BONDS
BULK!
BURKE
“I am not paid by any company to promote their products”

“Some manufacturers fund research that I carry out”
I will discuss materials, devices and techniques that I have used, but there may be others that are better.

"I will try to be evidence-based rather than anecdotal in everything that I say."
First, bonding to enamel

Bonding to dentine is therefore more difficult.
OBJECTIVE

To narrow the gap between bond strength to dentine and bond strength to enamel
Why do dentists need adhesion?

- Cervical restorations
- Build up of fractured anterior and posterior teeth
- Short clinical crown for full or partial coverage restorations
- Resin retained bridges
If the tubules are sealed using a Dentine Bonding System........
The peculiar nature of dentin sensitivity is a source of puzzlement to the dentist. Dentin is a good insulator, but even small temperature changes that do not reach the pulp may cause pain. A series of studies are described that provide evidence that the main cause of dentinal pain is a rapid outward flow of fluid in the dentinal tubules that is initiated by strong capillary forces.

The cavities was then subjected to negative pressure or desiccation. The teeth were subsequently extracted and prepared for light and electron microscopic examination.

In my first experiment on pairs of human premolars, reduced pressure using a vacuum pump was applied for 20 s and 2 min to cavities randomly selected for testing in one-half of the teeth. No suction was applied to cavities in contralateral control teeth. Pain was elic-
Maximising class V effectiveness

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

D. Stewardson, S. Creanor, P. Thornley, T. Bigg, C. Bromage, A. Browne, D. Cottam, D. Dalby, J. Gilmour, J. Horton, E. Roberts, L. Westoby and T. Burke

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%
Examples of Resin Modified Glass Ionomer (RMGI) filling materials
Flowable composites are relatively resilient. However, an optimum elasticity of 1 Gpa would be required, which is far below the range available with current materials.
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”
Class V meta analysis: conclusions
“Cervical restorations with GI may have good retention rates, but poor aesthetics”
“2-step self etching systems and 3-step etch&rinse systems perform better than other adhesive systems”

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

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

Dental Update 2015; 42: 829–839
Bonding to dentine

Chemical = Glass ionomer

Micromechanical = Dentine bonding systems
Smear Layer

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

Previous strategies to treat the smear layer

Etch & Rinse/
Total etch

Self etch/
No Rinse
The quality of the hybridised dentine is more important than the bond strength (T. Nakabayashi, 2003)
How wet is wet? 

Noosa Beach, Queensland, Australia 

Wet 
Moist 
Dry 

Important!

Noosa Beach, Queensland, Australia
The classification, *until recently*, of dentine bonding systems

1. Etch and rinse  
   *(etch & bond, total etch)*

2. Self etch  
   One bottle
   Two bottles
...a landmark paper
Five-year Clinical Effectiveness of a Two-step Self-etching Adhesive

Marleen Peumans\textsuperscript{a}/Jan De Munck\textsuperscript{b}/Kirsten Van Landuyt\textsuperscript{c}/Paul Lambrechts\textsuperscript{a}/Bart Van Meerbeek\textsuperscript{a}

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

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

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

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

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

*J Adhes Dent 2007; 9: 7-10.* Submitted for publication: 10.07.06; accepted for publication: 16.11.06.
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.
... the new approach is therefore.... selective enamel etching
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)
Scotchbond Universal Adhesive

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

- BisGMA
- MDP
- Vitrebond Copolymer
- HEMA
- Ethanol
- Water
- Filler
- Silane
- Initiators
For Scotchbond Universal, the concept of selective enamel etching should be employed.
Product Research and Evaluation by Practitioners

2013: A handling evaluation by the PREP Panel
Scotchbond Universal Adhesive: new vial design

- flip cap for opening and closing
- new nozzle design for improved dispensing and cleanliness
Handling evaluation of 3M ESPE Scotchbond Universal by the PREP Panel

12 evaluators

Variety of bonding agents used pre-study

875 restorations placed (Class 1:172, Class II:189, Class III:134, Class IV:178, Class V:182, Other:20)

Also used for dentinal hypersensitivity, repair of fractured porcelain, bonding of posts.

Rated material on visual analogue scales

75% of evaluators would be prepared to pay extra for the convenience of single-unit doses

All stated that the resin liquid easily wet the tooth surface, that the bond was easily visible. Some commented that it was “too yellow”
Handling evaluation of 3M ESPE Scotchbond Universal by the PREP Panel

Ease of use of previous bonding agent

Ease of use of Scotchbond Universal

Viscosity of Scotchbond Universal

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

Too thin  1   5 Too viscous

3.1
Handling evaluation of Scotchbond Universal by the PREP Panel: Comments

- “Disconcertingly yellow – but OK when thinned or light cured”
- “Spreads well when air applied”
- “Supposedly the lid can be opened one-handed but it is sometimes a problem”
- “First material that compares with G-Bond”
SBU is yellow, to start with!

Camphorquinone photoinitiator: bright yellow colour, bleaches upon irradiation

There is an excess of CQ, just in case your curing light is less than ideal!
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."
Reported Performance: 
Battle of the Bonds


“A good correlation was found between the annual failure rates reported in the systematic review of Peumans et al. and the “Battle of the Bonds” shear-bond strength data from Degrange et al.”
However, greater batch to batch variation in several mechanical & physical properties of the own-label materials was noted.
What’s in Clearfil Universal?

- 10-MDP
- Bis-GMA
- 2-HEMA
- Hydrophilic aliphatic dimethacrylate
- Colloidal silica
- Silane coupling agent
- Di-Camphorquinone
- Ethanol
- Water
Futurabond U

Liquid 1:
BisGMA, HDDMA, UDMA, HEMA, fumed silica, CQ, 10 MDP

Liquid 2:
Ethanol, water, catalyst

pH .................. 2.3
All-Bond Universal

- 10-MDP
- Phosphate monomer
- HEMA
- BisGMA
- Ethanol

pH 3.1
What’s in G-Premio Bond?

4-META
10-MDP
10-Methacroyldecyl dihydrogen thiophosphosphate
Methacrylate ester
Acetone
Distilled water
Photoinitiators
Silica fine powder
# Adhese Universal (Ivoclar-Vivadent)

<table>
<thead>
<tr>
<th>Monomer Name</th>
<th>Type</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDP</td>
<td>Phosphoric acid methacrylate</td>
<td>Forms strong bond to hydroxyapatite surfaces. Promotes adhesion to tooth surface by formation of non-soluble Ca(^{2+}) salts.</td>
</tr>
<tr>
<td>Methacryloyloxydecyl dihydrogen phosphate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCAP</td>
<td>Methacrylated carboxylic acid polymer</td>
<td>Carboxylic acid functional polymer reacts with and bonds to hydroxyapatite. The presence of many carboxylic acid groups along a polymeric backbone/chain allows multiple bonds to the tooth surface.</td>
</tr>
<tr>
<td>HEMA</td>
<td>Hydrophilic monofunctional methacrylate</td>
<td>Promotes wetting of polar / inorganic and moist surfaces. Assists penetration of liquid filled dentinal tubuli.</td>
</tr>
<tr>
<td>Hydroxyethyl methacrylate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bis-GMA</td>
<td>Hydrophilic / hydrophobic crosslinking dimethacrylate</td>
<td>Facilitates compatibility of hydrophilic HEMA and hydrophobic D3MA in the presence of water, thereby preventing phase separation of adhesive. Imparts high mechanical strength and resilience to adhesive layer.</td>
</tr>
<tr>
<td>Bisphenol A glycidyl methacrylate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3MA</td>
<td>Hydrophobic crosslinking dimethacrylate</td>
<td>Enables the reaction of the adhesive with the less polar monomers of the filling or luting composite.</td>
</tr>
<tr>
<td>Decandiol dimethacrylate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What's in Colteeme 7 Universal?

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

No silane: does that matter?
10-MDP seems to be the resin molecule of choice for bonding. 10-MDP is important for the status of the bond reaction with HAP.
Effects of moisture degree and rubbing action on the immediate resin-dentin bond strength

**Conclusion:**
High bond strength to dentine can be obtained under dry conditions when ethanol/H$_2$O and acetone based systems are vigorously rubbed on the dentine surface. On wet surfaces, light rubbing may suffice.
October 2015: The first clinical trial on Scotchbond Universal

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

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‡‡UAB Center for Clinical and Translational Science, 4411 Medical Tower, 1717 7th Ave S, Birmingham, AL 35294, USA
October 2015: The first clinical trial on Scotchbond Universal

CONCLUSIONS
Scotchbond Universal in total etch or self etch modes performed similar to or better than Scotchbond Multipurpose. But, more post-op sensitivity in total etch group.

So, why bother to etch dentine when using Scotchbond Universal?
SUMMARY: Universal bonding agents:

Can be used in total etch, self etch, selective enamel etch modes
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
Avoiding post-op sensitivity when using dentine bonding agents

Use a so-called self etch or Universal material

Do not etch the dentine when using these materials
MMPs

- Demineralised dentine contains these
- Require calcium to maintain their structure
- Need zinc ions for their catalytic activity
Suggestions for inactivation of MMPs

- EDTA
- Glutaraldehyde
- Carbodiimide
- Chlorhexidine

Trevor’s view: At present, this is a theoretical concept
Regarding MMPs

The way to obviate problems is to protect the collagen by thorough resin infiltration
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
Avoiding adhesive failures

Use a material from a manufacturer with experience in the field
Follow the instructions!!
One bottle bonding (reduced risk of error)
Effective light curing (check your light regularly!)
Think seriously about selective enamel etching
Benefits of lab testing

- Speed by which data are gathered
- The relative ease of test methodology
- Possibility to measure one specific parameter, while keeping others constant
- Ability to test many experimental groups simultaneously
- May use unsophisticated and inexpensive protocols and/or instruments
Long term survival of fragment bonding in the treatment of fractured crowns

reattachment of the coronal fragment is a realistic alternative (Andreasen et al)

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

Approx 25% of 334 rebonded fragments were retained at 7 years after bonding
The concept of pragmatic aesthetics

Take home messages

Dentine bonding is now reliable and effective
Self etch adhesives do not produce bond strengths as high as etch & rinse systems
Selective etching of enamel is a good idea
Universal bonding materials with MDP are now the business
Take home message

Bonding restorations is more minimally invasive, and, potentially therefore less likely to have a bad medicolegal outcome.
But, others are still adopting an invasive approach (and being sued!)

Reasons to adopt minimal intervention

⯈ Patients like it (if you advise them of your philosophy)
⯈ Teeth like it (fewer die!)
⯈ It’s easier for dentists (fewer die: better for their blood pressure!)
⯈ Lawyers hate it (fewer dentists get sued!)
⯈ We now have materials to make this work
BULK!

These need a topping because their wear resistance isn’t good enough.
Annex A, Part II; Measures to be taken to phase down the use of dental amalgam

- Set national objectives for caries prevention
- Set national objectives aimed at minimising the use of amalgam
- Promote use of cost-effective and clinically effective Hg-free alternatives
- Promote R&D into quality Hg-free materials
Annex A, Part II; Measures to be taken to phase down the use of dental amalgam

- Encourage professional organisations and dental schools to train dental professionals and students in the use of Hg-free alternatives
- Discourage insurance programmes that favour dental amalgam use, and encourage insurance programmes that favour use of alternatives
- Restrict use of amalgam to capsulated form
- Promote best environmental practices in dental facilities to reduce releases of Hg
NORWAY did it!
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

AMALGAM

Environmental concerns........YES
Toxicity issues......................... NO

No toxicity issues for patients: ?? for dentists??

Slide made in 1996
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

Compacted gold

Gallium alloys

Resin-based composite

Galloy bit the dust 10 years ago
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
Clinical performance of reinforced GIC materials in loadbearing situations

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
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.
Until more high quality evidence becomes available, for practitioners using reinforced GI materials in loadbearing situations in posterior teeth, it is prudent to advise patients of the relative paucity of good quality evidence for the success of the restorations that they are placing.
Do amalgam substitutes exist?

Are reinforced glass ionomers an alternative?

Not really, because their wear resistance isn’t good enough and they are soluble in dilute organic acids.
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...
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?
But, reinforced glass ionomers are a Godsend to special care dentists.
The "F" word

Glass-ionomer Restoratives: A Systematic Review of a Secondary Caries Treatment Effect
R.G. Randall and N.H.E. Wilson

Abstract. It is generally accepted that glass ionomers inhibit secondary caries in vivo, and data from in vitro studies support this effect. The aim of this review was a systematic assessment, from the literature of clinical evidence for the ability of glass-ionomer restoratives to inhibit secondary caries at the restoration margin. Inclusion and exclusion criteria for selection of the review papers were established prior to commencement of the literature search. Papers which conformed to these criteria, and reported on secondary caries as an outcome, were selected (N = 52). Papers and secondary lists of systematic reviews were also included. The publication of this review in the introduction of the systemic review of the literature search. Papers which conformed to these criteria, and reported on secondary caries as an outcome, were selected (N = 52). Papers and secondary lists of systematic reviews were also included.

Introduction

There is increasing interest in evidence-based dentistry (Antes, 1989, Anselm, 1992, Lawrence, 1985), echoing similar approaches in medicine. The intention of this approach is to improve the quality of care of patients on a combined use of data from controlled clinical trials and the individual clinical expertise of the operator. The application of treatments for which evidence for effectiveness is judged to have been reported in the literature, and for which the effectiveness is not yet proved, is judged to have been reported in the literature. The application of treatments which are judged to have been reported in the literature, and for which the effectiveness is not yet proved, is judged to have been reported in the literature. The application of treatments which are judged to have been reported in the literature, and for which the effectiveness is not yet proved, is judged to have been reported in the literature. The application of treatments which are judged to have been reported in the literature, and for which the effectiveness is not yet proved, is judged to have been reported in the literature. The application of treatments which are judged to have been reported in the literature, and for which the effectiveness is not yet proved, is judged to have been reported in the literature.

The F-word

Fluoride IS released by glass ionomers but its effect is small. Fluoride released by F-containing composites is negligible.

What does F stand for in dental materials?

Fraud
Fiction
Fudge
False
Fools
F all
Fairies

28 papers included
No conclusive evidence for or against inhibition of secondary caries by glass ionomer restoratives
Polymerisation contraction

A longstanding problem with resin composite – polymerisation contraction

STRESS
shrinkage **STRESS** is the problem

**Stress** is a function of materials factors such as:
- Polymerisation shrinkage
- Modulus of elasticity/filler load
- Degree of conversion

Degree of conversion
Reducing polymerisation contraction stress

Five ways:
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 low shrink material seems to be the obvious answer.
The Filtek™ Silorane System

The first composite to achieve 1% shrinkage

Class I & II restorations in a low shrinkage stress

Work by the Practice-based research group, The PREP Panel
Methods

- Ethical approval obtained
- Five UK dental practitioners
- Each practice recruited sufficient patients to provide a minimum of 20 class I or II restorations per centre.
- Restorations assessed using modified USPHS criteria by an independent examiner along with the practitioner who placed the restorations.
Anatomic form
A: Restoration is continuous with existing anatomic form, not under contoured.
B: Restoration is under contoured but no dentine or base exposed.
C*: Sufficient restorative material is missing so that dentine or base is exposed.

Margin integrity
A: No visible evidence of a crevice along the margin into which a probe will catch.
B: Probe catches in a crevice along the margin, no exposure of dentine or base.
C*: Visible evidence of a crevice with exposure of dentine or base along the margin

Margin discolouration
A: No discolouration evident at margin.
B: Slight staining at margin
C*: Obvious staining, cannot be polished away.

Colour match
A: Restoration matches adjacent tooth structure in colour and translucency
B: Mismatch in colour and translucency but within an acceptable range.
C*: Mismatch in colour and translucency outside acceptable range.

Surface roughness
A: Smooth surface with no irritation of adjacent tissues.
B: Dull, matte surface, can be refinished.
C*: Shallow surface pitting is present. Rough, cannot be polished
Results

- 127 restorations originally placed in 72 patients
- 8 restorations lost to the trial
- 70 restorations (recall rate 59%) of mean age 62 months (range 54 – 68 months) in 45 patients (28 female and 17 male) of mean age 53 years examined. The 70 restorations composed of 17 Class I and 53 Class II restorations

34% (n= 24) of the restorations involved the replacement of one or more cusps
Summary: Silorane at 5 years

Other message: almost zero post-op sensitivity

Main message = selective enamel etching
Selective enamel etching
Why no post-op sensitivity?

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

- Burrow and colleagues\(^2\) - 4% of restorations exhibited sensitivity in daily function
- Zero post-operative sensitivity reported by Opdam and co-workers\(^3\), 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\(^4,5\)
- 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\(^6\).

No post-operative sensitivity because of its low shrinkage stress.
Perceived difficulties with Silorane

- Needed its own dedicated 2-stage adhesive
- Only 2.5mm depth of cure
- Large filler particles
- Aesthetics suboptimal, other than A2
- Difficult manufacturing process
Novel Stress Relieving Monomer System

**AUDMA**
High molecular weight dimethacrylate—acts to lower volumetric shrinkage

**AFM**
Addition-fragmentation (AF) monomer
– Reacts into developing polymer network through terminal methacrylate bonds like other dimethacrylate monomers
– Central AF group can fragment and release stress
– Fragment may then polymerize into network in a lower stress orientation compared to its pre-fragmented state.
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
3MESPE Filtek Bulk Fill shows low shrinkage stress

Palin W, Watts D 2014
Filtek™ One Bulk Fill Restorative

More later!

Filtek™ One: resin the same as Filtek Bulk Fill Restorative, slight change in the filler.
Posterior composites take 2.5 times longer to place than amalgam.

Is bulk fill the answer?
The new 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)
First bulk fill materials needed a topping because their wear resistance wasn’t good enough.
Cusp deflection and microleakage in premolar teeth restored with bulk-fill flowable resin-based composite base materials


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Abstract

Objectives: To assess the cuspal deflection and cervical microleakage of standardised Class II cavities incrementally filled with a dimethacrylate RBC or bulk-fill flowable RBC bases.

Methods: Twenty-four sound upper premolar teeth with Class II cavities were allocated to three groups (n = 8). Restoration of the teeth involved the placement of an RBC (GrandioSO) in eight oblique increments (Group A) or Groups B and C were restored to within 2 mm of the palatal cusp in a single increment with bulk-fill flowable RBC bases (SDR and x-tra base) before the two occlusal cavity increments were placed with GrandioSO. Buccal and palatal cuspal deflections were recorded postirradiation using a twm channel deflection measuring gauge. Following restoration, the teeth were thermocycled, immersed in 0.2% basic fuchsin dye for 24 h, sectioned and examined for cervical microleakage.

Results: The mean total cuspal deflection for the oblique incremental restoration technique was 11.26 (2.56) μm (Group A) and 4.63 (1.19) μm (Group B) and 4.73 (0.99) μm (Group C) for the bulk-fill flowable RBC bases. A significant increase in the mean total cuspal deflection for the incrementally filled GrandioSO compared with the SDR (P = 0.007) and x-tra base (P = 0.005) restored teeth was evident. No significant difference in the cervical microleakage scores was recorded between groups AC (P > 0.05).

Conclusions: The bulk-fill flowable RBC bases significantly reduced cuspal deflection compared with a conventional RBC restored in an oblique incremental filling technique with no associated change in cervical microleakage recorded.
Cusp deflection experiments

Cusp deflection, microns

Grandoso  11.26+/-2.56
SDR            4.53+/-1.59
Xtra-Base    4.73+/-0.99
Cusp deflection in Dublin

5. Conclusion

The current study showed that the bulk-fill flowable RBC bases investigated (SDR and x-tra base) significantly reduced cuspal deflection during light irradiation compared with a conventional RBC (GrandioSO) restored in an oblique incremental filling technique with no associated change in cervical microleakage recorded.

SDR caused less cusp movement because it contains a stress modulator.
SDR: Clinical evidence at last!

A randomized controlled three year evaluation of “bulk-filled” posterior resin restorations based on clinical examination conducted on 104 restorations available at 3 year recall. Two failures in the composite only group observed in the first year (1.3% per annum). No failures in the SDR group. Conclusion: Bulk fill – highly acceptable clinical results.
Bulk Fill Flowables provide:

- Potentially faster restorations in back teeth
- Fewer steps than incrementally placed composites, therefore, potentially easier restorations
- Potentially fewer voids

But, their wear resistance wasn’t good enough, their compressive strength was poor and they were very translucent!!
The bulk fill base materials are now history!
The **NEW** classification for **BULK FILL** materials:

**BULK FILL RESTORATIVE MATERIALS**
(satisfactory wear resistance)
The new Filtek™ One Bulk Fill Restorative handles similarly

The PREP Panel evaluation
Designed for speed, 75-second setting time

12 dentists, used FBFR (shade A3) for 8 weeks

Respond to questionnaire

183 restorations placed:
23 Class I, 37% Class II, 27% MOD, plus cusp replacements, restorations in primary teeth and cores

The PREP Panel evaluation
FBFR assessment
Ease of use

None of the evaluators had difficulty with FBFR sticking to instruments

- 4.8
Further comments:

“Excellent handling & viscosity. Doesn’t slump, good depth of cure and no post-operative sensitivity”

“Initially I didn’t think there was a need for a Bulk Fill material but the longer I used it the better I felt about complete curing. Less shrinkage than Filtek Supreme – I have found an alternative!”

“Great material, looks great. Very convenient to place in 4mm increments – a good time saver. I would definitely buy!”

“Aesthetics good but heavily stained dentine shows through – problem to leave remove more dentine or leave and opaque out”
FBFR assessment
Conclusions
75% of evaluators would purchase
92% (n=11) would recommend to colleagues
New Filtek One
Filtek™ One Bulk Fill Restorative Technology

- Same patented nanofiller technology as Filtek™ Supreme Universal Restorative
- Same innovative methacrylate monomers as Filtek™ Bulk Fill Posterior Restorative

Nanofiller Technology

Innovative Methacrylate Monomers
Nanofiller technology enables …

- Excellent polish retention
- Management of opacity and translucency
- Excellent handling
- High strength
- Excellent wear resistance
Filtek™ One Bulk Fill Restorative

Resin
- Aromatic urethane dimethacrylate (AUDMA)
- Addition-fragmentation monomer (AFM)
- Urethane dimethacrylate (UDMA)
- Dodecane dimethacrylate (DDDMA)

Filler (total inorganic filler loading = ~76.5 wt%, 58.5 vol%)
- Silica filler, 20nm, non-agglomerated
- Zirconia filler, 4-11nm, non-agglomerated
- Zirconia/silica cluster
- Ytterbium trifluoride, 100nm
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 bisphenol-A diglycidyl-ether-dimethacrylate (bis-GMA):triethylene glycol dimethacrylate (TEGDMA) formulations with refractive indices ranging from 1.4703 to 1.5370.

INTRODUCTION
Direct-placement resin-based composites are replacing amalgam and gold for extensive posterior restorations (Latz and Krejci, 1999; Burke, 2004). This trend will continue as clinicians seek to satisfy the expectations of patients who request affordable, aesthetic, minimally invasive restorations (Liebenberg, 2000; Roeters 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 (Liebenberg, 2000). A limitation of light-activated composites is their finite cure depth relating to inefficiency 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 interaction. Composites became more opaque or translucent on curing. Optimizing filler/resin refractive index mismatch provides increased curing depth and assists shade-matching.
Field Evaluation: Methodology

- In-vivo evaluation in three European countries (Germany, Italy and UK)
  - 60 dentists from each country (180 total) participating
  - Mix of bulk fill (Filtek™ Bulk Fill Posterior and competitive products) and universal composite (Filtek™ Ultimate Universal Restorative and competitive product) users

- Participants received five shades of Filtek One Bulk Fill Restorative to use clinically over a five week period
  - 5,935 restorations placed using Filtek One Bulk Fill Restorative (~38 per participant)
  - 63% posterior; 17% anterior; and 10% core build-up

- 40 participants evaluated procedure kits
  - Filtek One Bulk Fill Restorative + Single Bond™
  - Universal + Sof-Lex™ Diamond Polishing System
Field Evaluation Results

Would you recommend to a colleague?

93% of dentists who used Filtek™ One Bulk Fill Restorative clinically would recommend the material to a colleague!
Another bulk fill with no capping

3 shades
“Enamel-like translucency”

Contains a “shrinkage stress reliever”
BEAUTIFIL-Bulk Flowable

Shofu now offers a superior bulk fill flowable composite with ideal opaque shade stability, low shrinkage stress and full polymerization at 4mm depth of cure. The unique light properties of Giomer and high filler content (72.5wt%) helps to reduce polymerization shrinkage and shrinkage stress. BEAUTIFIL-Bulk Flowable is an advanced Giomer restorative you can trust.

- Ideal handling characteristics eliminate ooze and waste
- Low shrinkage and shrinkage stress (2.06 MPa)
- Unique light diffusion properties allow complete polymerization at 4mm depth of cure
- High flexural strength (139 Mpa) and flexural modulus (9 Gpa)
- Sustainable fluoride release and rechargability
- Self-leveling feature increases cavity adaptation
- Base/liner in class I and II posterior restorations

NEW! BEAUTIFIL-Bulk Restorative

BEAUTIFIL-Bulk Restorative is a conventional packable composite resin indicated for direct posterior restorations including the occlusal surfaces. It has excellent condensability and sculptability as well as shade stability before and after light curing. Fully polymerized at 4mm depth of cure, BEAUTIFIL-Bulk Restorative has a high fill ratio at 87.0wt%, and low shrinkage stress.

- Complete polymerization at 4mm depth of cure
- Low shrinkage (1.7%) and shrinkage stress (1.06 MPa)
- Optimum translucency creates esthetic shades unaffected by surrounding intraoral color
- Fluoride release and rechargability
- Strong and radiopaque
- Excellent condensability and sculptability optimal for posterior restorations
- Shade stability before and after light-curing
- High Vickers Hardness Value (61), flexural strength (114 Mpa) and flexural modulus (11.4 Gpa)
VOCO Admira Fusion x-tra

Ormocer technology, low volumetric shrinkage (1.25%), claimed low shrinkage stress, 4mm depth of cure, one shade (U)
Aura Bulk Fill (SDI)

Bulk fill:

For clinicians looking for a bulk filling restorative material, Aura's Bulk Fill (BKF) is the solution. It can be cured to a maximum of 6mm in 20 seconds with an LED curing light or 2 x 20 seconds with a halogen curing light. Available in 4g syringe and 0.25 unit dose.
Aura Bulk Fill (SDI): How does it work?

The opacity of Aura Bulk Fill is a function of the refractive index of the filler and the resin. The curing process alters the refractive index of the resin marginally, to match the refractive index of the filler. This lowers the opacity temporarily, allowing deeper light penetration for a high depth of cure. Upon cooling, the indices move apart again to give an ideal opacity.
Bulk fills without a cap seem to stress cusps less.
Sonic Fill
Viscosity change when sonic energy applied

High Viscosity

Low Viscosity
(adapt & fill cavity)

High Viscosity
(Press & Sculpt)
Sonicfill: Potential benefits

- Single step filling of cavities of 5mm depth
- No need for packing instruments
- Reduced potential for voids
- Ergonomic tip allows good access to cavity
- Satisfactory aesthetics

...and you cannot shape fissures with a hand instrument

...but need to purchase the handpiece
So, today there are several bulk fills which do not need a topping

.. more will appear in the months to come!!
Advantages of Bulk Fill Restorative materials

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

BULK FILL IS IN!
How do manufacturers do it?

More potent/efficient initiator systems
Increasing the translucency of the filler
For some, improved resin systems
The Configuration Factor

Feilzer et al

C-Factor

Total Bonded Area

\[ C = \frac{\text{Total Bonded Area}}{\text{Total Unbonded Area}} \]

C < 1 required to survive polymerisation contraction stress (Feilzer et al., 1987)
Bulk fill might lead to high stress!

In addition, polymerisation shrinkage stress increases in a thicker composite bulk. It is therefore important that the material that we use has demonstrable low shrinkage stress.
Curing profile of bulk-fill resin-based composites

Xin Li, Pong Pongprueksa, Bart Van Meerbeek, Jan De Munck *

KU Leuven-BIOMAT, Department of Oral Health Sciences, KU Leuven (University of Leuven) & Dentistry, University Hospitals Leuven, Kapucijnenvoer 7, Blok A – Box 7001, BE-3000 Leuven, Belgium

In general, manufacturers of bulk-fill RBCs were able to improve polymerization depth by the use of potent photoinitiator systems along with an increased translucency.¹,⁷,²⁵,²⁶
The most important layer with regard to light curing
Light curing may not be as simple as it seems!

Some readers may recall some recent clinical studies that used resin composites. Materials were pressed into place, and then the actual light curing was not performed until after the material had hardened to some extent. This meant that the problem of light exposure was eliminated, and the problem of the curing process was reduced.

However, the problem of light curing may not be as straightforward as it seems. Some factors must be considered.

First, light-activated resin composite materials are known to be highly curing. It is essential that they receive sufficient light energy to initiate and complete the curing process. Failure to do this may result in a less than optimal cure, restoration whose physical properties and long-term stability will suffer as a direct result.

This has been brought home to me recently when I was called to see a case of light curing failure. Light curing in an upper first molar was under-reported, and the inaccuracy being measured in a specially designed apparatus called a MARC (Managing Annular Resin Cure). The result was suboptimal because I had not held the light source steady in one position and perpendicular to the restoration. A serious wake up call. I have now reduced the intensity of the curing light source in the instrument so that it is only used in a controlled manner. The quality of the light curing unit is critically important, and a recent review of dental literature has indicated that the units marketed and sold in recent years do not perform as well as expected.

Lack of attention to the potential difficulties in designing light-curing units, and then the transmission of light through these units, can result in incomplete curing. This means that the material has not cured properly, and this can lead to complications.

In conclusion, light curing is not as simple as it seems. It is essential to ensure that the correct light energy is delivered to the material, and that the curing process is conducted in a controlled manner. The quality of the light curing unit is critical, and it is important to ensure that the units marketed and sold in recent years do not perform as well as expected.
The future of composite

Might bulk fills be the answer?
Self Etch + Low shrink + 5mm depth of cure = Amalgam substitute??
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

In addition, today, adequate aesthetics for back teeth
...and, how close are we?

perhaps it’s the older dentists who need some extra teaching?
The treatment of deep caries lesions may be fraught with difficulty, and total removal of deep caries in an asymptomatic tooth may result in a pulp exposure. The sealing of caries into the tooth has been suggested following the work of Mertz-Fairhurst et al, but the recent introduction of a material (Biocadite, Septodont, UK), which has demonstrable dentine repair properties, may be of value. This material is composed of a purified tricalcium silicate powder which is mixed with water in a capsule, with the reaction releasing calcium hydroxide.

Deep caries was noted on a bitewing radiograph (Figure 1). In a number of otherwise symptoms free teeth in a 22-year-old female patient with high caries activity. The maxillary 1st and 2nd molar teeth lasted vital. After removal of wet and infected dentine, it was decided that a pulpal exposure was likely if excavation was to be continued (Figure 2). Accordingly, excavation was stopped and Biocadite placed in the caries and, after 15 minutes' setting time, basic carvings could be carried out (Figure 3). After 9 months, the restorations were intact (Figure 4) and the tooth symptom free. A医生 will be made in due course regarding the need for replacement of the restorations and whether removal of the remaining caries will be carried out, or simply that the restorations be restorated with resin composite.

References

F J Trevor Burke, DDS, MSc, MGDS FDS RCS (Eng), FDS RCS (Edin), FFDS FADM Professor of Dental Primary Care, University of Birmingham School of Dentistry, St Chad’s Queensway, Birmingham B4 6NN, UK.
Direct placement restorations: some examples: 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

Seven years’ difference in median survival time between MOD restorations and class I restorations.
Take home message

Size matters – big fillings last less well than small.

Keeping crowns off teeth is important in preserving the lifespan of teeth.
INTRODUCTION

1993 saw the establishment of a group of practicing dental practitioners, the PREP (Product Research and Evaluation by Practitioners) Panel, who were prepared to complete evaluations of new materials and techniques in the practice environment. To date, over 40 evaluations, including handling evaluations and clinical trials, have been completed. The PREP panel presently has 29 members (61% holding post-graduate qualifications) with an average time since graduation of 21 years. The Panel has a UK-wide distribution and a wide range of dental interests facilitating the assessment of a full range of products and techniques.

METHOD

Twelve dental practitioners from the PREP Panel were chosen at random and sent twenty of the retractors along with a questionnaire designed to evaluate the presentation, handling and ease of use of the system. Most responses were given on a visual analogue scale (VAS). The evaluators were also asked the reasons for use of lip retraction systems, and to compare the currently used system with the new retractor.

BACKGROUND INFORMATION

Ten (83%) of the evaluators currently used a lip retraction system. All but one evaluator used the plain plastic photographic type of retractor. Nine (75%) used the retractors for photography and 4 (33%) for an aid to isolation. The evaluators rated the ease of use of the currently used lip retraction system on a VAS (where 1 = difficult to use & 5 = easy to use) as follows:

RESULTS

Six (50%) of the evaluators stated that the sizes provided were adequate. The remaining 50% all stated that the regular size was too large and a smaller size than 'small' was required. (See note in Introduction).

When asked if Optragate adequately protected the lips, 9 (75%) stated that it did. The remaining three evaluators (25%) all stated that the bottom lip slipped out.

88% (n=7) of the evaluators encountered difficulties initially with the use of Optragate. Comments made by these evaluators included: “Initially difficult but with practice – and Vaseline- I could slip it on almost undetected!” and “Needs to be moist to fit”

Patient comments reported included: “Easier to keep my mouth open”; “More comfortable then rubber dam” and “Uncomfortable behind lower lip”

Just one evaluator reported a symptom or side effect from the use of Optragate, and that was hypersalivation in 2 cases.

Eight (67%) of the evaluators stated that they would purchase the Optragate system and 9 (75%) that they would recommend the system to colleagues.

The evaluators rated the ease of use of the currently used lip retraction system on a VAS (where 1 = difficult to use & 5 = easy to use) as follows:

3.9

Final comments included:
“I use them all the time for surgical procedures now, especially implant placements - it helps keep the patient’s mouth open, and is more gentle on the tissues than a conventional retractor. It also allows both me and my nurse an extra hand as we are not having to retract!” and “Innovative and effective – a joy!”

CONCLUSIONS

The Optragate lip retraction system has been subject to an extensive clinical evaluation in which it scored better for ease of use than the lip retraction system used previously. The majority of evaluators would both purchase the system and recommend it to colleagues. The sizes of Optragate provided for this evaluation did prove problematic, with 50% of the evaluators requiring a smaller size (now provided). This was a product that seemed to gain favour and find more applications the more it was used.

ACKNOWLEDGEMENT

The support of Ivoclar Vivadent UK is acknowledged. The authors also wish to thank the participating practitioners.

REFERENCES


Fig 1: Optragate
Patients know (and care!) more about dental materials than we think!

Burke’s tips!
A practice-based assessment of patients' knowledge of dental materials

F. J. T. Burke*1,2 and R. J. Crisp1,2

**Aims** It is the aim of this study to determine, by means of a questionnaire completed by patients attending ten UK dental practices, patients' level of knowledge on dental materials and techniques. **Materials and methods** Members of The PREP (Product Research and Evaluation by Practitioners) Panel were asked to recruit patients to participate in a questionnaire-based assessment of their knowledge of dental materials. **Results** Two hundred and forty-nine patients took part in the questionnaire. Sixty-three percent (n = 157) of the respondents were female and 92% (n = 229) of the respondents stated they were regular attenders at the dental practice. The respondents were asked how important the quality of dental materials used in their mouth was, and on a Visual Analogue Scale (VAS) where 1 = not important and 10 = very important, the result was 9.6. The same score was recorded when they were asked how important it was that the materials used in their mouth were supported with relevant clinical research evidence and long term data of the success of the material. They were also questioned on the subjects of price, manufacturer, source or material and type of filling material. A significant amount of respondents demonstrated that they had concerns over the use of amalgam. **Conclusions** Respondents expressed strong views that the materials used on their teeth should have a robust evidence base and they care about the materials that are used in their mouths.
CONCLUSIONS:
- Patients feel that materials should have a robust evidence base, produced by manufacturers with experience in the field.
- Patients care about the materials that we use.
- Almost half did not wish “own label” materials to be used in their mouths.
- One third expressed anxieties regarding the use of amalgam in their teeth.
Me too:
Are own label brands a threat to the development of new materials?
There is no evidence base for “own label” Glass Ionomer materials.
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 adhesive,” 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

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, 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 research was carried out, with particular reference to OL brands.

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

Table 1. Most frequently mentioned dentine bonding agents in the ‘Bonding agent’ research abstracts.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Number of Mentions in Research Abstracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearfil SE Bond</td>
<td>40</td>
</tr>
<tr>
<td>Scotchbond Multipurpose (3M ESPE)</td>
<td>29</td>
</tr>
<tr>
<td>Adper Easy Bond (3M ESPE)</td>
<td>17</td>
</tr>
<tr>
<td>Optibond Solo (Kerr)</td>
<td>17</td>
</tr>
<tr>
<td>Prompt L Pop (3M ESPE)</td>
<td>10</td>
</tr>
<tr>
<td>Optibond FL (Kerr)</td>
<td>10</td>
</tr>
<tr>
<td>Optibond all-in-one (Kerr)</td>
<td>10</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Number of Mentions in Research Abstracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtek Supreme/Z250 (3M ESPE)</td>
<td>51</td>
</tr>
<tr>
<td>Filtek Z250 (3M ESPE)</td>
<td>35</td>
</tr>
<tr>
<td>Filtek Z100 (3M ESPE)</td>
<td>18</td>
</tr>
<tr>
<td>Venus Diamond (Heraeus Kulzer)</td>
<td>18</td>
</tr>
<tr>
<td>EsthetX (Dentsply)</td>
<td>18</td>
</tr>
<tr>
<td>Kalore (GC)</td>
<td>17</td>
</tr>
<tr>
<td>Promptise (Kerr)</td>
<td>12</td>
</tr>
<tr>
<td>Grandio (Voco)</td>
<td>10</td>
</tr>
<tr>
<td>Gradia Direct (GC)</td>
<td>10</td>
</tr>
</tbody>
</table>

Results
A total of 189 abstracts from the IADR classification ‘Dentine adhesives’ were identified, although 31 of these did not mention specific bonding agents and two were on light-curing units. The results indicated that 84 different types of bonding agent (note that some of these may be discounted as some manufacturers may name the same bonding agent differently for different markets) had been subjected to research in the remaining 156 abstracts. A total of 233 bonding agents were tested in these abstracts. The most frequently researched bonding agents are presented in Table 1. Four materials did not specify their manufacturers, so these materials were investigated further in an internet search and their manufacturers identified. No OL brands were identified during the search.

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

Acknowledgment
Thanks are due to Mrs Jeannette Hiscock for tabulating the data.

Disclosure
The author is a member of the 3M ESPE Scientific Advisory Board but has no financial interest in any of the products mentioned.
However, greater batch to batch variation in several mechanical & physical properties of the own-label materials was noted.
44 years of evidence-based publishing!
University of Birmingham Masters in Advanced General Dental Practice

Six modules

- Informed & informing clinician (20 credits)
- Contemporary dental practice (20)
- Medical and surgical management of oral disease (20)
- Oper. Dent 1: Aesthetic dentistry and endodontics (20)
- Oper. Dent.2: Fixed and Removable Prosthodontics (20)
- Running a clinical business (20)

Case study 30 credits, Audit project 30 credits:
When completed, a total of 180 PG credits = MSc
Dentistry is changing!

New bonds and bulk will help that to happen!