

Resin luting materials

...majoring on self-
adhesive resin
cements



Disclosures

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

"Some manufacturers fund my research: I was involved in the early research on Unicem"

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

What I plan to talk about:

- 👄 A brief history of luting materials
- 👄 Why resin cement is best
- 👄 The dentine-bonded all-ceramic crown
- 👄 Self adhesive resin luting
- 👄 Clinical evaluation of Unicem

Ideal requirements of luting material

Combe, Burke & Douglas, 1999

- 👄 Biocompatible
- 👄 Cariostatic
- 👄 Adhesive to tooth structure
- 👄 Prevent leakage
- 👄 Insoluble in the dilute organic acids found in plaque

Ideal requirements of luting material

Combe, Burke & Douglas, 1999

- Resistant to water absorption
- Sufficient tensile & compressive strengths
- Available in a range of shades
- Facilitates easy removal of excess
- Low film thickness

Factors in selection of luting materials

Combe, Burke & Douglas, 1999

- ✧ Type of restoration
- ✧ Resistance and retention form
- ✧ Available tooth tissue
- ✧ Risk of pulpal irritation
- ✧ Working time and setting time requirements

Trevor's simple classification of luting materials

TODAY!
We need
active

ACTIVE	PASSIVE
LUTING	LUTING

Review of properties of luting materials

Combe, Burke, Douglas, 2000,
Olio, 1991

Van Zeghbroeck, 1995

Rosenstiel et al., 1998

We thought that
this was bonding!

1875

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

1875



Smith, Wright and Brown, 1986

1875

NOT TODAY!

1875

Baldwin 1897

“I was struck by the readiness by which the oxyphosphate cement laid hold of the amalgam.

This composite filling is suitable for all which are considered suitable for amalgam alone.”

Zinc Phosphate

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

Lactic acid erosion test



Polycarboxylate cement



Soon became Poly-F

Polycarboxylate Cements



Advantages	Disadvantages
Notable lack of post-op sensitivity	Clean up timing is critical
Long history of success	High solubility
Tolerant of mild contamination	Low compressive strength
Chemical adhesion to tooth	Low tensile strength
Appearance change at end of working time	Low fracture toughness

Glass-ionomer luting cements

Advantages

Chemical adhesion
to tooth
F release
Moderate
compressive
& tensile strengths
Easy to mix

Disadvantages

Low tensile strength
Low fracture toughness
Soluble in oral
environment
History of post-op
sensitivity
Clean-up time is critical

RMGI luting materials

Advantages

Good compressive
& tensile strengths
Resistant to dissolution
F release
Reasonable working time
Easy clean-up

Disadvantages

Not very aesthetic
Slight expansion on
setting (some
materials)

Performs well in lactic acid erosion testing

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1985

The retention of gold crowns on human dentine preparations — a comparison of eight cements

By S M BLACK BDS; and G CHARLTON BDS MDS FDSRCS; Department of Conservative Dentistry, University of Edinburgh, Old Surgeons' Hall, Edinburgh

Experiments were carried out to compare the retentive properties of eight dental luting cements, using gold crowns cemented onto human dentine. The order of retention of the cements was: 1 Composite (Panavia-Ex, J & S Davis); 2 Glass-ionomer (AquaCem, DeTrey); Glass-ionomer (Ketac-Bond, Cottrell); and Polycarboxylate (Bondalcap, Vivadent); 3 Polycarboxylate (Poly F Plus, DeTrey); Zinc phosphate (DeTrey); and Zinc phosphate (Phosphacap, Vivadent); and 4 Zinc oxide/eugenol, alumina, EBA (Opotow, Teledyne Getz).

has shown that recementation affects the retention of cement lutes.

Methods and materials

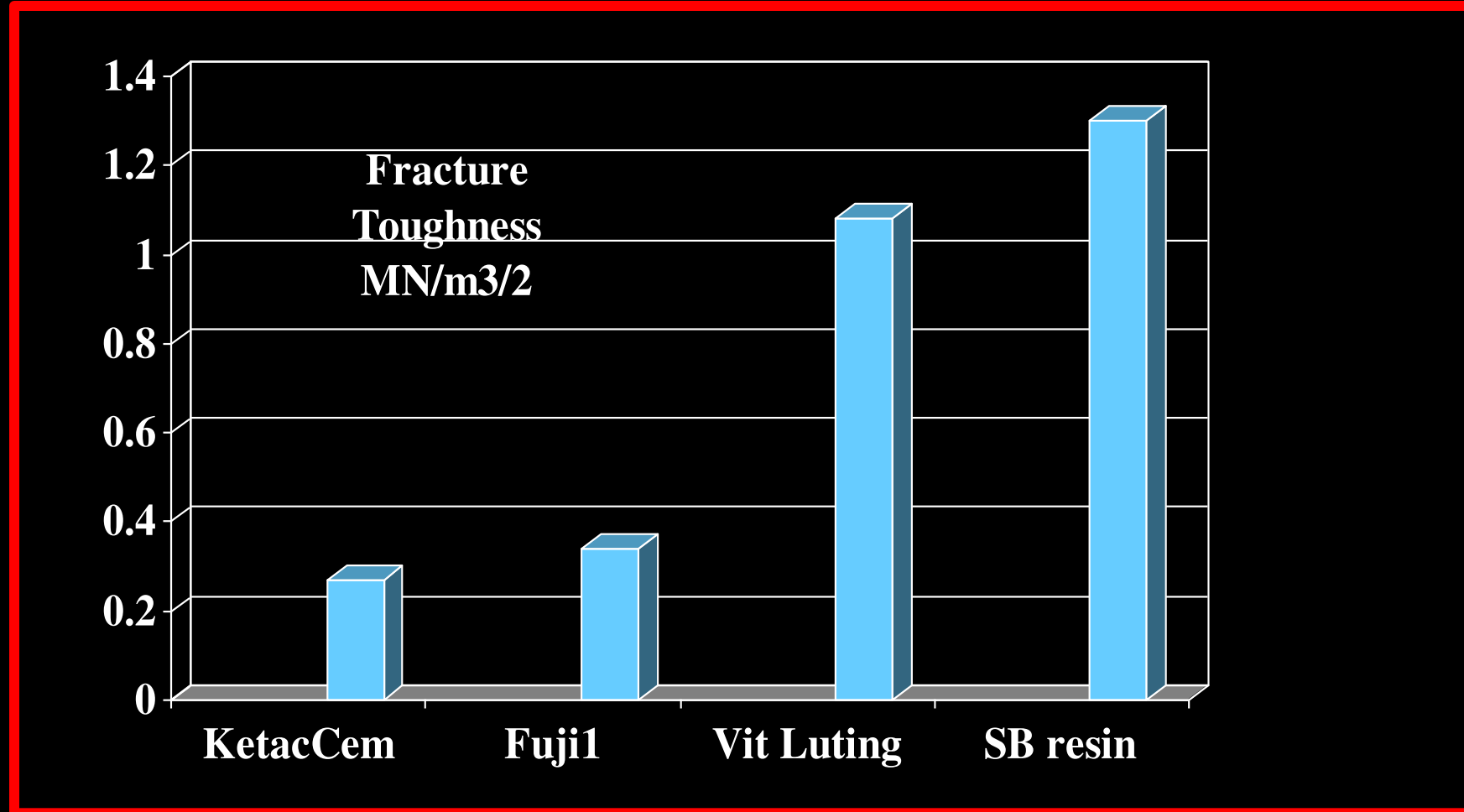
Eight cements were used as shown in Table 1.

The crown preparations were made on extracted human teeth. Before preparation the teeth were kept in water at room temperature, and after preparation they were stored at 37°C and 100 per cent humidity. Fig 1 shows the dimensions of the

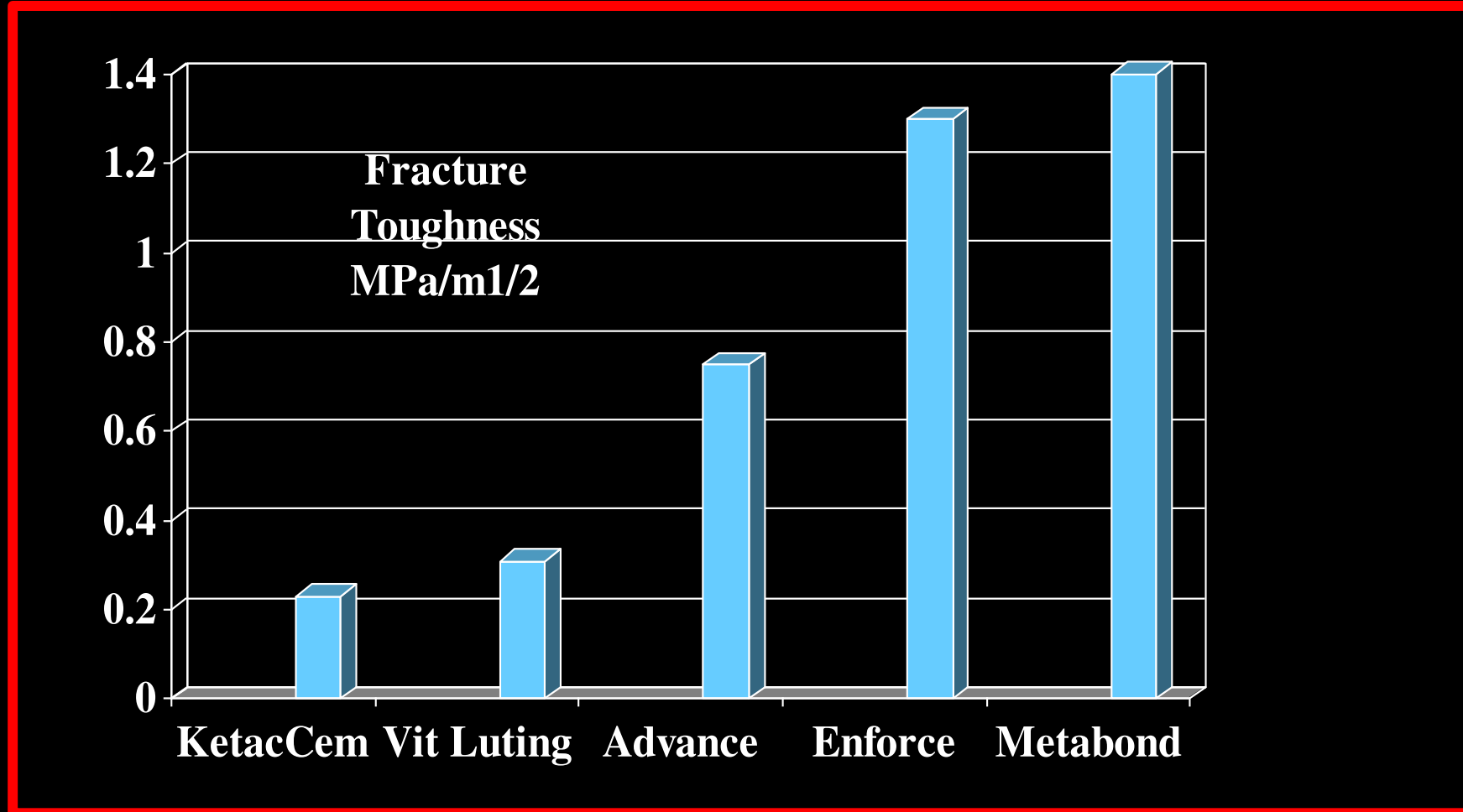
**Resin-based cements:
Is there a better way
of luting restorations?**

Christensen, 1989

The Cement Effect Mitchell et al, 2000



The Cement Effect Knobloch et al, 2000



Some early resin luting materials



4-META based



!0-MDP based



In comparison
with resin
composite
restorative
materials, the
uptake of resin
luting materials
has been slow

Christensen 1990

WHY?

- 👄 Etching and bonding takes time and is technique sensitive
- 👄 Time = Money
- 👄 Clean-up is difficult

Which cement is indicated for
luting all-ceramic restorations?

Are Adhesive Technologies Needed to Support Ceramics? An Assessment of the Current Evidence

F.J.Trevor Burke^a/Garry J.P. Fleming^b/Dan Nathanson^c/Peter M. Marquis^d

Abstract: Despite large variations in the reported fracture strengths of dispersion strengthened, glass infiltrated, castable, pressable and machinable ceramics utilised for the construction of all-ceramic crowns, the annual clinical failure rate reported for these materials in the dental literature is remarkably consistent at ca 3%. These results emphasise that there may be little correlation between the average fracture strength and resultant clinical performance. Consequently, if ceramics are to be used for dental applications, then clearly more detailed information on the statistical variations in strength combined with the influence of cementation media are required.

The effect of adhesive technology has been examined in laboratory and clinical studies. The laboratory studies focused on the effect of cement lute on crown performance, whilst surface degradation and strengthening effects with different systems were examined utilising conventional materials science techniques. Clinical studies focused on the failure rates of conventionally luted and adhesively luted crowns and inlays.

There would appear to be evidence from clinical studies that crowns luted with a resin cement and with the placement procedure incorporating a dentine bonding stage have enhanced rates of survival. It is therefore concluded that the available research strongly suggests that the use of resin as a luting material for ceramic restorations is indicated, given the research from three differing sources – laboratory fracture studies comparing restorations luted with resin vs other materials, clinical studies, and laboratory studies examining the surface sealing/strengthening effect of resin on ceramic. Laboratory studies also confirm the enhanced resistance to fracture of crowns cemented with an adhesive procedure.

J Adhes Dent 2002; 4:7-22

Submitted for publication:20.12.01; accepted for publication:01.02.02.

AGAINST 4

IN FAVOUR OF CERAMIC 28

Resin cements

Advantages

Not soluble in oral environment

High compressive & tensile strengths

Good fracture toughness

Capable of bonding to tooth structure via DBA



Disadvantages

Requires acid etch technique

Requires dentine bonding

Moisture control is critical

Clean –up time is critical

Technique sensitive



Take home message

Resin luting materials have excellent physical properties and are indicated for all-ceramic restorations.

Additionally.....

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

- ✎ 18 luting materials
- ✎ Extracted premolars
- ✎ Standardised cone-shaped preparations with 33° taper
- ✎ Gold copings made and cemented
- ✎ Tensile force applied after 24h

Retentive properties and film thickness of 18 luting agents and systems

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

Enamel and dentin bonding and fluoride release are required attributes of newer generation cements. Adhesive forces like those generated through chelation by polycarboxylate and glass ionomer cements are weak compared to those systems for which dentin primers are recommended in conjunction with the luting component. Hypersensitivity following use of resin or hybrid cements appears to be of little concern, in contrast to experience with some glass ionomer cements.³ There is no persuasive evidence for this hypersensitivity, although possibilities have been noted.⁴ However, calcium hydroxide [$\text{Ca}(\text{OH})_2$] used as a liner under crowns has been shown to reduce inflammation.⁵ Resin and hybrid cements or ionomer resins are the newest additions to luting agents. One such cement (Binner, I.D. Caulk & Co., Milford, DE), tested for pulp reactions in primates, caused little irritation after 5 days; after 26 and 60 days, the initial mild irritation had been resolved.⁶ Since postoperative hypersensitivity is common, research has been directed at finding modifications

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

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

Methods and materials

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

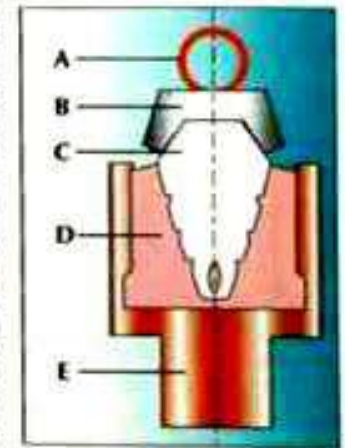


Fig. 1. Cross section of the experimental design. A = the ring to be attached to the Instron to apply a tensile force; B = the casting; C = the crown preparation; D = resin securing the

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

Think adhesive cementation!

Think adhesive cementation!

Zidan & Ferguson 2003

- ✎ Complete crowns prepared with three different tapers, luted with four different cements
- ✎ Retention of the adhesive resins investigated were 20% higher at 24-degree taper than the retentive values of conventional cements at 6-degree taper.

Think adhesive cementation!

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

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

Heintze SD

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

Systematic review including 18 studies

Most important factors for crown dislodgment were stump height, convergence angle and luting agent.

Frequency of debonding was higher for restorations luted with zinc phosphate than all other types.

Heintze SD

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

Think adhesive
cementation!

In clinical situations with low mechanical retention, or situations with low stump height or high convergence angle, the adhesive properties of the luting agent are crucial for the prevention of debonding.

Take home message

For the day (almost always!) when I cannot get an ideal taper (6° taper, Shillingburg 1995) I need (adhesive) resin luting !

Other advantages of
resin luting

No risk of cement
dissolution

Use a tooth coloured
resin cement to avoid this



Today!

"Smart" resin cements

3M ESPE RelyX Ultimate Adhesive Resin Cement

3M

www.3m.com/dental

Consultants' Comments

- "A very complete kit."
- "This one kit does everything I need!"
- "Fewer steps than other cements I have tried."
- "No post-operative sensitivity."
- "No refrigeration required."
- "Reduces the number of products I need to keep in the office."
- "Great bond strength."
- "Excess cement is difficult to remove once it is fully set."
- "Add a glycerin gel to the kit to cover cement during self-curing."

Description

RelyX Ultimate is an adhesive resin cement used in combination with *Scotchbond Universal Adhesive*. It is dual curing and supplied in an automix syringe. It is used for the adhesive cementation of indirect restorations and is available in shades A1/Light, A3/Opaque/Yellow Opaque, B0.5/White, and Translucent. The cement can be used either in a "total



+++++ (96%)



FEATURED IN:

VOLUME 29
NUMBER 05
JUNE 2012

[VIEW ISSUE](#)



+



G-CEM LinkForce: one system, three base elements
That's all it takes to create strong adhesion of your indirect restorations in all situations



G-Premio BOND
Bonds with no compromises to ALL preparations (tooth, Core build-ups & abutments)



G-CEM LinkForce
Provides a strong link in ALL indications



G-Multi Primer
Bonding to ALL types of restorations



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1995

1995

The dentine-bonded crown
concept

The dentine-bonded crown

 Etchable (HF) ceramic

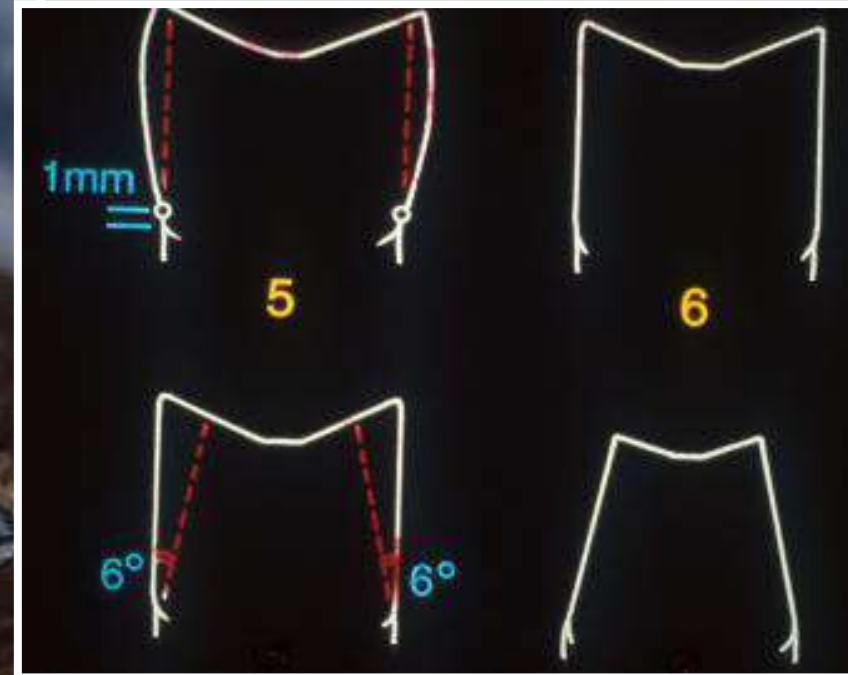
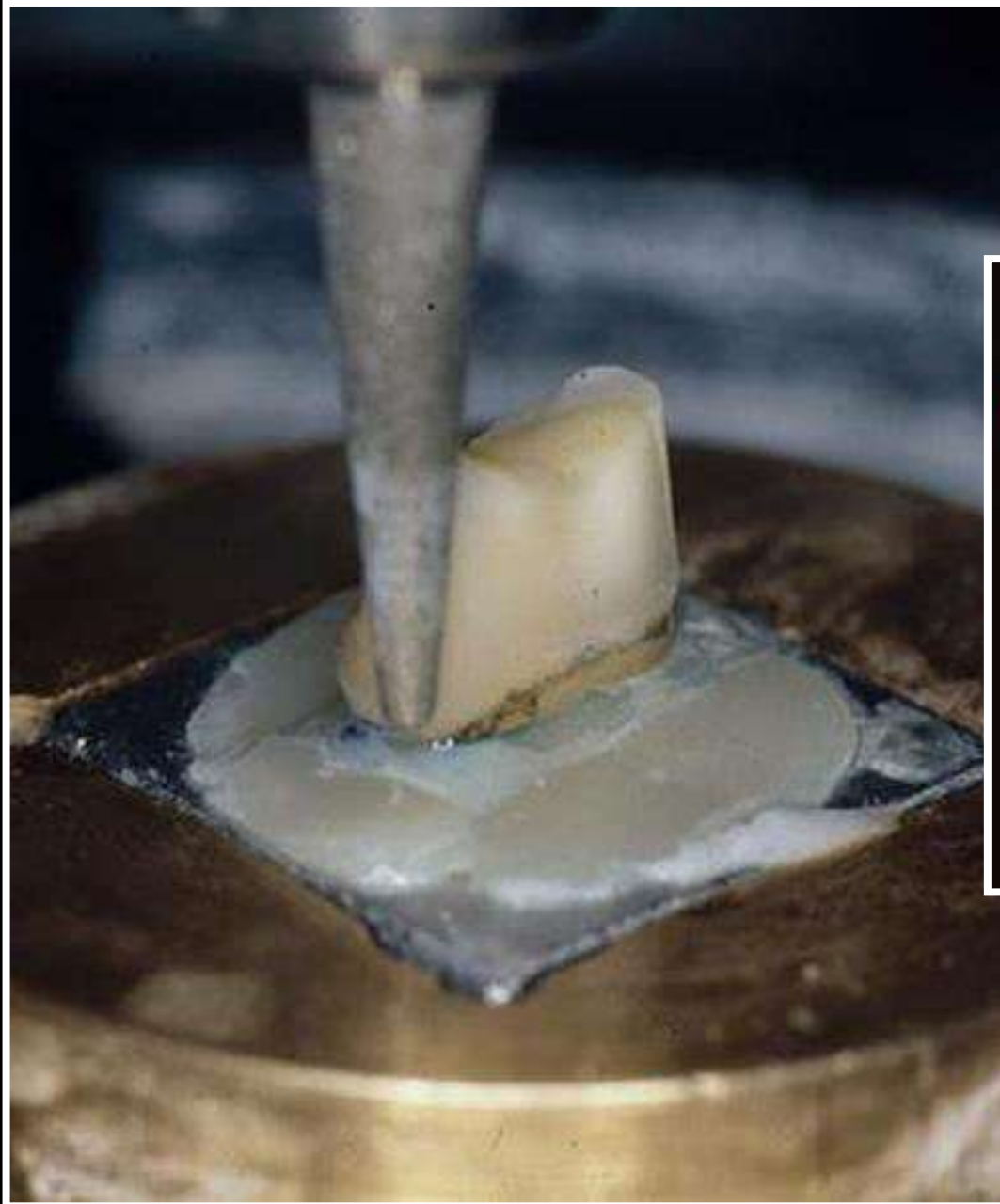
 Silane coupling agent

 Minimal film thickness

dentine bonding agent

 Dual-cure resin cement

Dentine-bonded crown – fracture resistance



Burke F.J.T. and Watts D.C.
Fracture resistance of teeth
restored with dentin-bonded
crowns. Quintessence
Int.1994; 25; 335-340.

Dentine-bonded crown- fracture resistance

Burke F.J.T. and Watts D.C.
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restored with dentin-bonded
crowns. Quintessence
Int.1994; 25; 335-340.

When the ceramic and the tooth
are bonded together using
resin technology, the complex
becomes synergistic

No difference in fracture strength
between teeth restored with
dentine-bonded crowns and unrestored teeth

Placement of dentine-bonded crowns

- ✎ Try-in paste
- ✎ Clean fitting surface and silanize
- ✎ Clean tooth with pumice, isolate
- ✎ Apply DBA
- ✎ Apply dual cure luting agent to crown
- ✎ Place with *gentle* finger pressure
- ✎ Remove XS luting material
- ✎ Light cure and finish margins
- ✎ Check occlusion and polish



The big
worry!

It was necessary to
apply the dentine
bonding agent and
light cure it prior
to crown placement



2001

Thinks!

“ A self-adhesive resin
cement would solve
these problems”



Self adhesive resin luting materials: Mode of action

Ferracane JL, Stansbury JW, Burke FJT. J.Oral.Rehabil.2011;38:295-314.

The incorporation of acid-functionalised methacrylate or related monomers is a critical component in self-adhesive resin cements

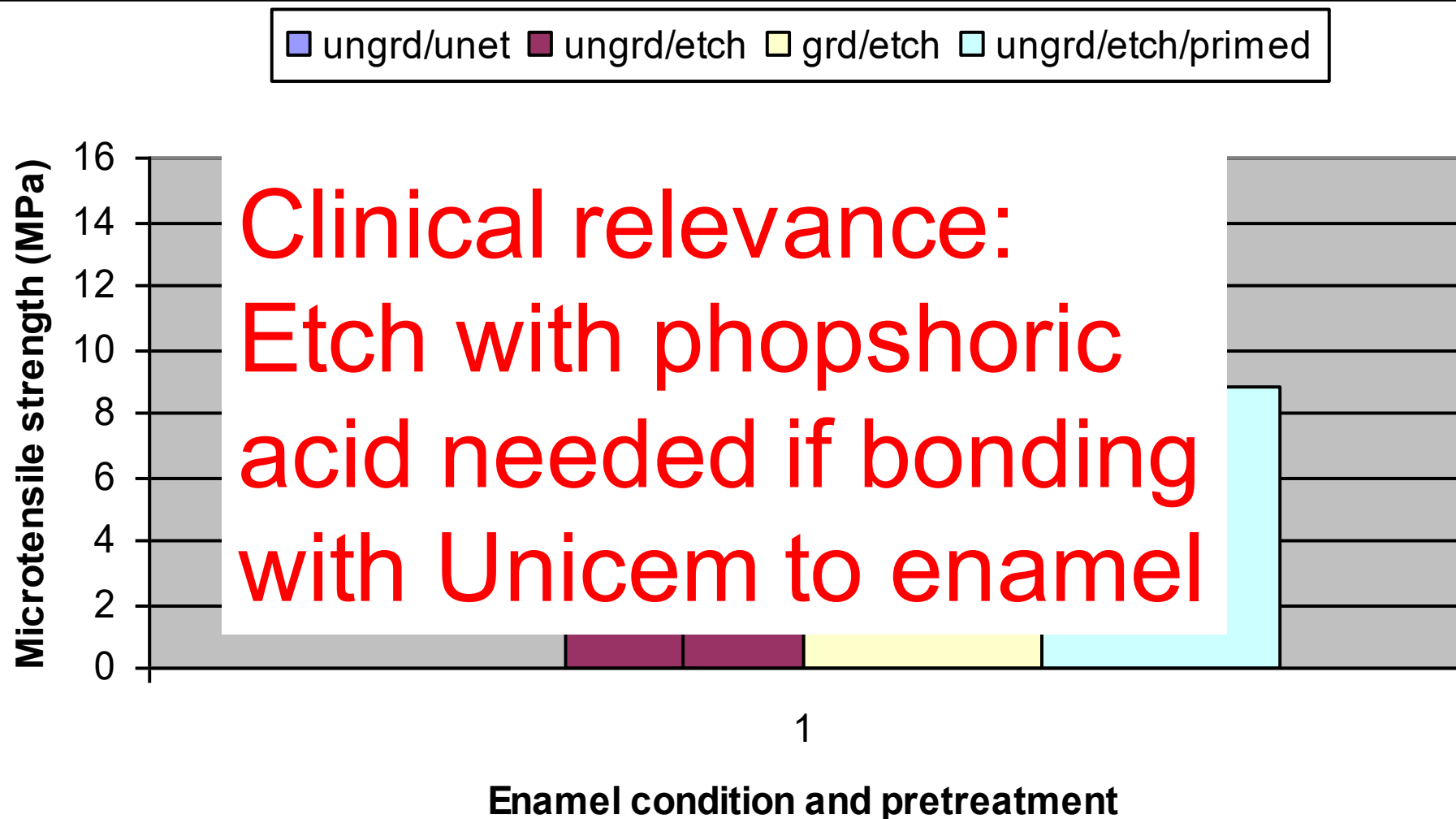


The self-adhesive resin cements offer a reasonable degree of unassisted adhesion to dentine although bonding directly with enamel still presents a greater challenge.

Microtensile bond strength of RelyX

Unicem to enamel

Ahmed, Fleming, Burke, 2004



Self adhesive resin luting materials: Mode of action

Ferracane JL, Stansbury JW, Burke FJT. J.Oral.Rehabil.2011;38:295-314.

The fillers are combinations selected from barium fluoroaluminoborosilicate glass, strontium calcium aluminosilicate glass, quartz, colloidal silica, and other glass fillers.

The partial surface dissolution of acid-soluble glass serves to neutralise the resin acidity and is capable of delivering sodium, calcium, silicate and fluoride ions that part in the setting reaction.

.

The total filler content is typically in the range of 60–75 wt%.

Self adhesive resin luting materials: Mode of action

Ferracane JL, Stansbury JW, Burke FJT. J.Oral.Rehabil.2011;38:295-314.

Self-adhesive resin cements are two-part materials that require either hand mixing, capsule trituration or delivery by an auto-mixing dispenser. One component is comprised of conventional mono-, di- and/or multi-methacrylate monomers that are used in a variety of resin-based dental materials: Bis-GMA, urethane oligomers of BisGMA, UDMA, HEMA, glycerol dimethacrylate (GDMA), TEGDMA, etc.

Review Article

Self-adhesive resin cements – chemistry, properties and clinical considerations

J. L. FERRACANE*, J. W. STANSBURY[†] & F. J. T. BURKE[‡]
**Department of Restorative Dentistry, Division of Biomaterials and Biomechanics, Oregon Health & Science University, Portland, OR, [†]Department of Craniofacial Biology, School of Dental Medicine, University of Colorado Denver, Aurora, CO, USA and [‡]Primary Dental Care, University of Birmingham School of Dentistry, Birmingham, UK*

SUMMARY Self-adhesive resin cements were introduced to dentistry within the past decade but have gained rapidly in popularity with more than a dozen commercial brands now available. This review article explores their chemical composition and its effect on the setting reaction and adhesion to various substrates, their physical and biological properties that may help to predict their ultimate performance and their clinical performance to date

and handling characteristics. The result of this review of self-adhesive resin cements would suggest that these materials may be expected to show similar clinical performance as other resin-based and non-resin based dental cements.

KEYWORDS: dental cement, self-adhesive, self-etch, properties, clinical performance

Accepted for publication 10 July 2010

Introduction

Self-adhesive resin cements, defined as cements based on filled polymers designed to adhere to tooth structure without the requirement of a separate adhesive or

glass-ionomer and resin composite. However, dentists may still experience confusion over the specific composition and indications for other types of 'hybrid' cements, such as resin-modified glass-ionomer and polyacid-modified resin (compomers). Because of their

Do you
want
to read
more?

Self adhesive chemistry



New monomers, FAS glass filler,
new initiator systems

Unicem: Intelligent chemistry: Transformation from hydrophobic to hydrophilic



hydrophilic



adaptation to tooth
structure and **moisture**
tolerance

radical polymerization
+ neutralization reactions

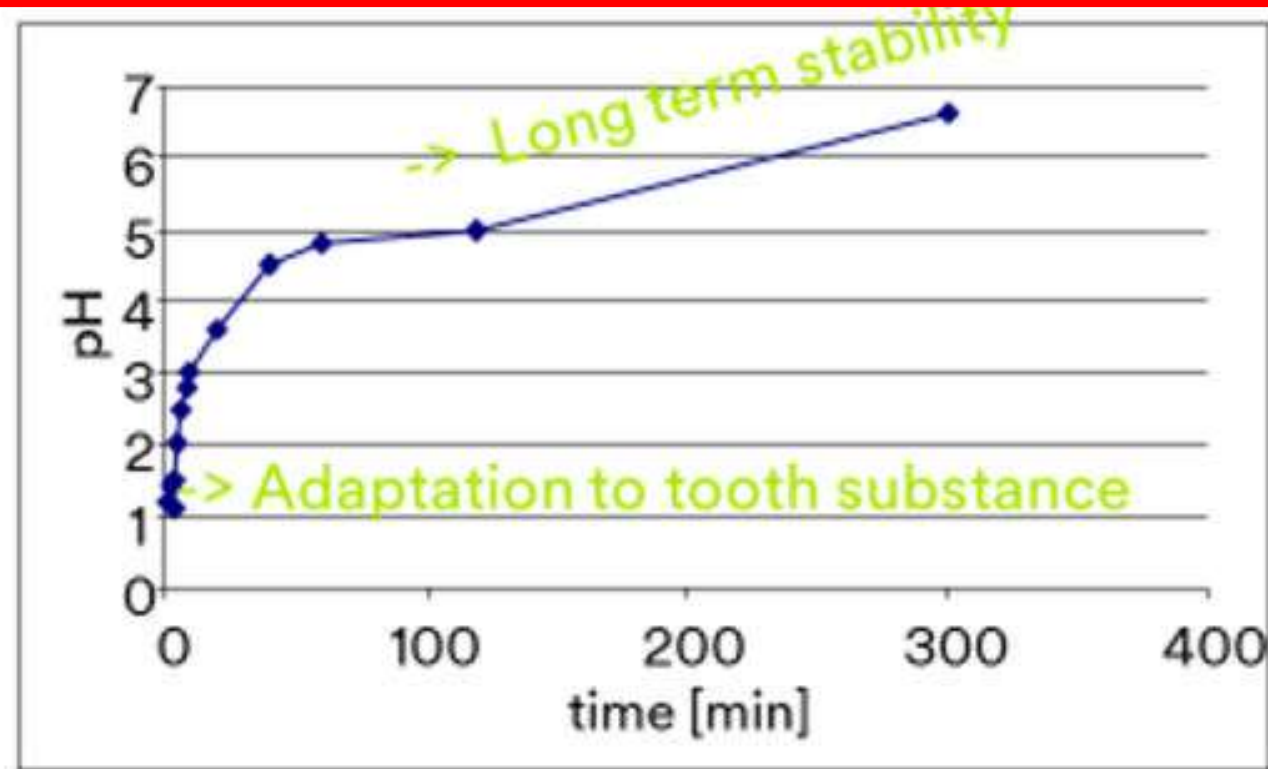


hydrophobic



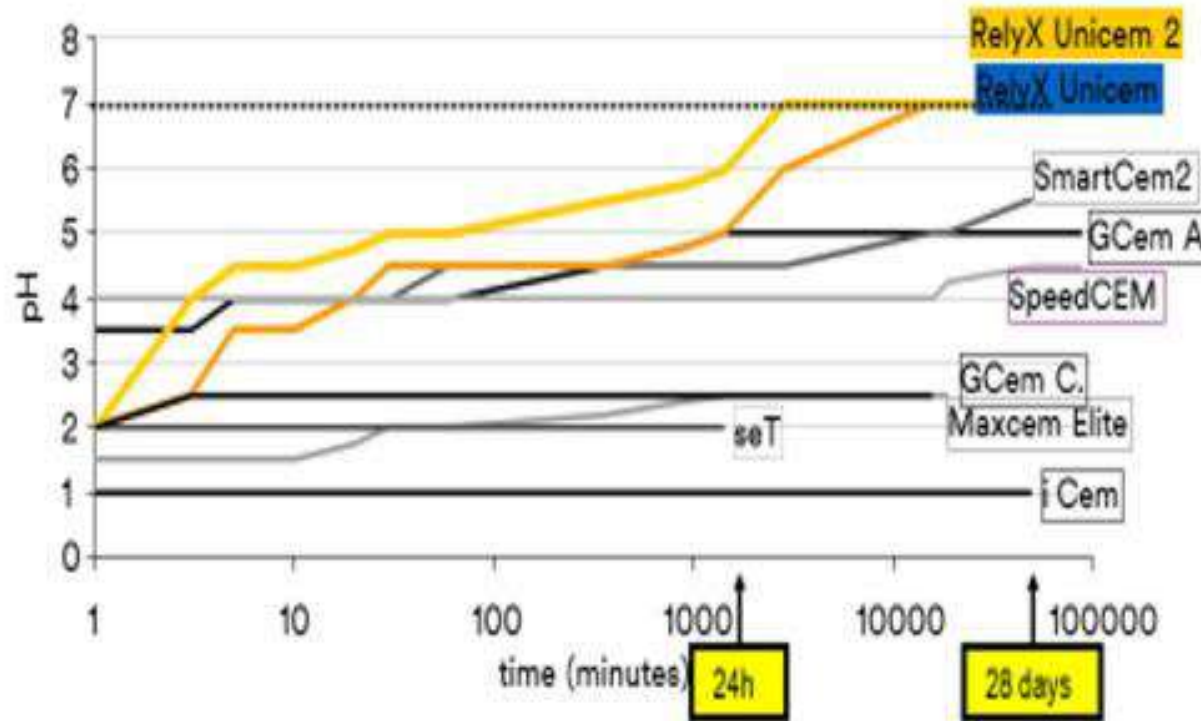
high mechanical strength,
dimensional stability
→ long term stability

Unicem: A neutralization reaction occurs upon polymerization



Self adhesive resin cements: pH change

Complete Neutralization: from acidic to neutral for longevity



pH measurement 3M ESPE internal data

Neutralisation reaction confirmed

Linlin HAN, Akira OKAMOTO, Masayoshi FUKUSHIMA and Takashi OKIJI

Table 3 pH values of test materials

Materials	Light cured	90 seconds	48 hours
G-Cem	2.0	1.8	3.6
Maxcem	2.2	2.0	2.4
Smart Cem	3.6	3.6	4.0
Relyx Unicem	5.0	2.8	7.0

Dental Materials Journal 26(6) : 906–914, 2007

Force to fracture (kN) of dentine-bonded crowns

“It is concluded that standardised ceramic crowns, luted with a new self-adhesive resin cement, had similar fracture resistance to those luted with a dentine bonding agent and conventional resin cement”

Burke FJT, Fleming GJP, Abbas G, Richter B. Effectiveness of a self-adhesive resin luting system on fracture resistance of teeth restored with dentine-bonded crowns. Eur.J.Prosthodont.Rest.Dent.2006;**14**:185-188.

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Clinical evaluation of RelyX Unicem by the PREP Panel

- 👉 12 UK general dental practitioners
- 👉 Use Rely-X Unicem for 6 weeks
- 👉 Complete questionnaire on handling of material

- 👉 Variety of luting materials used pre-study
- 👉 134 crowns cemented
- 👉 Rated material on analogue scales

Clinical evaluation of RelyX Unicem by the PREP Panel

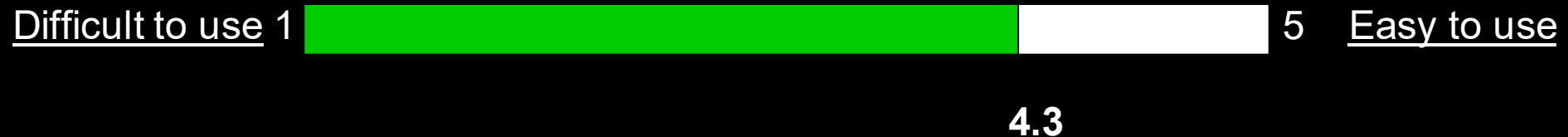
Ease of use of previous resin luting system



Ease of use of conventional luting system used
prior to evaluation

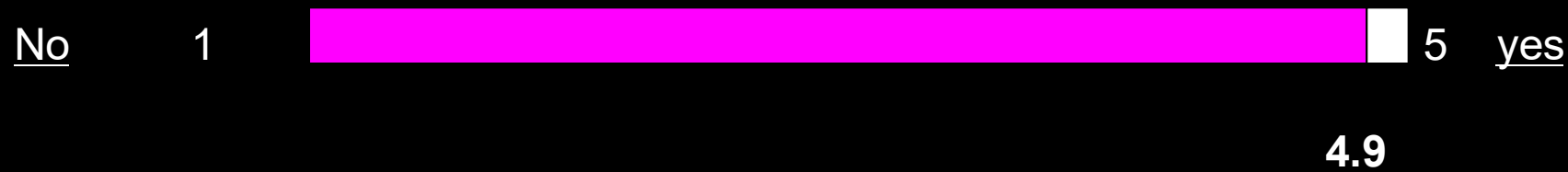


Overall ease of use of RelyX Unicem



Clinical evaluation of RelyX Unicem by the PREP Panel

Was the flow of RelyX Unicem satisfactory
when seating restorations?



Viscosity of RelyX Unicem



No reported incidence of post-op sensitivity

Clinical evaluation by the PREP Panel:

Comments

- 👄 Nurse thinks it's great!
- 👄 Could be a godsend!
- 👄 No post-op sensitivity
- 👄 No adverse tissue reaction
- 👄 No need to etch is very advantageous (92%)

PREP Panel study of Unicem:

Summary

“the clinical handling of RelyX™
Unicem has been rated as being as
good as conventional luting materials”
“.....the material takes away the
technique sensitivity which is
associated with etching,
washing/drying and bonding”

Burke FJT, Crisp RJ, Richter B. A practice-based evaluation of
the handling of a new self-adhesive universal resin luting material.
Int.Dent.J.2006;56:142-146.

TODAY

TODAY

The dentine-bonded (adhesive) crown concept lives on, using self adhesive luting materials (such as Unicem):ceramics have also improved

Take home message

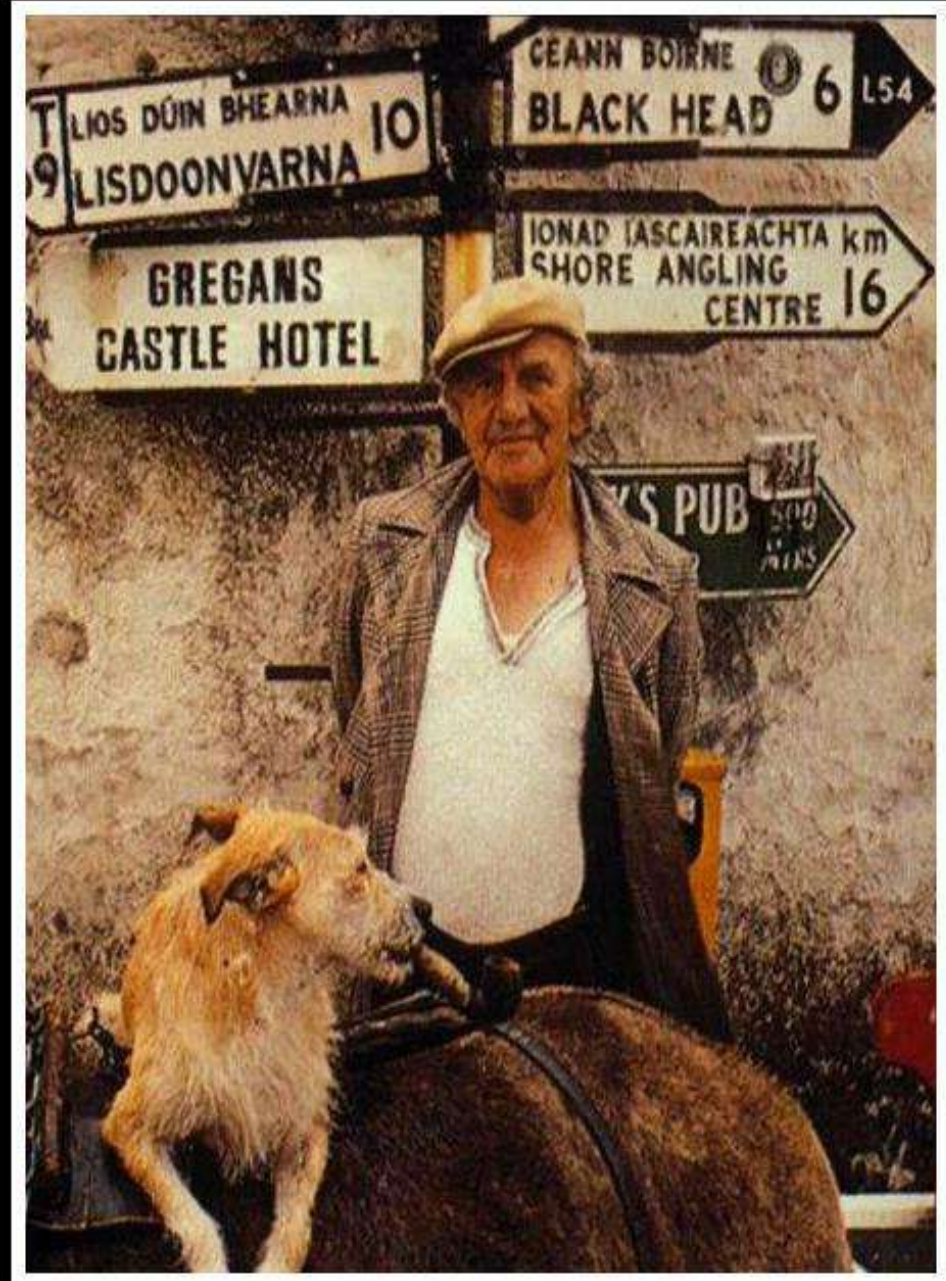
Resin cements have optimal physical properties, but, until the recent introduction of a self-adhesive material, have been technique sensitive

Second take home message

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



Which
way now
For
Unicem?



RelyX™ Unicem Clicker



RelyX™ Unicem 2 Automix, 2011

- ✎ Additional monomer included
- ✎ New rheology modifier
- ✎ Optimised processing of the filler particles (improved delivery service)
- ✎ Better mechanical properties

The Automix syringe ensures consistency of mix quality

Evaluation of Unicem 2 by the *PREP* Panel

Flow of Unicem 2: Was flow satisfactory?

NO 1



Ease of use of Unicem 2

Difficult to use 1



PREP Panel evaluation of Unicem 2

- “A definite improvement on RelyX Unicem Applicap”
- “Great advantage to only dispense the amount required”
- “The only issue is cross-infection control”

Unicem 2 Automix

PREP Panel evaluation

Conclusion: Results indicate that 3M ESPE have managed to further improve a successful material.

Unicem: Does it work?



3M Oral Care
www.3M.com/dental

96%
rating at
recall

Description:

RelyX Unicem Self-Adhesive Resin Cement is dual-cured and does not require separate etching, priming or bonding. The cement is filled 72% by weight and contains fluoride. **RelyX Unicem** is available in capsules in shades A1, A2, A3 Opaque, White Opaque, and Transpore. **RelyX Unicem 2** is available in a prepackaged formulation delivered via a Clicker or an automatic syringe. The manufacturer claims that **RelyX Unicem 2** provides an excellent marginal seal. Both formulations are indicated for the cementation of composite crowns, bridges, inlays and onlays, PFM and metal restorations, implant abutments and endosteal posts.

Clinical Evaluation Protocol:

More than 1000 restorations have been cemented with **RelyX Unicem** and **RelyX Unicem 2** over the past 15 years. Close to 3400 were recalled at about 15 years. The restorations include crowns, inlays, onlays, crowns and bridges as well as ceramic crowns and bridges and endosteal posts (Figure 1). Approximately 2/3 (2226) of the recalled restorations were cemented with **RelyX Unicem**, whereas 5/5 (1166) were cemented with **RelyX Unicem 2**. The age of the restorations recalled ranged from 5 to 15 years (Figure 2). Twenty-seven percent of these restorations were cemented with **RelyX Unicem 2** and 73% were cemented with **RelyX Unicem**.

Fig. 1: Distribution of restorations cemented with 3M™ RelyX™ Unicem and 3M™ RelyX™ Unicem 2 recalled at 15 years.

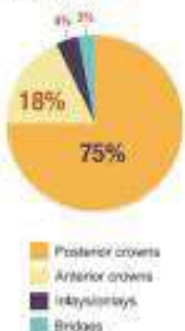
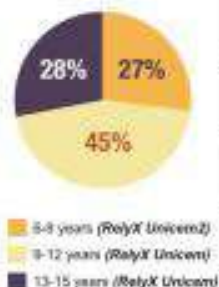


Fig. 2: Age of restorations cemented with 3M™ RelyX™ Unicem and 3M™ RelyX™ Unicem 2 evaluated at recall.



Results at 15 years:

Categories evaluated at recall included: Lack of post-operative sensitivity, lack of marginal discoloration and retention. Each category was rated on a scale of 1-5: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

Lack of Post-operative Sensitivity

From its inception **RelyX Unicem** has had very low reported and documented instances of post-operative sensitivity (Figure 3). The post-operative sensitivity was less than 1% of the seated restorations and even lower for restorations cemented with **RelyX Unicem 2**. Sensitivity usually occurred shortly after seating the restorations and often subsided within a couple of weeks after cementation.

Consultant's Comments:

- "**RelyX Unicem** is still my first choice for self adhesive resin cement."
- "Very retentive with very low debonds over the 15 years that I have been using it."
- "Excellent esthetics overall; in very few cases, I have noticed some discoloration at the margin due to microleakage."
- "After all these years **RelyX Unicem** has proven itself in my dental practice - good retention, good esthetics and almost no marginal discoloration."

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- "Very retentive with very few debonds over the 15 years that I have been using it."
- "Excellent esthetics overall; in very few cases, I have noticed some discoloration at the margin due to microleakage."
- "After all these years **RelyX Unicem** has proven itself in my dental practice - good retention, good esthetics and almost no marginal discoloration."

6,000 restorations at 15 years



3M Oral Care
www.3M.com/dental

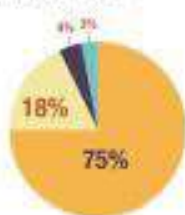
Description:

RelyX Unicem Self-Adhesive Resin Cement is dual-cured and does not require separate etching, priming or bonding. The cement is filled 72% by weight and contains fluoride. **RelyX Unicem** is available in capsules in shades A1, A2, A3 Opaque, White Opaque, and Translucent. **RelyX Unicem 2** is available in a pastepaste formulation delivered via a Clicker or an automatic syringe. The manufacturer claims that **RelyX Unicem 2** provides an excellent marginal seal. Both Variations are indicated for the cementation of composite crowns, bridges, inlays and onlays, PFM and metal restorations, implant abutments and endosseous posts.

Clinical Evaluation Protocol:

More than 6200 restorations have been cemented with **RelyX Unicem** and **RelyX Unicem 2** over the past 15 years. Close to 3400 were recalled at about 15 years. The restorations include ceramic inlays, onlays, crowns and bridges as well as zirconia crowns and bridges and endosseous posts (Figure 1). Approximately 2/3 (2226) of the recalled restorations were cemented with **RelyX Unicem**, whereas 1/3 (1166) were cemented with **RelyX Unicem 2**. The age of the restorations recalled ranged from 5 to 15 years (Figure 2). Twenty-seven percent of these restorations were cemented with **RelyX Unicem 2** and 73% were cemented with **RelyX Unicem**.

Fig. 1: Distribution of restorations cemented with 3M™RelyX™ Unicem and 3M™RelyX™ Unicem 2 recalled at 15 years.



Posterior crowns
Anterior crowns
Inlays/onlays
Bridges

Fig. 2: Age of restorations cemented with 3M™RelyX™ Unicem and 3M™RelyX™ Unicem 2 evaluated at recall.



5-8 years (RelyX Unicem 2)
9-12 years (RelyX Unicem)
13-15 years (RelyX Unicem)

96%
rating at
recall

15-Year Clinical Performance

3M™RelyX™ Unicem Self-Adhesive Resin Cement +++++

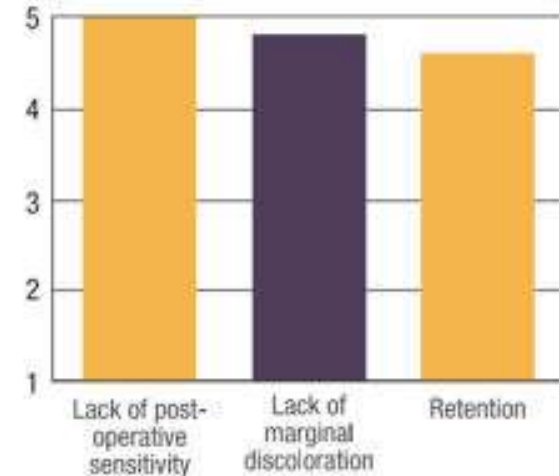
Lack of Marginal Discoloration

Ninety-five percent of the recalled restorations cemented with **RelyX Unicem** showed no marginal discoloration, while 98% of restorations cemented with **RelyX Unicem 2** exhibited no discoloration at the margins (Figure 3). Discoloration was exhibited by graying at the margin of ceramic restorations. Graying was observed in 5% of the restorations. In half of these, the graying was minimal; in 1% the graying was moderate; and in the final 1.5%, the graying was more severe, requiring the replacement of about 35 restorations. It is important to note that the discoloration seemed to get worse with time. Less discoloration was observed when the restorations were cemented with **RelyX Unicem 2**.

Retention

One hundred and eight (4.8%) of the recalled restorations debonded over the 15-year evaluation period (Figure 3). In 90% of these debonds, the cement was in the restoration and not on the prepared tooth. It was not unusual to notice grey or black stain on many of the debonded restorations.

Fig. 3: Results of 15-year recall of restorations cemented with 3M™RelyX™ Unicem.



Summary:

RelyX Unicem Self-Adhesive Resin Cement has proven to be very reliable over the 15-year recall period. This product received a 96% clinical performance rating.

We looked at the margins of bridges luted with Unicem at 12 years



Five-year clinical evaluation of zirconia-based bridges in patients in UK general dental practices

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ABSTRACT

Objective: This study reported the results at 5 years of fixed-fixed all-ceramic bridges, constructed in a yttria oxide stabilized tetragonal zirconium oxide polycrystal (Y-TZP) substructure, placed in adult patients in UK general dental practices.
Materials and methods: Four UK general dental practitioners recruited patients who required fixed bridgework and, after obtaining informed written consent, appropriate clinical and radiographic assessments were completed. The teeth were prepared and bridges constructed in accordance with the manufacturer's instructions. Each bridge was reviewed annually within 3 months of the anniversary of its placement by a calibrated examiner, together with the clinician who had placed the restoration, using modified USPHS criteria.
Results: Of the 41 bridges originally placed, 33 bridges were examined at 5 years. All Y-TZP frameworks were intact and no bridge retainers had debonded. Eight chipping fractures in the veneering ceramic were noted over the 5-year period. In five cases the patients were



Keywords

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A Case Series of Zirconia-Based Bridges Luted with a Self-Adhesive Resin Luting Material at 12 Years, in Patients in UK General Dental Practices

ABSTRACT

Objectives: Further to the publication reporting the results at five years of fixed-fixed all-ceramic bridges, constructed in a yttria oxide stabilized tetragonal zirconium oxide polycrystal (Y-TZP) substructure, placed in adult patients in UK general dental practices, it was possible to recall 7 patients after 12 years in order to examine the performance of the luting cement, ResiX Unicem by way of assessing the restoration margins. **Materials and methods:** In the original study, four UK general dental practitioners recruited patients who required fixed bridgework and, after obtaining informed written consent, appropriate clinical and radiographic assessments were completed. The teeth were prepared, bridges constructed in accordance with the manufacturer's instructions and luted with the self-adhesive resin luting material 3M[®] ResiX[®] Unicem Self-Adhesive Resin Cement (3M Oral Care Solutions Division). Of the 41 bridges originally placed, 33 bridges were examined at five years. Eight bridges were reviewed after 12–13 years by the clinician who had placed the restoration, using modified USPHS criteria. **Results:** Of the 16 bridge retainers, no unsatisfactory margins were noted. **Conclusion:** The 12 year follow-up indicated satisfactory performance of the eight bridges which were evaluated, with good performance of the luting material, as assessed by examination of the restoration margins.

Margins of 16 bridge retainers assessed: 12 Optimal ratings 4 satisfactory, none unsatisfactory

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CASE 8: BRIDGE UL2 TO UR1: MARGIN ASSESSMENT



Figure 8: Bridge at 13 years.
Patient is 60 years of age.

DISCUSSION

This short paper has described the margins of sixteen bridge retainers (eight fixed/fixed bridges) formed with a V-TZP framework, these having been present in patients' mouths for between 12 and 13 years. This could be considered to be a convenience sample of eight patients who were able to attend, from the 33 who were included in the original study. Ideally, the evaluation should be conducted by one or two independent assessors, but this was not possible in the present study, given that there was no funding for an independent assessment, and, furthermore, such an assessment would have required ethical approval. Hence, the patients' bridges were assessed as part of the patients' routine examinations. However, the dentists who carried out the assessments were members of the UK-based practice-based research group, the PREP (Product Research and Evaluation by Practitioners) Panel and had received training in the USPHS/Ryge criteria as part of the original study.

The results indicated satisfactory performance of the luting material which was used, RelyX Unicem Self-adhesive cement, given that no bridge retainers, after 12 to 13 years in service, had a marginal gap into which a probe would penetrate. This

may not be considered surprising, given the low solubility of resin cements in the dilute organic acids found in plaque,⁷ which could be responsible for the dissolution of conventional cements such as glass ionomer or zinc phosphate. The number of bridges assessed is too small to allow firm conclusions to be drawn, but could be considered to indicate that satisfactory performance of V-TZP-based bridges is possible, as indicated by research such as that by Al-Amleh et al.⁸

CONCLUSION

After 12 to 13 years in clinical service, the performance of Rely X Unicem resin luting material may be considered satisfactory, as evidenced by its performance at the margins of the convenience sample of eight bridges which were examined.

ACKNOWLEDGMENTS

Thanks are due to the patients whose bridges were examined and to the staff of the practices involved and to 3M ESPE who funded the original study.

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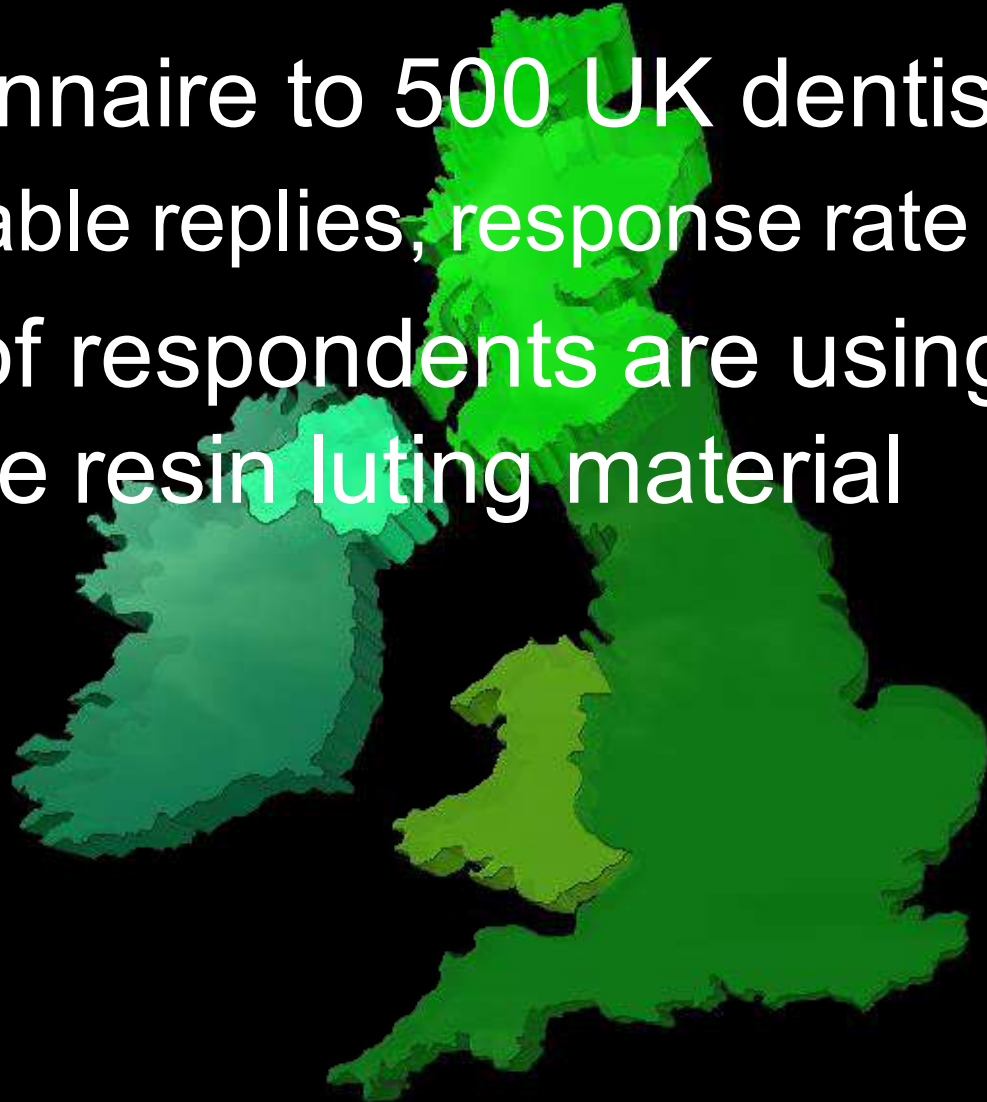
CONCLUSION

After 12 to 13 years in clinical service, the performance of Rely X Unicem resin luting material may be considered satisfactory, as evidenced by its performance at the margins of the convenience sample of eight bridges which were examined.

Contemporary UK dental practice 2016

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

- 👉 Questionnaire to 500 UK dentists, 2016
- 👉 388 useable replies, response rate of 77%
- 👉 13.1% of respondents are using a self-adhesive resin luting material



Contemporary UK dental practice 2016:

Comparison with previous results

Self adhesive resin cements, 2002....0%

Self adhesive resin cements, 2008....9%

Self adhesive resin cements, 2016....13%



Take home message

Resin luting materials have excellent physical properties and are indicated for all-ceramic restorations.

Self adhesive resin luting materials have simplified luting for the clinician.

Take home message

Unicem self adhesive resin luting material, and others in this class of materials, have excellent physical properties and may be used for (*the easy*) cementation of all indirect restorations.

Conventional luting materials are fast becoming redundant.

Take home message

Unicem self adhesive resin luting material, and others in this class of materials, have ex



Dentistry is changing!

Choosing the correct
(adhesive)

luting material
is part of this process