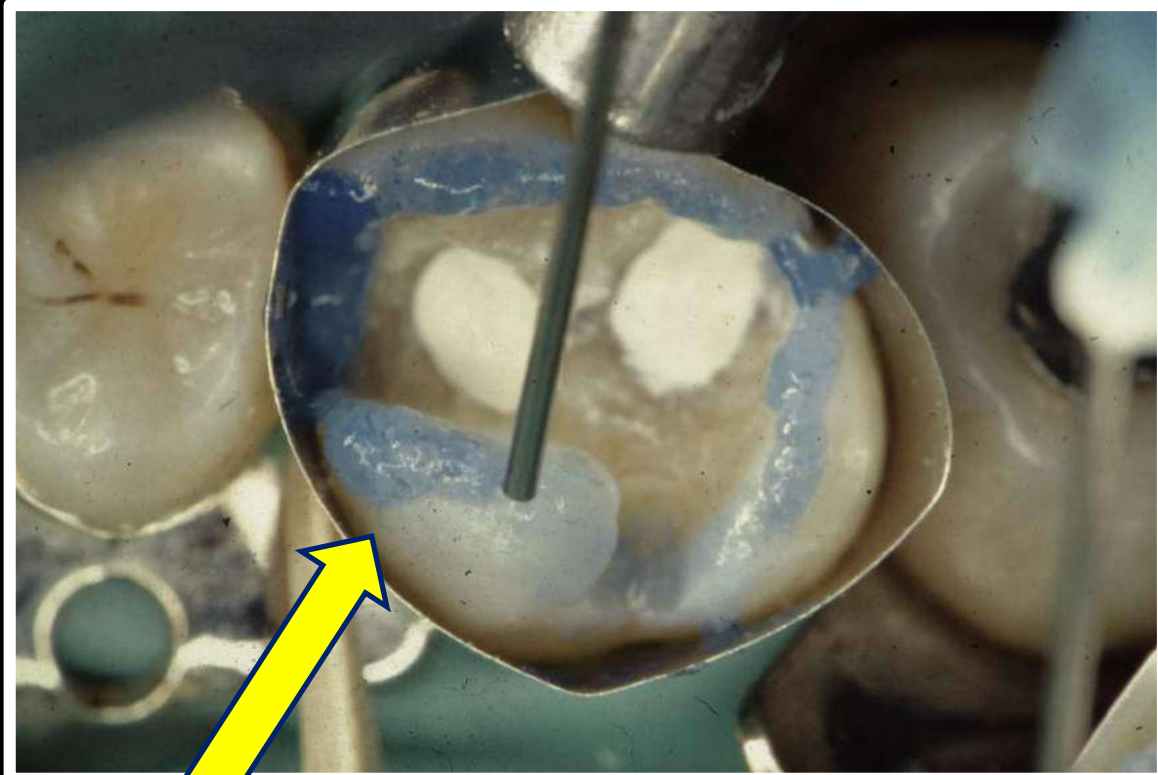


## RESULTS at 5 years

- ✓ 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 2010;36:1474-1485

**Trevor's view: Use selective enamel etching.**  
For composite, it is not necessary to wash the etchant off with a 3 in1 syringe. A dampened cotton roll or pledget will suffice.



Too much etchant



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

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FJ Trevor Burke

## Light curing may not be as simple as it seems!

Some readers may recall a time when resin composite materials were presented in two pots, with equal amounts of the material from each pot being mixed to produce the restorative material, which then had a working time of less than three minutes. These were the early composite materials which were chemically cured. The introduction, in the early 1980s, of so-called 'command set' materials which polymerised when exposed to a light of wavelength circa 460nm (in the blue part of the spectrum) was a welcome change, as the clinician had much longer working time. As a result, the ease of use of composite materials improved dramatically and, indeed, the only problem was that some materials slowly polymerised in the ambient light of the surgery. Light curing materials, whose chemistry was derived as a by-product from the paint industry, are now an accepted, indeed fundamental, part of restorative dentistry. However, light curing may not be as straightforward as it seems: a number of factors are involved.

First, while light-activated resin composite materials cannot be over-cured, it is essential that they receive sufficient light energy to initiate and satisfy the curing process. Failure to do this may result in a less than optimally cured restoration whose physical properties, and resultant longevity, will suffer as a direct result. This has been brought home to me recently when I was asked to light cure a restoration in an upper first molar in a phantom head, with the irradiance being measured in a specially designed apparatus called MARC (Managing Accurate Resin Curing: BlueLight Analytics Inc. Halifax Canada)<sup>1</sup>. My result was suboptimal because I had not held the light steady in one position and perpendicular to the restoration – a serious wake up call. I was not alone, however, as a large quantitative and qualitative variation was identified in the irradiance delivered to teeth by operators carrying out a similar experiment to that which I had done<sup>2</sup>. In addition, the light energy delivered to a class V preparation was less than to the class I. Some dentists delivered as little as 20% of the energy achieved by others using the same light source and intra-oral location. However, there was no difference between dentists and fourth year dental students. This message is also worthy of transmission to our nurses, to whom many of us delegate our light curing and who may have other duties within the surgery to distract them while operating a curing light unit. The first ever study reporting on individual intra-oral variations in light curing ability also noted a wide spread difference in individual operator performance. Whilst dentists' performance was more consistent overall than second and third year undergraduates the most consistent individual was a student! If nothing else these studies should highlight the need for concentration to the task in hand. All individuals in these studies knew they were being tested! Results may have been even worse had this not been the case. Second, research studies have demonstrated considerable variability in the maintenance and quality of light curing units in dental practice<sup>3</sup>. In this respect, correct maintenance of these units is essential and their irradiance should be checked regularly, although newer types may have their own built-in radiometer<sup>4</sup>. The quality of the light curing unit, per se, is also relevant here – I recently spotted a new curing light on sale on eBay for £50 and felt that there must be questions asked about its fitness for purpose. It is interesting also to note, that while quality standards are in place for dental materials, my recent searching of the literature has indicated that no such standards exist for dental light curing units. Message: be careful what you buy!

Last, a recent paper<sup>5</sup> has drawn our attention to the potential difficulties in disinfecting light curing units. Bacterial contamination of 52 units was measured for a week, with the results indicating that, while few viable organisms were detected on the fan or handle areas, many were identified on the on/off button, including *Staphylococcus aureus*. It would therefore appear that this area is not disinfected as effectively as is necessary, presenting a theoretical infection-control risk and indicating that this area should be added to the cleaning regime.

Do we now take light curing too much for granted? It has revolutionised and enhanced restorative dentistry but also has the potential for being abused. As in life, there is a danger that familiarity may breed contempt!

## References

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# Microbial contamination of light curing units: a pilot study

Z Janoowalla, K Porter, ACC Shortall, FJT Burke, RL Sammons\*

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Accepted for publication: 3 September 2010

Key words: Halogen light curing unit, disinfection, cleaning

## Abstract

**V**isible light units (LCU) used in routine dentistry to cure light activated materials may become contaminated with oral micro-organisms. This pilot study was designed to investigate whether the fan, handle and base unit main on/off button areas of three different designs of quartz tungsten halogen LCU (3M Unitek 2500, Elipar Highlight, Demetron Optilux 401) were effectively disinfected after use in a dental teaching hospital. Over a period of seven days 52 LCUs were swabbed before clinic in the morning and 28 were swabbed again after clinic in the afternoon. Bacterial contamination was detected on approximately 40% (20/52) of units before use and 64% (18/28) after use; low viable organisms were detected on the fan or handle areas, but many were isolated from the main button, including *Staphylococcus aureus*. These findings highlight the need for greater awareness of the potential risk of contamination of the base unit and compliance with recommendations to clean and disinfect all areas of the units.

## Introduction

Halogen light curing units (LCUs) are used increasingly frequently in dentistry in association with a diverse range of light activated materials including fillers, sealants and adhesives. Many practices have only one light that is used for successive patients. The LCU may pose a potential risk of cross-infection from patient to clinical staff and/or to other patients, as shown by Caughman et al. (1987) who identified fan and trigger portals as possible sites of cross-contamination of light curing units. In accordance with the requirements for all medical instruments, manufacturers of LCUs are obliged to provide guidance on cleaning and disinfection. In general, the light guides that enter the oral cavity (Figure 1) are recommended to be routinely autoclaved or soaked in disinfectant after each patient or (to avoid damage by these processes) the light curing tips may be covered with disposable sheaths or barriers, whilst disinfectant wipes are recommended for cleaning the external parts of the instruments (Milton and Wilson, 2001; Follington et al. 2009; Sanofi, 2010). However, disinfectants

should not be sprayed directly onto the instruments as this may damage the electrical components housed inside the fan or unit body (Sanofi, 2010). In accordance with the recommendations, in this dental hospital light guides are routinely autoclaved and staff and students are instructed to wipe the surfaces of the handpiece and the base unit with 70% isopropanol wipes after each patient. The design of LCUs may be important with regard to cross-infection. For example, the Elipar Highlight model has a fan design like a 'concertina' (Figures 1 and 2), thus disinfecting the fan area can become difficult and it is possible that micro-organisms could get 'trapped' or can 'hide' within it. In the 3M Unitek 2500 (Figure 2b) and Demetron 401 Optilux designs (Figure 2c), the fan area is a smoother surface with grooves. Here we report the results of a study to evaluate microbial contamination following routine disinfection procedures of the fan area, handle and base unit on/off main button of the different designs of LCU. Although the study was carried out in 2003 we believe that the results are still relevant to inform dental practitioners and to serve as a basis



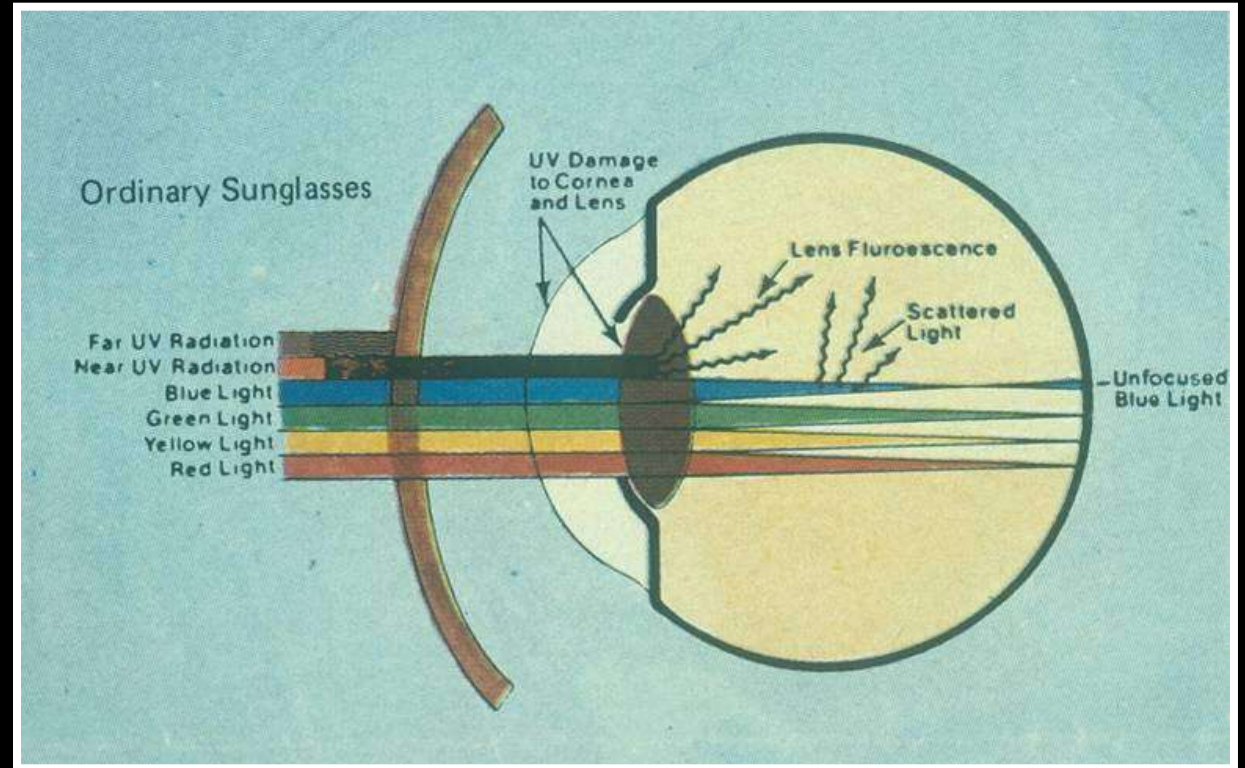
Figure 1. Use of a light curing unit in dental restoration. The whole length of the light guide may enter the patient's mouth, depending on the location of the tooth being treated. The model illustrated is an Elipar Highlight (see Figure 2A). The 'concertina' style fan on these units, assisting the fan in star designs can track against the inner of the patient's mouth and become contaminated directly by saliva in that manner.

# Managing Accurate Resin Curing: MARC



Fewer than 50% of my Masters students provided optimum energy for the restoration

# DANGER!



## Avoid retina burns

## Polish with diamonds. Skip the paste.

### Sof-Lex™ Diamond Polishing System

How much time and effort do you spend creating beautiful smiles? Whether you currently use a rubberized finishing and polishing system or an intraoral diamond polish, the process can be time-consuming. And, even with your best effort, the gloss may not last. 3M has a simple solution for both problems, using two of our innovative technologies.

**Restore with Filtek™ Supreme Ultra Universal Restorative.** Unsurpassed esthetics is just one reason why doctors use this nanocomposite. Thanks to 3M's true nanotechnology, it is easy to polish and offers unsurpassed polish retention.

**Polish with the Sof-Lex™ Diamond Polishing System.** Forget the messy paste. Our pre-polishing spiral prepares the restoration for final gloss, while our diamond-impregnated polishing spiral gives your restorations that gorgeous paste-like gloss. The system offers the convenience of a rubberized system while also adapting to all tooth surfaces.

You'll be happy to know that while the spirals are effective, they're also kinder to gingival tissues\*—and maintain the integrity and anatomy of your restorations!

When patients leave your office smiling, you'll marvel at how simple it's become to create beautiful, natural-looking esthetics.

\*Compared to other finishing and polishing tools.

You can create a diamond paste-like gloss  
with just two steps.



A difference that  
you can see!



Filtek™ Supreme Ultra Universal Restorative polished with Sof-Lex™ Diamond Polishing System (left) vs. TPH Spectra® Universal Composite polished with Enhance® Finishing System and PoGo® Polishing System (right). Notice a clearer reflection with the Sof-Lex™ Diamond Polishing System.

### Summary of advantages

- Imparts paste-like gloss in the convenience of a rubberized system
- Unique, flexible shape adapts to all tooth surfaces
- Fast and easy to use
- Multi-use, can be sterilized and reused
- High, long-lasting gloss when used with Filtek™ Supreme Ultra Universal Restorative

# DISCUSSION POINT!

What degree of  
shine is  
necessary for  
posterior  
restorations?

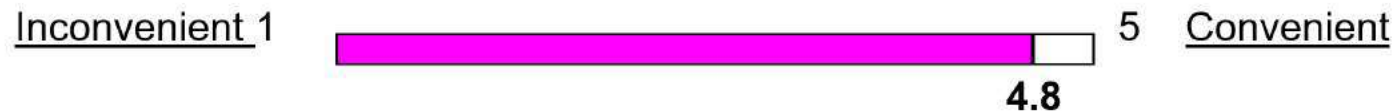
## Trevor's view:

Spend time polishing cusp replacement restorations to a high shine: it feels good to the patient's tongue or cheek.

# What the PREP Panel thought of the Enhance system

200 restorations (37% anterior, 63% posterior) polished using the system

Evaluators and nurses' rating of the overall performance of the Enhance system



Comments:

All the evaluators stated the Enhance finishing, discs, cups and points were suitable for both anterior and posterior restorations.

Overall ease of use of the Enhance system



# What the PREP Panel thought

## Further comments on the Enhance system

Comments made on the Prisma Gloss and Prisma Gloss Extra were as follows:

“...good lustre on final polishing” (3 similar)

“In combination with ceram.X the Enhance polishers and pastes achieved an excellent surface”

When the evaluators were asked if the finish on the restorations was satisfactory, the response was as follows:



Evaluators and nurses' rating of the overall performance of the Enhance system

Is a layer of  
“glaze” needed  
on posterior  
composites?

Bonding agents and standard unfilled resins  
have an oxygen inhibited layer



**DO NOT USE!**

**Trevor's tip!**  
Use a glaze  
(eg Biscover)  
on your  
temporary  
crowns to  
make them  
look like a  
\$million!

## Trevor's view:

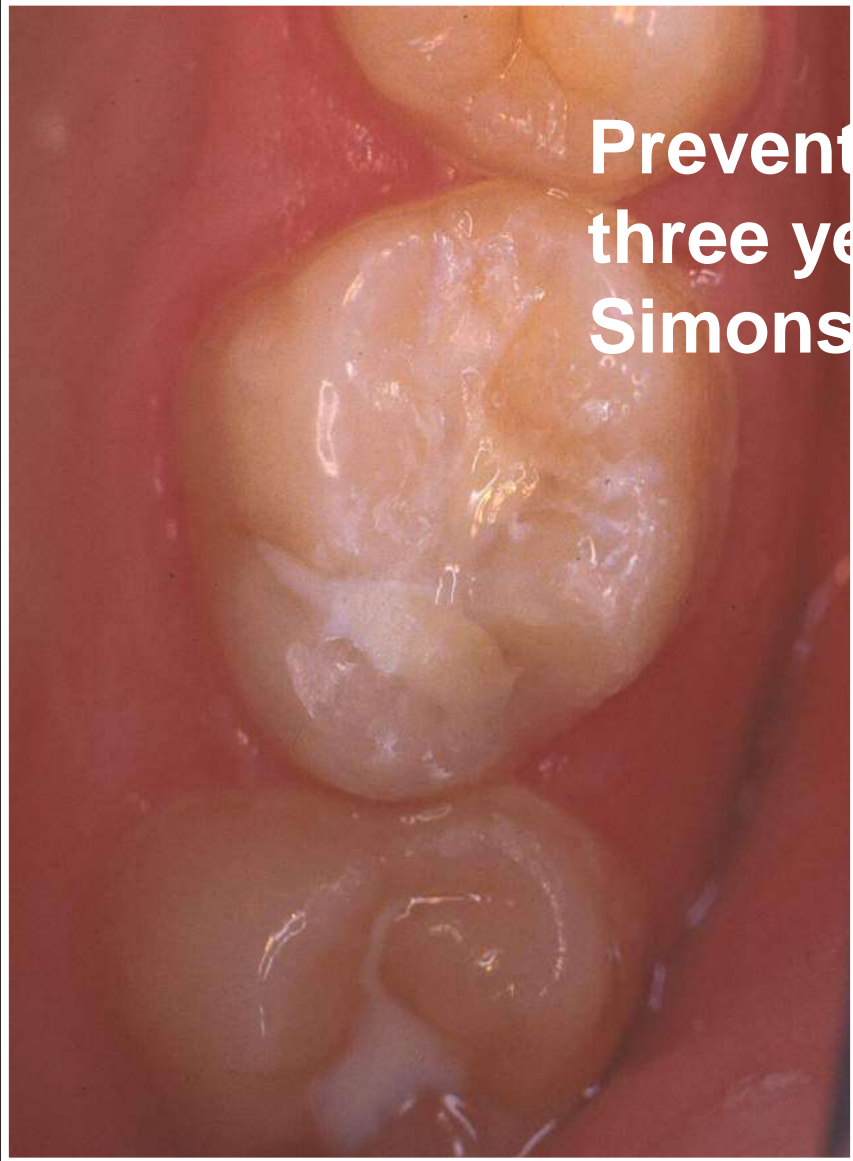
A glaze layer is not needed unless you are using a difficult-to-polish composite material.

## Trevor's view:

Not sure that stained fissures matters a lot for most patients! They simply want a tooth-coloured filling.

# Other uses of composite resin

# The Preventive Resin Restoration



**Preventive resin restorations:  
three year results**

**Simonsen RJ. JADA 1980:100:535-539**

**6 to 8 year old patients**

**88 preventive resin  
restorations**

**98.9% success (complete  
retention)**

# Disadvantages of posterior composite

- 💋 More technique sensitive
- 💋 More time consuming, more costly
- 💋 Need to learn new technique

But, patients like them!



# Advantages of posterior composite

- 💋 Good aesthetics
- 💋 Conservation of tooth substance
- 💋 Low thermal conductivity
- 💋 Polishable at placement visit
- 💋 May be repaired easily
- 💋 No potential for galvanism
- 💋 Avoids the use of mercury



# Avoiding post-op sensitivity with posterior composites

- ✎ Use a so-called self etch or Universal Bonding Agent, AND do not etch the dentine
- ✎ Do not overdry the dentine
- ✎ Use a flowable base layer with “conventional” composites
- ✎ Use a low shrinkage stress composite
- ✎ Be aware of the Configuration Factor

IMPORTANT!

# Avoiding post-op sensitivity with posterior composites

- ✎ Ensure good adaptation at the gingival margin (indeed, all margins)
- ✎ Use a reliable manufacturer's material
- ✎ Ensure adequate light curing

IMPORTANT!

# An amalgam substitute should:

- Be self adhesive

- Have 5mm depth of cure

- Have low shrinkage stress

- Have good physical properties  
and good wear resistance

- Be quick & easy to place

- Be non toxic

- Adequate aesthetics for back teeth

# The future of composite

Might bulk fills be the answer?



# Successful posterior composites

- Amalgam & the post-Minamata era
- Bonding to dentine
- Properties of composite materials
- Placing posterior composites and FAQs
- Success rates
- The concept of sealing in caries
- Final thoughts

...finally, another advantage  
for posterior composite

Effect of resin sealing on  
progress of caries

# Ultraconservative and cariostatic sealed restorations: Results at year 10

Mertz-Fairhurst EJ, Curtis JW, Ergle JW, Rueggeberg FA, Adair SW JADA.1998;129:55-65

156 pairs of restorations, 85 evaluated at year 10

Three groups of restorations in frankly cavitated lesions :

Conventional amalgam,

Conservative amalgam/sealed,

Cariostatic sealed composite

... did not remove undermined enamel or caries below the bevel”

# Ultraconservative and cariostatic sealed restorations: Results at year 10

Mertz-Fairhurst EJ, Curtis JW, Ergle JW, Rueggeberg FA, Adair SW JADA.1998;129:55-65

Restorations assessed using USPHS criteria

- 💋 12 failures from 85 sealed composites (14%) (caries only at margin of 1 restoration)
- 💋 1 failure from 44 sealed amalgams (2%) (caries only at margin of 1 restoration)
- 💋 7 failures from 41 unsealed amalgams (17%) (caries at margins of all 7 failed restorations)

# Ultraconservative and cariostatic sealed restorations: Results at year 10

Mertz-Fairhurst EJ, Curtis JW, Ergle JW, Rueggeberg FA, Adair SW JADA.1998;129:55-65

## CONCLUSIONS

- Undermined enamel may be stronger than we believed
- Class I amalgams should be sealed after placement
- Bonded and sealed resin composite restorations placed over frankly cavitated lesions arrested the progress of these lesions over a period of 10 years

# Edwina Kidd's paper in Dental Update on this topic is essential reading

## Cariology



Edwina Kidd



Ole Fejerskov



Bente Nyvad

## Infected Dentine Revisited

**Abstract:** Dentine becomes infected as a result of caries lesion formation on root surfaces and when lesions progress following cavitation of enamel lesions. However, this infection is unimportant because the driving force for lesion formation and progression is the overlying biofilm. This explains why root surface caries can be controlled by mechanical plaque control and fluoride, and restorations are not needed to arrest these lesions. Similarly, the infected dentine in cavitated coronal lesions does not have to be removed to arrest the lesion. If the lesion is either accessible or opened for cleaning by the patient or parent, the lesion can be arrested. Sealing of infected dentine within the tooth, either by a Hall crown in the primary dentition or by partial caries removal prior to placing a well-sealed filling, will also arrest the lesion. When restoring deep lesions in symptomless, vital teeth, vigorous excavation of infected dentine is likely to expose the pulp and make root canal treatment necessary. Thus 'complete excavation' is not needed and should be avoided.

**CPD/Clinical Relevance:** Root surface caries can be arrested by cleaning and fluoride application. Restorations are not essential. Vigorous excavation of softened dentine in deep cavities of symptomless, vital teeth is contra-indicated. It is not needed and increases the risk of

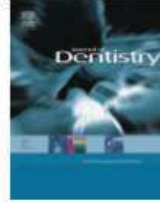
## CONCLUSIONS

When restoring deep caries lesions in vital, asymptomatic teeth, vigorous excavation is likely to expose the pulp. This complete excavation is not needed and should be avoided.

Always produce a sound cavity margin for bonding.

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: [www.intl.elsevierhealth.com/journals/jden](http://www.intl.elsevierhealth.com/journals/jden)

## Review

# Effects of using different criteria for caries removal: A systematic review and network meta-analysis

Falk Schwendicke<sup>a,\*</sup>, Sebastian Paris<sup>a</sup>, Yu-Kang Tu<sup>b</sup><sup>a</sup> Department of Operative and Preventive Dentistry, Charité – Universitätsmedizin Berlin, Aßmannshauser Str. 4-6, 14199 Berlin, Germany<sup>b</sup> Institute of Epidemiology & Preventive Medicine, College of Public Health, National Taiwan University, Taipei, Taiwan

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Excavation

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## ABSTRACT

**Objectives:** Conventionally, caries excavation is performed until only hard dentine remains, while more selective and reliable criteria might be available. We aimed at systematically comparing the effects of using different excavation criteria via network meta-analysis.

**Sources:** Electronic databases were searched for randomised or non-randomised clinical trials (RCTs/NRCTs) evaluating excavation of cavitated lesions.

**Data:** Criteria were divided into six groups: Excavation until pulpo-proximal dentine on the cavity floor was (1) either hard on probing, (2) slightly softened on probing, (3) not stainable by caries-detector-dye, or until (4) self-limiting polymer burs, (5) fluorescence-assisted devices or (6) chemo-mechanical gels indicated termination of the excavation. Evaluation of risk of complications, risk of pain/discomfort, excavation time, and number of remaining bacteria were then undertaken using Bayesian network meta-analysis.

**Study selection:** 28 studies (19 RCTs, 9 NRCTs) with 1782 patients (2555 lesions), most of them investigating primary teeth, were included. Risk of complications was highest when excavating until only non-stainable dentine remained, and lowest when not attempting to remove all softened dentine. Risk of pain significantly decreased if self-limiting chemo-mechanical excavation or fluorescence-assisted lasers were used instead of excavating until all dentine was hard. When not attempting to remove all softened dentine, the time required for excavation was shortest, whilst the greatest number bacteria remained.

**Conclusions:** Not attempting to remove all softened or stainable dentine might reduce the risk of complications. Data regarding self-limiting excavation is insufficient for definitive conclusions. Excavation criteria should be validated against clinically relevant outcomes.

**Clinical significance:** Given current evidence, dentists might not need to attempt excavation until only hard dentin remains in proximity to the pulp. Instead, their choice of excavation criterion or method should be guided by clinical requirements and outcomes.

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Removal of all softened biomass until only hard dentine remains was clinically ineffective

No studies indicated that complete excavation had any advantages to removing only soft dentine

Not attempting to remove all softened dentine could reduce the risk of complications

*HOT* under the collar?

Trevor's view:

The evidence base  
for sealing caries is  
now strong

...but only proven for  
occlusal lesions

# Another way of managing deep caries in a vital tooth

***Biodentine™***  
**Bioactive Dentine Substitute**



ACTIVE  
BIOSILICATE  
TECHNOLOGY



# Bioactivity of Biodentine



## CONCLUSION:

“There is a clear need to improve the bioactivity of restorative dental materials and calcium silicate systems offer exciting possibilities in achieving this goal”

# Most recent research on Biodentine

RESEARCH

How does the pulpal response to Biodentine and ProRoot mineral trioxide aggregate compare in the laboratory and clinic?

R. Careddu<sup>1</sup> and H. F. Duncan<sup>\*1</sup>

MEDLINE search

**CONCLUSION:** Biodentine presents an evidence-based biological Vital Pulp Therapy material

# ***Biodentine™***

## Advantages & disadvantages

### Advantages

Maintains pulp vitality

Biocompatibility

Long working time

Suitable for use with  
the “thumb” technique

### Disadvantages

Technique sensitive

Long working time

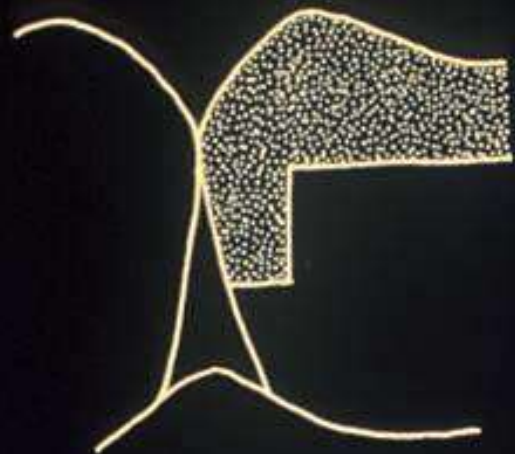
Idiosyncratic handling

Mixing sensitive

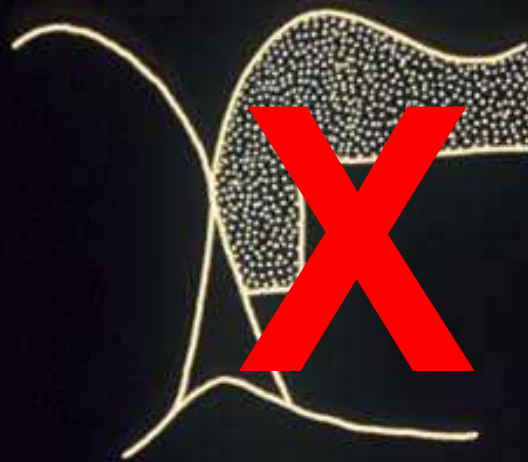
But, I used Biodentine only a few months' ago,  
and it handled much better!

# How to make the sealed caries concept work in your practice

- ✎ Make sure that the patient understands the PIL (consent)
- ✎ Advise the patient that (s)he is having a therapeutic (healing) filling
- ✎ That (s)he will have to pay for that and again in 9-12 months to have it resurfaced

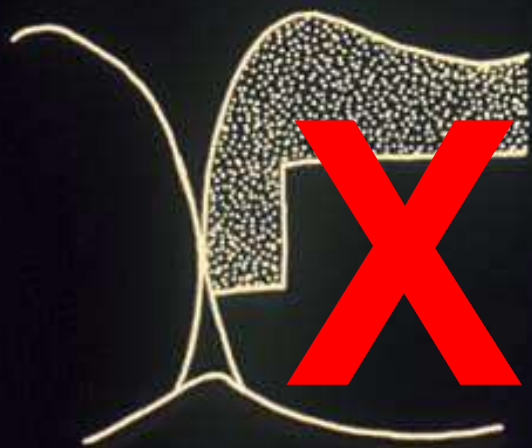


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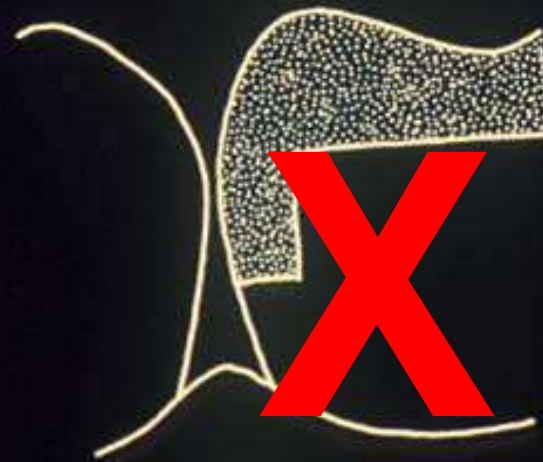


2

What about contact points?



3



4

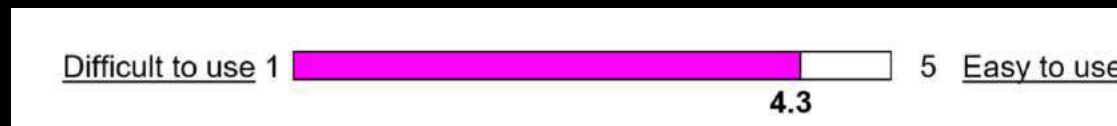
# Sectional matrices: curvature buccolingually and gingivo-occlusally



# What the PREP Panel thought

Seven used a sectional matrix system, five had used the Palodent V3, 167 Class II/MOD restorations placed.

Ease of use of previously used system



Presentation of Palodent V3



Ease of use of Palodent V3



# What the PREP Panel thought

There didn't appear to be limitations on the box size that the matrices were used for:

The size of interproximal box for which typically the evaluators used a

## COMMENTS:

"Haven't found one yet that is easier but they do produce significantly better contacts",

"The hole is excellent for securely holding the matrix & wedges but takes a little getting used as the forceps counter-intuitive"

85% of evaluators would recommend to colleagues

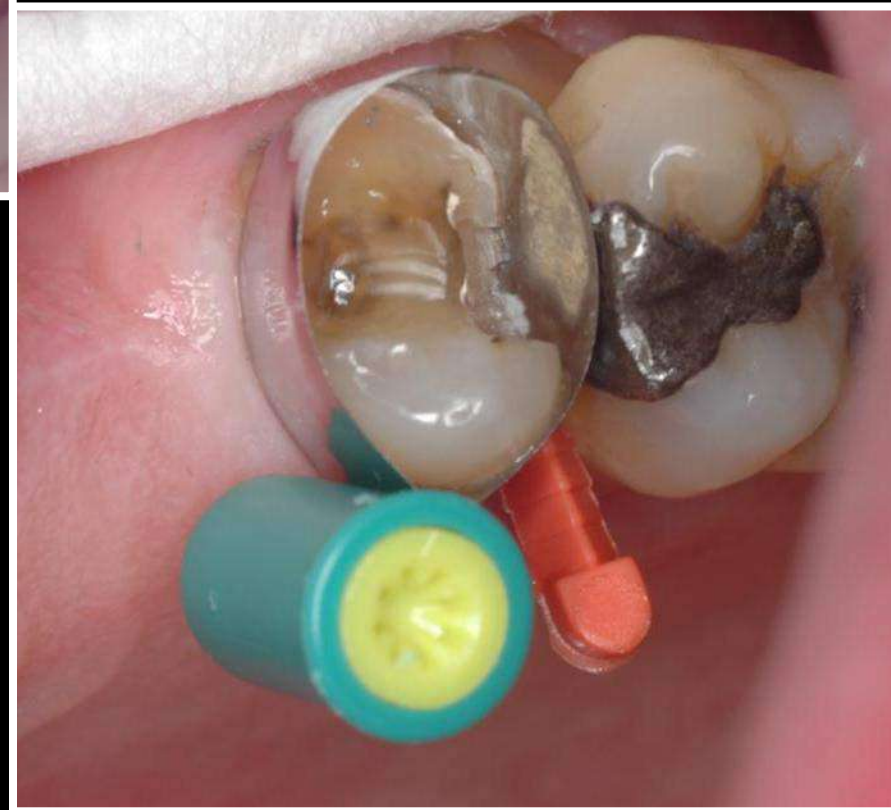
5 evaluators

Trevor's view:  
Use a sectional matrix for  
small/average size cavities



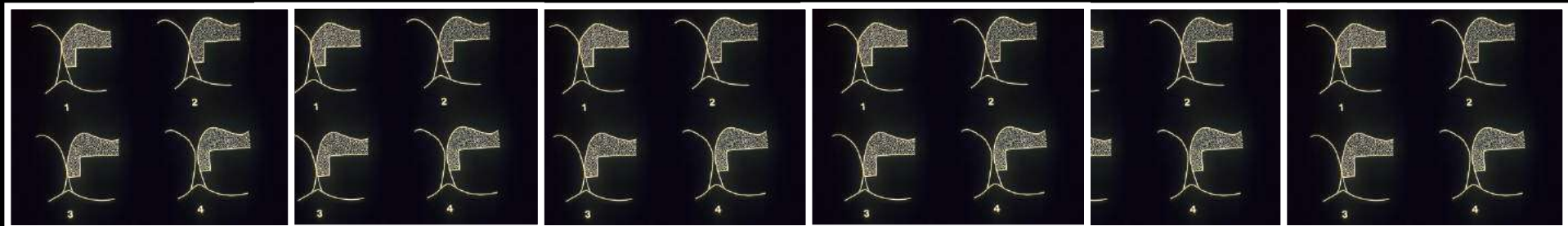
For larger cavities or  
cusp replacements

Supermat  
(Kerr) is  
what you need



..for good proximal contacts:

- 👄 Use a thin metal matrix
- 👄 Push/burnish the matrix
- 👄 Wedge firmly
- 👄 Use a packable/stiff composite
- 👄 Use a non-stick composite
- 👄 Use a non-slumping composite



# Palodent 360 holds promise

## TechniqueTips



## Technique Tips

### Matrix Revolutions

Dent Update 2021; 48: 976-977

#### Matrix technique challenges

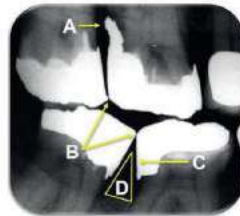
Matrix technique has been demonstrated to be the most important determinant in the restoration of tight, anatomically correct proximal contacts and contours.<sup>1</sup> Unfortunately a high percentage of dentists complain of regular problems with open Class II posterior composite contacts. This primarily results from reliance on out-moded matrices designed for amalgam, such as the notoriously unsuitable Sioveland matrix system. Common errors are illustrated in Figure 1.

To combat this, a range of specialized matrices, wedges and contact forming instruments are available that are designed to:

- Promote tight, suitably positioned contacts using thin, contoured, burnishable matrices;
- Reduce the risk of food trapping, subsequent periodontitis and secondary caries;
- Reduce the risk of adhesive failures that have commonly been tracked to the cervical margins of proximal boxes;
- Recreate self-cleansing, easy to clean, embrasure anatomy that promotes healthy interdental papillae;
- Reduce the risk of restorative material extrusion;
- Promote tooth separation to compensate for matrix thickness, which may be maximized by immediate pre-wedging at the start of restorative procedures;
- Provide moisture control and haemostasis in clinical situations where rubber dam isolation is not used;
- Prevent orthodontic movement of restored teeth.

#### Matrix options

Sectional matrices, wedges and separation rings have been demonstrated to produce optimal restorative contacts, but are not suitable for all clinical situations or



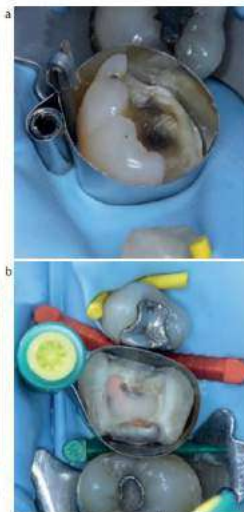
**Figure 1.** Common restorative errors: (A) overhanging margins; (B) open, light or poorly positioned contacts; (C) flat proximal contours; (D) triangular stagnation areas.



**Figure 2.** Sectional matrix, wedge and separation ring (Optident, Garrison Dental Solutions).

for amalgam restorations.<sup>1</sup> In larger cavities and those with wider proximal boxes, specialized circumferential matrices, such as AutoMatrix (DentsplySirona, Weybridge, UK) and SuperMat (Kerr, Orange County, CA, USA) (Figure 3) are recommended because they confer a number of advantages (Table 1).

These matrices are applied to the tooth and tightened with a matched instrument. Only metal matrices



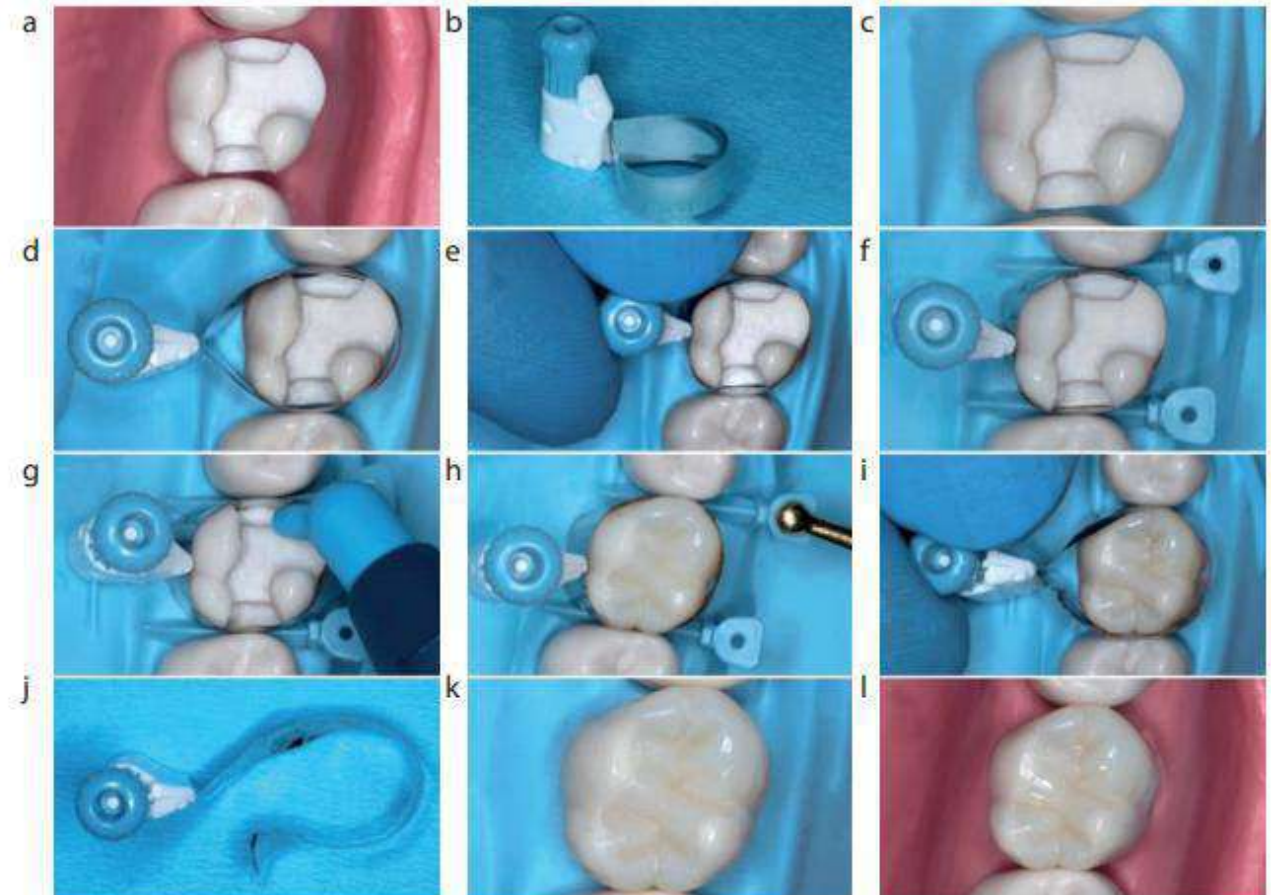
**Figure 3.** (a) AutoMatrix and (b) SuperMat matrix systems.

In extensive cavities with limited residual coronal tissue, freehand build-up of missing cusps may be carried out to facilitate circumferential matrix retention and stabilization.

#### New Palodent 360

Launched in January 2021, the Palodent 360 is the latest single-use circumferential matrix system from DentsplySirona. As well as the advantages listed in Table 1, the Palodent 360 does not require a separate tightening

**Table 1.** Advantages of circumferential matrix systems.



**Figure 4.** (a-l) Step-by-step simulation guide to using the new Palodent 360 matrix system.

## Trevor's view:

A sectional will be your “go-to” matrix for the average box, with Supermat and Palodent 360 for cusp replacement restorations and wide boxes.

# How to make posterior composites work in your practice

- 👄 Know your hourly rate
- 👄 Start with smaller cavities
- 👄 Make sure that your nurse is properly trained
- 👄 Use matrices that give you a firm contact
- 👄 Know how to minimize post-op sensitivity
- 👄 Have a successful isolation routine

# 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

# Dentistry is changing!

Posterior  
composite  
is part  
of the process

Thank you for listening

