The not so **nasty** way of treating the deep caries lesion!

Contemporary, minimally invasive methods of managing caries

Disclosures

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

"Some manufacturers fund my research"

"I will try to be evidence-based rather than anecdotal in everything that I say"

What I plan to talk about:

- The **"nasty"** way
- Prevention, briefly
- When prevention fails and there's a cavity
- Minimally invasive/chemical methods for treating a cavity
- Minimally invasive cavities using adhesive technology
- Deep caries in the asymptomatic vital tooth

Saunders WP, Saunders EM. Assessment of microleakage in the pulp chamber of endodontically treated multirooted teeth. Int.Endod.J. 1990:23:28-33.

With apologies to my endodontist friends!

Nasty

+

Cost = £800

Authors' Information

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DENTAL FACULTY

The Dental Faculty of the Royal College of Physicians and Surgeons of Glasgow offers its Fellows and Members *Dental Update* as an exclusive membership benefit.

FJ Trevor Burke

The return of the inlay/onlay?

I have attended, recently, a number of overseas conferences and, as happens to all of us at such meetings, there was an opportunity to discuss a variety of clinical topics with delegates. One topic was the ideal treatment for the tooth (a premolar, perhaps) which has a fractured cusp. In my days as a dental student, the UL4 illustrated in Figure 1 would have been built up with a pin-retained core (amalgam in those days!) and then a crown preparation would have been carried out, in effect removing most of the remaining coronal tooth substance. Does that make sense in 2012? I would suggest not. Adhesive technology has advanced to such a degree that a cusp-replacement resin composite restoration could be expected to have a reasonable chance of success,[1] with the bond not being stressed (remember the Configuration Factor?). An indirect cusp replacement ceramic restoration might also be considered appropriate (Figure 1), as discussed by van Dijken and colleagues.[2] This has the advantage of not thinning the small amount of remaining tooth substance. Van Dijken called such restorations extensive dentine/enamel bonded ceramic coverages, perhaps the most appropriate name, but a bit of a mouthful. He and his colleagues followed up 182 such restorations for 5 years, with 13 (7%) of these large restorations being classed as non-acceptable,[2] surely an excellent result for such large restorations? Only one tooth in the study required a root canal treatment, again an excellent statistic in view of the extent of the restorations. Perhaps the secret for success is not so surprising, given the fact that the preparations required little additional removal of tooth substance. In this regard, inlays and onlays have been considered to be easier to do than a crown and are no more expensive than crowns or root canal treatments.[3] Perhaps the name inlay/onlay is inappropriate, but the need to conserve residual tooth substance is the most appropriate objective. Direct-placement composite may also be appropriate (Figure 2), perhaps more technique sensitive for the operator, but cheaper for the patient. It should be added, however, that the situation may be slightly different in the non-vital tooth, in which the need to cover residual tooth substance in order to prevent its fracture perhaps overrides the tooth preservation principles suggested above. The time for the inlay/onlay, or large ceramic coverage restoration, as opposed to a crown, is at hand.

References

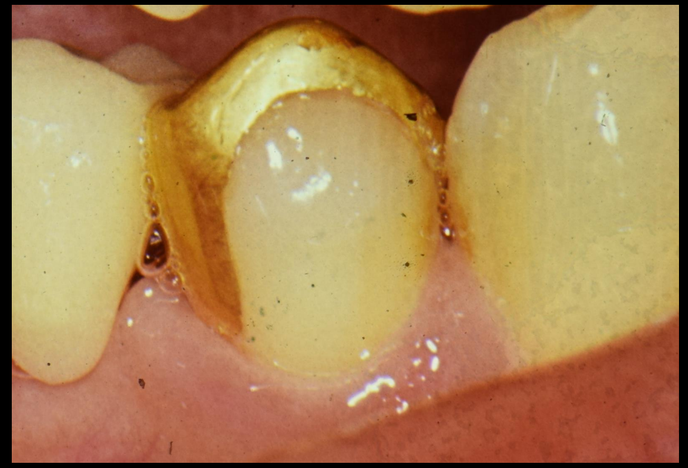
1. Dellperi S, Bardwell DN. Clinical evaluation of direct cuspal coverage with posterior composite resin restorations. *J Esthet Restor Dent* 2006; **18**: 256–267.
2. van Dijken JWV, Hasselrot L, Ormin A, Olofsson A-L. Restorations with extensive dentin/enamel-bonded ceramic coverage. A 5-year follow up. *Eur J Oral Sci* 2001; **109**: 222–229.
3. Jackson RD. Aesthetic inlays and onlays: the coming of age. *Br Dent J* 2008; **204**: 407–408.

Figure 1. Large cusp replacement ceramic restorations at UL4, UL6 after 5 years.

Figure 2. Composite used to replace fractured buccal cusp of UR5 in a 74-year-old patient. Crowning a tooth like this will result in the removal of almost all of the remaining tooth substance.

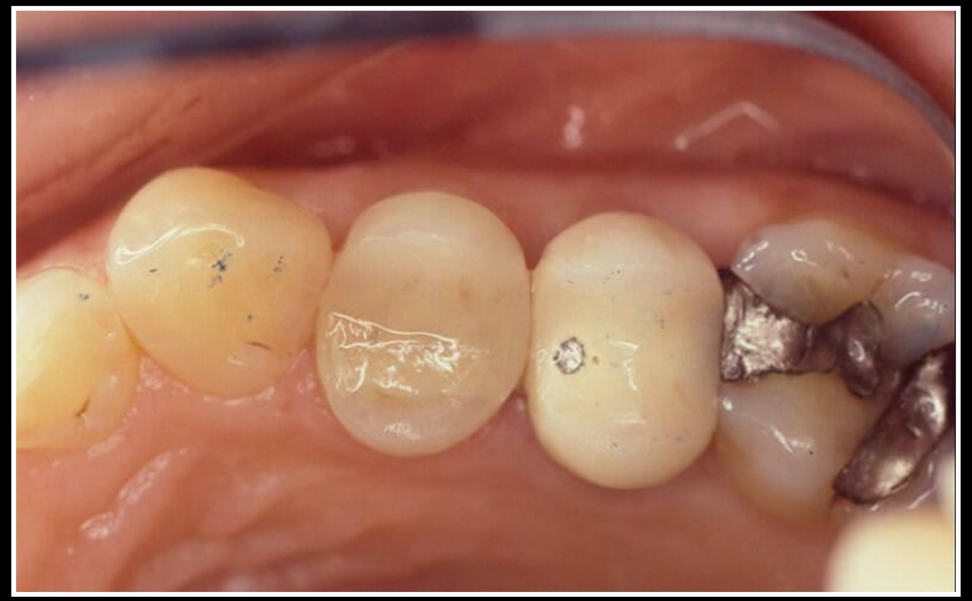
Cost = £800

or



Cost = £800

By the way…..



Cost *circa* £250

There is nothing in the dental rule book which states that you cannot do cuspal coverage directly!

Another reason

Patients' views of endodontic treatment

The help of Dr James Darcey is acknowledged

"I would rather have a baby than a root canal," "This isn't going to hurt, is it?", and "No offense, doctor, but I don't [illegible] dentists" are among the unsolicited comments of pati[illegible]ts that endodontists frequently encounter before the start of therapy. Other patients will express their apprehension by crying, hyperventilating, or becoming faint at the time of local anesthetic injection. Still others communicate apprehension by clenching their fists or becoming extremely loquacious.

In the fall of 1984 a public opinion telephone survey (1) of 1,000 people was commissioned by the American Association of Endodontists to measure awareness and attitudes about root canal therapy. Although only about one-fourth of the respondents had experienced a root canal procedure, three-fourths had an opinion concerning discomfort or pain associated with the procedure: 52% perceived root canal therapy as painful, 24% associated little or no pain with the procedure, and 24% did not know. Individuals who had actually experi-

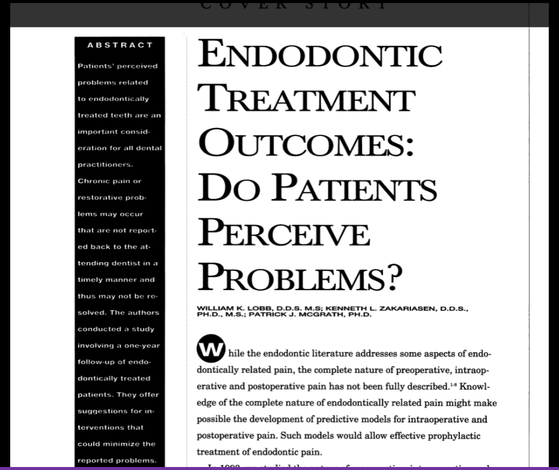
560

Public Communications Inc. Public knowledge about endodontics: a survey conducted by the American Association of Endodontists, Chicago, 1984

Another reason..

Patients' views of endodontic treatment

The help of Dr James Darcey is acknowledged



COVER STORY

ABSTRACT

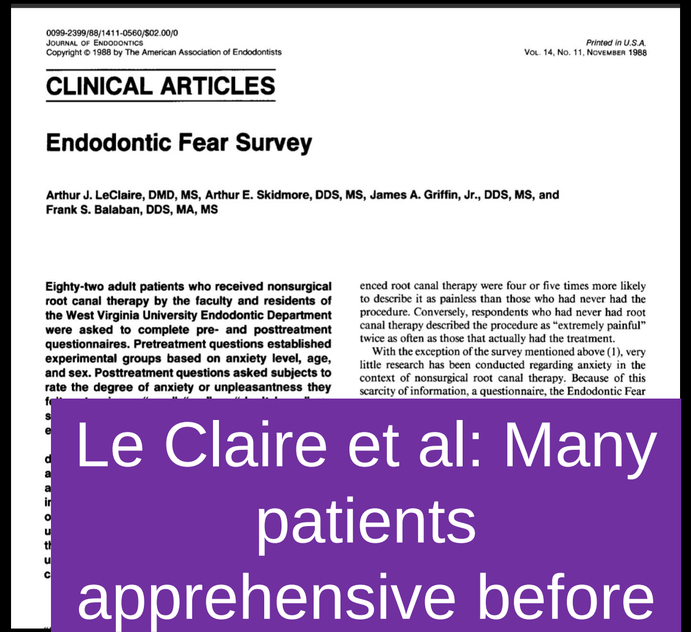
Patients' perceived problems related to endodontically treated teeth are an important consideration for all dental practitioners. Chronic pain or restorative problems may occur that are not reported back to the attending dentist in a timely manner and thus may not be resolved. The authors conducted a study involving a one-year follow-up of endodontically treated patients. They offer suggestions for interventions that could minimize the reported problems.

ENDODONTIC TREATMENT OUTCOMES: DO PATIENTS PERCEIVE PROBLEMS?

WILLIAM K. LOBB, D.D.S., M.S.; KENNETH L. ZAKARIASEN, D.D.S., PH.D., M.S.; PATRICK J. MCGRATH, PH.D.

While the endodontic literature addresses some aspects of endodontically related pain, the complete nature of preoperative, intraoperative and postoperative pain has not been fully described.[1-6] Knowledge of the complete nature of endodontically related pain might make possible the development of predictive models for intraoperative and postoperative pain. Such models would allow effective prophylactic treatment of endodontic pain.

Lobb et al: 1 in 5 patients experienced problems but did not always seek help



0099-2399/88/1411-0560/$02.00/0
JOURNAL OF ENDODONTICS
Printed in U.S.A.
VOL. 14, NO. 11, NOVEMBER 1988

CLINICAL ARTICLES

Endodontic Fear Survey

Arthur J. LeClaire, DMD, MS, Arthur E. Skidmore, DDS, MS, James A. Griffin, Jr., DDS, MS, and Frank S. Balaban, DDS, MA, MS

Eighty-two adult patients who received nonsurgical root canal therapy by the faculty and residents of the West Virginia University Endodontic Department were asked to complete pre- and posttreatment questionnaires. Pretreatment questions established experimental groups based on anxiety level, age, and sex. Posttreatment questions asked subjects to rate the degree of anxiety or unpleasantness they

enced root canal therapy were four or five times more likely to describe it as painless than those who had never had the procedure. Conversely, respondents who had never had root canal therapy described the procedure as "extremely painful" twice as often as those that actually had the treatment.

With the exception of the survey mentioned above (1), very little research has been conducted regarding anxiety in the context of nonsurgical root canal therapy. Because of this scarcity of information, a questionnaire, the Endodontic Fear

Le Claire et al: Many patients apprehensive before endo, but 96% would have another RF

0099-2399/91/1709-0461/$03.00/0
JOURNAL OF ENDODONTICS

Printed in U.S.A.
VOL. 17, NO. 9, SEPTEMBER 1991

CLINICAL ARTICLE

A Comparison of Anxiety Levels Associated with Root Canal Therapy and Oral Surgery Treatment

Marston Wong, DDS, MS, and W. Reed Lytle, DDS

Although the negative perception of root canal therapy is disproportionate when compared with oral surgery, it must be noted that one in seven experiencing root canal therapy still perceived it to be the most unpleasant dental experience.

Take home message

Might sedation help?

Although hearsay is an important factor, there is some evidence of adverse patient views regarding endodontic treatment

Perhaps a Public Awareness Programme is needed?

Therefore, keeping teeth vital when treating deep caries is imporatant

Take home message

Although root fillings are a better option than extraction, root filled teeth survive less long than vital teeth

Therefore, keeping teeth vital when treating deep caries is imporatant

Life expectancy in industrialised countries now 80 years

Therefore mean restoration longevity must be 73 years!

All restorations are temporary,
except for the last one!

Message:

Start the restoration cycle as late as possible (primary prevention)

Keep as much sound tooth structure as possible (adhesion)

Increase the longevity of every restoration as much as possible (perfect seal and maintenance of restoration)

Caries prevention strategies

- Increasing fluoride exposure
- Decreasing level of *Mutans Streptococci*
- Increasing saliva flow, pH, buffering capacity
- Increasing availability of Calcium & Phosphate ions

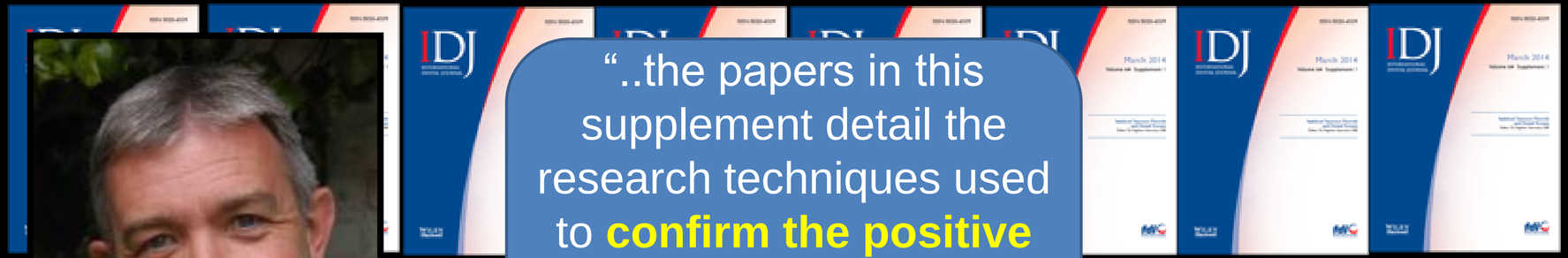
- Topical fluoride – gel, paste, varnish, rinse
- Chlorhexidine rinse, varnish etc (F, Xylitol)

- Sugar-free chewing gum
- Casein Phosphopeptide-Amorphous Calcium Phosphate CPP-ACP

#1 preventive measure

Fluoride, in all its presentations, is central to prevention

...and, by the way



"..the papers in this supplement detail the research techniques used to **confirm the positive effects of stabilised stannous fluoride on tooth erosion"**

CONCISE REVIEW

The "F" word

Glass-ionomer Restoratives: A Systematic Review of a Secondary Caries Treatment Effect

R.C. Randall* and N.H.F. Wilson

Restorative Dentistry, Manchester University Turner Dental School, Higher Cambridge Street, Manchester, MI5 6FH, Un
*corresponding author

Abstract. It is generally accepted that glass ionomers inhibit

Introduction

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

secondary caries as an outcome, were selected (N = 52).
Primary and secondary lists of systematic criteria for use in

effectiveness is judged to have been establishe

The F-word

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

Summary: F in the lab is good!

of caries lesions in tooth surfaces adjacent to dental materials. This effect has been clearly shown by *in vitro* and *in situ* studies but not in randomized clinical trials.

Significance. The anti-caries effect of fluoride releasing materials is still not based on clinical evidence, and, in addition, it can be overwhelmed by fluoride delivered from dentifrices.

restoratives. Fluoride-releasing materials, predominantly glass-ionomers and compomers, did show cariostatic properties and may affect bacterial metabolism under simulated cariogenic conditions in vitro. However, it is not proven by prospective clinical studies whether the incidence of secondary caries can be significantly reduced by the fluoride release of restorative materials.

CPP-ACP What is it?

Casein is the predominant phosphoprotein in bovine milk. Casein phosphopeptides (CPP) can stabilise Calcium Phosphate in an Amorphous Calcium Phosphate complex (ACP).

The CPP-ACP complex was patented by the Univ. of Melbourne. They are the owner of the trademark Recaldent. Its use in remineralising dentine & enamel has been an “off-label” application (US Food & Drug Administration, 2007). Products containing it are Trident White chewing gum and GC Tooth Mousse and Tooth Mousse Plus.

CPP-ACP

Does it work?

Caries preventive effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP): a meta analysis. Yengopal V, Mickenautsch S. Acta.Odontologica Scand.2009:1-12.

11 RCTs accepted, but only 5 included in the meta-analysis

CONCLUSION

Within the limitations of this meta-analysis, the results of clinical trials support the short-term remineralising effect of CPP-ACP. Additionally the in vivo RCTs provide promising results for the long term use of CPP-ACP for caries prevention

What I plan to talk about:

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- Minimally invasive cavities using adhesive technology
- Deep caries in the asymptomatic vital tooth

Ozone and caries:

Systematic Reviews:

Dent.Update.2012:39: 271-278

Author(s)	Year of publication	In vivo or in vitro	O_3 successful or unsuccesful
(Cochrane) Rickard et al	2004	In vivo	X
NICE	2005	In vivo	X
Brazzelli M et al	2006	In vivo	X
Azarpazooh A, Limeback H.	2008	In vivo	X

Photo Activated Disinfection

P.A.D. can achieve appreciable kills of oral bacteria, including *S.mutans*, when the organisms are embedded in a collagen gel or are present in carious teeth

- Williams J. Pearson GJ, Colles M, Wilson M. The photo-activated antibacterial
- action of Toluidine Blue in a collagen matrix and in carious dentine.
- Caries Res. 2004:38:530-536

Minimal cavity preparation by chemopreparation

Carisolv™

Carisolv™

- Derived from Caridex
- Relies on Caridex data for safety
- Has approval for use in EC
- Red gel and transparent fluid
- Softens caries
- Perceived less need for LA

Clear liquid

NaOCL

Red gel (pH11)

3 amino acids:

Leucine

Lycine

Glutamic acid

Carboxymethyl-cellulose gel

$Na(OH)_2$

Colouring agent

Patient assessment of Carisolv™

Burke FJT, Hall AF, J.Dent.Res.1999

- ✓ 8 dentists, 62 patients, ethical approval
- ✓ Mean age 29yrs, range 6 to 76 years
- ✓ Most found treatment with Carisolv to be pain free
- ✓ Over half the patients thought treatment with Carisolv was faster then normal
- ✓ Sound, smell and taste of the procedure was acceptable to a large proportion of patients
- ✓ Cavity prep. with Carisolv had a significant preference over preparation with drill

Dentist assessment of Carisolv

Burke FJT, Hall AF, J.Dent.Res.1999

- ✓ Majority of dentists disliked the Carisolv procedure because it took longer (20 minutes in comparison with 5 mins.)
- ✓ Further refinement of the procedure indicated

Carisolv:
Patients liked it!
Dentists didn't!

Comparative clinical study on the Carisolv caries removal method
Kakaboura A, Masouras C, Vougioklakis G
Quintessence Int.2003:34:269-271

RESULTS
Patients found Carisolv more pleasant (82%) and preferable to drilling
40% of drill patients needed LA , cf 8% with Carisolv
More time needed for Carisolv (12mins *vs* 7mins)
Carisolv induced no gingival reaction

Eur. J. Prosthodont. Rest. Dent., Vol.15, No. 2, pp 77-80
Printed in Great Britain

An Evaluation of Polymer Rotary Instruments' Ability to Remove Healthy, Non-carious Dentine

Catharina H.J. Hauman* and Dusan V. Kuzmanovic†

Abstract - *The aim of this study was to confirm that Smartprep™ burs do not cut non-carious, healthy dentine. Twenty non-carious extracted molars were trimmed with a diamond bur to remove enamel and to create a flat dentine surface. A new Smartprep™ bur (RA # 4) was applied to each tooth for 30 seconds. As a control, a new number three round stainless steel bur was applied to each tooth. The mean dentine loss was 4.25 mg (range 1.4 – 9 mg) for Smartprep™ burs and 12.21 mg (range 7.6 – 16.5mg) for stainless steel burs. The Smartprep™ burs remove significantly less dentine than stainless steel burs.*

Twenty non-carious extracted molars were trimmed with a diamond bur to remove enamel and to create a flat dentine surface. A new Smartprep™ bur (RA # 4) was applied to each tooth for 30 seconds. As a control, a new number three round stainless steel bur was applied to each tooth. The mean dentine loss was 4.25 mg (range 1.4 – 9 mg) for Smartprep™ burs and 12.21 mg (range 7.6 – 16.5mg) for stainless steel burs. The Smartprep™ burs remove significantly less dentine than stainless steel burs.

KEY WORDS

INTRODU

The treatmen
gression of t
foundation[1]; ideally, the treatment will remove the infected ... This selective dentine removal will result in exposing of

Take home message

Some contemporary minimally invasive methods of cavity preparation are showing promise but need further development.

What I plan to talk about:

- The “nasty” way
- Prevention, briefly
- When prevention fails and there’s a cavity
- Minimally invasive/chemical methods for treating a cavity
- Minimally invasive cavities using adhesive technology
- Deep caries in the asymptomatic vital tooth

Preventive resin restorations: three year results
Simonsen RJ. JADA 1980:100:535-539

6 to 8 year old patients
88 preventive resin restorations
98.9% success (complete retention)

The preventive resin (composite resin/sealant) restoration:nine year results. Houpt M, et al.Quintessence Int.1994:25:155-159

332 restorations placed, Patients aged 6 to 14 years. 79 restorations assessed after 9 years, 54% success (complete retention), 25% had lost some sealant, 29% lost all sealant, 24% caries

CONCLUSION: The preventive resin restoration provided excellent long term results .

No significant difference in median survival time between the amalgam and composite restorations

150 pairs of restorations in 163 patients
5 year follow up

Amalgam restorations occupied 25% of the occlusal surface
Composite restorations occupied 5% of the occlusal surface

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

What about Glass Ionomer sealants?

Conclusion

The evidence suggests that GIC protects pits and fissures of permanent molars against caries at same levels as resin-based sealants. However, there is a need for well-designed standardised RCTs, particularly including newer high viscosity GICs.

Atraumatic perspectives of ART Schriks and van Amerongen, 2003

403 children, 2 groups (750 rpm rotary instrument and ART)

- Discomfort scores determined by heart rate and anxiety (Venham scores)
- Children treated with ART using hand instruments alone had less discomfort than those treated with rotary instruments

UK dental practitioners' understanding of ART

FJT Burke, S.McHugh, L.Macpherson,M-T Hosey, L.Shaw, S.Delargy & B.Dopheide

Br Dent.J.2005:**199**:365-370.

CONCLUSIONS

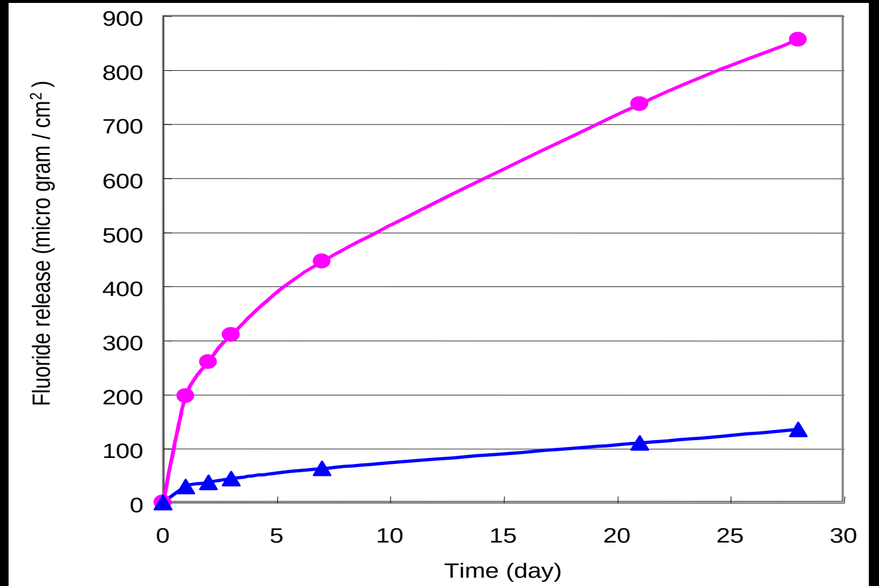
Although almost half of the respondents indicated that they were aware of ART, few had adopted it in its true form in their treatment of caries.

More education of UK GDPs is indicated in minimal intervention techniques in the treatment of caries in the primary dentition

Fuji VII is useful in these cases

Command
set glass
ionomer

Now called Fuji Triage



Take home message

Glass ionomer performs adequately in ART, but needs further improvements in its physical properties

Clin Oral Invest (2012) 16:429–441
DOI 10.1007/s00784-011-0513-3

ORIGINAL ARTICLE

Survival of atraumatic restorative treatment (ART) sealants and restorations: a meta-analysis

Rodrigo G. de Amorim · Soraya C. Leal · Jo E. Frencken

Received: 15 July 2010 / Accepted: 10 January 2011 / Published online: 28 January 2011

Abstract The purpose of this study is to perform a systematic investigation plus meta-analysis into survival of atraumatic restorative treatment (ART) sealants and restorations using high-viscosity glass ionomers and to compare the results with those from the 2005 ART meta-analysis. Until February 2010, four databases were searched. Two hundred four publications were found, and 66 reported on ART restorations or sealant survival. Based on five exclusion criteria, two independent

86% (CI, 59–98%). The mean annual dentine lesion incidence rate, in pits and fissures previously sealed using ART, over the first 3 years was 1%. No location effect and no differences between the 2005 and 2010 survival rates of ART restorations and sealants were observed. The short-term survival rates of single-surface ART restorations in primary and permanent teeth, and the caries-preventive effect of ART sealants were high. Clinical relevance: ART can safely be used in single-

observed. The short-term survival rates of single-surface ART restorations in primary and permanent teeth, and the caries-preventive effect of ART sealants were high. Clinical relevance: ART can safely be used in single-surface cavities in both primary and permanent teeth. ART sealants have a high caries preventive effect.

29 publications included on high-viscosity GIs: Survival of single-surface ART restorations in permanent teeth was 85% at 5 years

The Infiltration Concept

Sebastian Paris
Hendrik Meyer-Lueckel

The Potential for Resin Infiltration Technique in Dental Practice

Abstract: Caries infiltration is a micro-invasive treatment to arrest non-cavitated caries lesions. The method is based on the penetration of low-viscosity light-curing resins, so called infiltrants, into the pores within the enamel lesion. That way, diffusion pathways for cariogenic acids are occluded, resulting in a reduction or even arrest of lesion progression. A positive side-effect of caries infiltration is that lesions change their optical properties and appear similar to sound enamel. Therefore, caries infiltration can also be used to camouflage aesthetically disfiguring white spot lesions on buccal surfaces.
Clinical Relevance: Resin infiltration is a micro-invasive treatment to arrest and to camouflage non-cavitated proximal caries lesions that virtually bridges non-invasive and restorative treatment options.
Dent Update 2012; 39: 623–628

The caries decline observed in many nations in the past decades has led to the clinical observation that today's adolescents and young adults present many fewer open cavities compared with the generation of their parents or grandparents. However, a high number of caries lesions in earlier stages, particularly in proximal surfaces, can still be observed in these patients. This shift to earlier stages should not be misinterpreted to suggest that these individuals do not need therapeutic (non-invasive) intervention anymore, because many of the non-cavitated lesions progress to cavitated stages.[1,2] Rather, these epidemiological changes present a challenge not only to diagnose but also to manage these lesions to avoid their further progression.

The treatments of choice for early non-cavitated caries lesions are non-invasive interventions that support the natural repair processes of the oral cavity. However, these approaches usually depend on good compliance and a sustained change of a patient's habits (eg oral hygiene, diet) and therefore seem to have only limited effectiveness. Invasive treatment may bring the tooth into a 'death spiral of restorations' in which more and more tooth tissue gets lost when restorations are often replaced, even resulting in loss of tooth vitality or even extraction of the tooth.[3] For this reason, the first restorative intervention should be postponed as long as possible. Particularly for proximal lesions, the collateral damage during cavity preparation is high because relatively large amounts of sound tissue have to be removed to get access to the lesion. Therefore, for proximal caries lesions radiographically extending around the enamel dentine junction, the treatment decision is often difficult. Similar to caries sealing of occlusal surfaces, caries infiltration aims to bridge non-invasive and restorative interventions for proximal caries lesions, providing a minimum of tissue destruction, with the objective of arresting the caries process (Figure 1).

Sebastian Paris, DDS, PhD, Associate Professor, Clinic for Conservative Dentistry and Periodontology, School of Dental Medicine, Christian-Albrechts-Universität zu Kiel, Germany and **Hendrik Meyer-Lueckel**, DDS, PhD, MPH, Head of Department, Department of Operative Dentistry, Periodontology and Preventive Dentistry, RWTH Aachen University, Germany.

Caries infiltration – principle

The aim of caries infiltration is to occlude the pores within the lesion body within enamel of non-cavitated caries lesions with special low-viscosity light-curing resins, so-called infiltrants. That way, diffusion pathways for cariogenic acids are blocked, resulting in a reduction, or even arrest, of lesion progression (Figure 2). To enable penetration of the infiltrant into the lesion body, first the covering pseudo-intact surface layer, as a result of the remineralization processes, has to be removed.[4] This can be achieved by etching the lesion for 2 minutes with 15% hydrochloric acid gel.[5] Subsequently, the lesion has to be properly desiccated to allow capillary action to soak the resin into the lesion body. Finally, the infiltrant must be applied for sufficient time to infiltrate the lesion deeply and be light-cured.

The limited access to the proximal surfaces is a challenge for any therapeutic intervention on this caries predilection site. Therefore, in contrast to caries sealing where a resin coating is created on the lesion surface, for caries infiltration all resin excess is removed from the surface before light-curing. In the narrow and hardly accessible proximal area, resin layers on the lesion surface are hard to control clinically and might even promote plaque stagnation and gingival inflammation. Therefore, for caries infiltration the resinous diffusion barrier is solely created within the

Read all about it!
Dent. Update
2012:39:
623-628.

Superb result in anterior teeth

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)

The first Universal

Composition

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

Scotchbond Universal Adhesive

- 📖 Works with both Total- and Self-Etch technique, providing high flexibility in clinical procedures
- 📖 Provides procedural simplicity
- 📖 Total-etch or Selective-enamel etch for highest enamel bond strength, e.g. for incisal edges
- 📖 Self-etch for low post-op sensitivity, fast technique

SUGGESTION

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

Take home message

Dentine bonding is now reliable and effective and is central to minimally invasive dentistry.

Selective etching of enamel appears essential.

New Universal systems hold promise.

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

What's New in Dentine Bonding?: Universal Adhesives

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

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

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A dentine-bonding agent should perform the following functions:[3]

- Provide a strong, immediate and permanent bond to dentine;
- Seal the cavity and minimize leakage;
- Resist microbial or enzymatic degradation;
- Provide adhesion *per se* of the restoration in cases where this is necessary;
- Prevent post-operative sensitivity;
- Reduce the risk of recurrent caries;
- Prevent marginal staining;
- Be easy to use.

It is the intention of this paper to update readers on the new group of Universal Dentine Bonding Agents, this being a follow-up to a paper published in 2004 giving details of the last major innovation in bonding to dentine, the introduction of the *so-called* self-adhesive dentine bonding agents[3] and to other *Dental Update* publications on the subject which readers may wish to read as background or a further update, such as those by Green and Banerjee,[2] Green, Mackenzie and Banerjee[4] and others.[5,6]

A brief history of bonding to dentine

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

There are two principal means by which a bond to dentine may be achieved:[9]

- First, glass ionomer materials (GIC – glass-ionomer cements) which were developed in the 1970s, initially being derived from the Fluoro-Alumino-Silicate glass used in the silicate cement materials which were used until the 1960s, but with the phosphoric acid used in silicate cements being substituted by a

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

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

51 restorations, study commenced in 1987. Restorations in Ful-fil, Occlusin not using a dentine bonding system. Patients aged 13 to 17 yrs.

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

What I plan to talk about:

- The “nasty” way
- Prevention, briefly
- When prevention fails and there’s a cavity
- Minimally invasive/chemical methods for treating a cavity
- Minimally invasive cavities using adhesive technology
- Deep caries in the asymptomatic vital tooth

Ultraconservative and cariostatic sealed restorations: Results at year 10

Mertz-Fairhurst EJ, Curtis JW, Ergle JW,

Restorations assessed using USPHS criteria

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

Ultraconservative and cariostatic sealed
restorations: Results at year 10

Mertz-Fairhurst EJ, Curtis JW, Ergle JW,
Rueggeberg FA, Adair SW

JADA.1998:129:55-65

CONCLUSIONS

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

Phenotypic and genotypic selection of microbiota surviving under dental restorations

Paddick JS, Brailsford SR, Kidd EAM, Beighton D.

Applied & Environmental Microbiology 2005:71:2467-2472

METHOD

Ten carious lesions were treated, with infected dentine being sealed below dental restorations for 5 months. Samples of infected dentine taken at baseline and after the removal of the restorations.

CONCLUSION

We propose that during the interval between restoration placement and removal, the available nutrient significantly affected the surviving microbiota. The surviving microbiota was less complex than that isolated from carious lesions.

Research Article

Clinical and microbiological effect of calcium hydroxide protection in indirect pulp capping in primary teeth

ALICE SOUZA PINTO, DDS, MS, FERNANDO BORBA DE ARAÚJO, DDS, MS, PhD, RENATA FRANZON, DDS, MARCIA CANÇADO FIGUEIREDO, DDS, MS, PhD SANDRA HENZ, DDS, MS, FRANKLIN GARCÍA-GODOY, DDS, MS & MARISA MALTZ, DDS, MS, PhD

ABSTRACT: ***Purpose:*** To evaluate clinically and microbiologically the effect of calcium hydroxide (CH) on carious dentin on primary teeth submitted to indirect pulp capping (IPC). ***Methods:*** Twenty 4-7 year-old subjects with 42 treated teeth participated in the study. The treatment consisted of incomplete excavation of the demineralized dentin, application of a CH or gutta-percha (GP) layer and sealing with a resin-based composite for 4-7 months. After cavity preparation and sealing, the dentin was evaluated clinically (color and consistency) and microbiologically. Dentin samples were cultured on blood agar under aerobic and anaerobic conditions, in *Mitis Salivarius* agar and Rogosa SL agar. ***Results:*** 39 teeth (20 in the CH Group and 19 in the GP Group) were reopened 4-7 months post-treatment for clinical and microbiological evaluation. In all teeth, the initial demineralized dentin was wet and soft or leathery. In the CH Group, 10% of the lesions were yellow, 80% light brown and 10% dark brown and in the GP Group, 94.7% were light brown and 5.3% dark brown. After treatment, the dentin was dry, 90% (Group CH) and 84.2% (Group GP) were dark brown. The final consistency was either leathery or hard. Three samples in the CH Group and five in Group GP changed from soft to leathery; only one sample (GP) remained leathery. 85% in the CH Group and 68.4% in GP Group turned hard after treatment. All bacterial

- Two treatment groups: Ca (OH)2 or gutta percha
- Complete caries removal in 4-7 year old children
- Sealed with resin composite for 4 to 7 months
- Cavities reopened and examined

CLINICAL SIGNIFICANCE: The resin-based composite sealing of dentin caries lesions in primary teeth, with or without calcium hydroxide liner over the infected remaining tissue, may help preserve dental tissue as well as pulp vitality.

✉ Prof. Fernando Borba de Araújo, Department of Pediatric Dentistry, Faculty of Dentistry, UFRGS, Rua Ramiro Barcelos, 2492, Bom Fim, Porto Alegre, Rio Grande do Sul, Brazil. E-✉: fernando.araujo@ufrgs.br

Soft caries changed to hard or leathery

The bacteria disappeared

Maltz M, Alves LS et al. Incomplete caries removal in deep lesions: a 10-year prospective study. Am.J.Dent.2011:24:211-214.

CONCLUSION

- Incomplete caries removal in deep caries lesions is able to arrest the caries process on a long-term basis, preventing pulp exposure and maintaining tooth vitality. The need for more invasive techniques such as endodontics may be avoided.

…and, the success rate is better than direct pulp capping (13% at 10 yrs).
Barthel et al. Pulp capping of carious exposures: treatment outcome after 5 & 10 years. J.Endod.2000:26:525-528.

How “clean” must a cavity be before restoration?
Kidd EAM.
Caries Res.2004:38:305-313

- If the caries process is driven by the biofilm, the process should be arrested simply by sealing the cavity
- The persistence of a few micro-organisms may be irrelevant
- They may be opportunistic squatters adapting themselves to the new environment in which they find themselves
- This review makes uncomfortable reading for those of us teaching operative dentistry
- There is no clear evidence that it is deleterious to leave infected dentine, even if it is soft and wet, prior to sealing the cavity
- This cautious approach may be preferable to vigorous excavation because fewer pulps will be exposed

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Review

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

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ABSTRACT

Objectives: Conventionally, caries excavation is performed until only hard dent
while more selective and reliable criteria might be available. We aimed at sy
comparing the effects of using different excavation criteria via network meta
Sources: Electronic databases were searched for randomised or non-random
trials (RCTs/NRCTs) evaluating excavation of cavitated lesions.
Data: Criteria were divided into six groups: Excavation until pulpo-proximal dentine or re

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

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

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

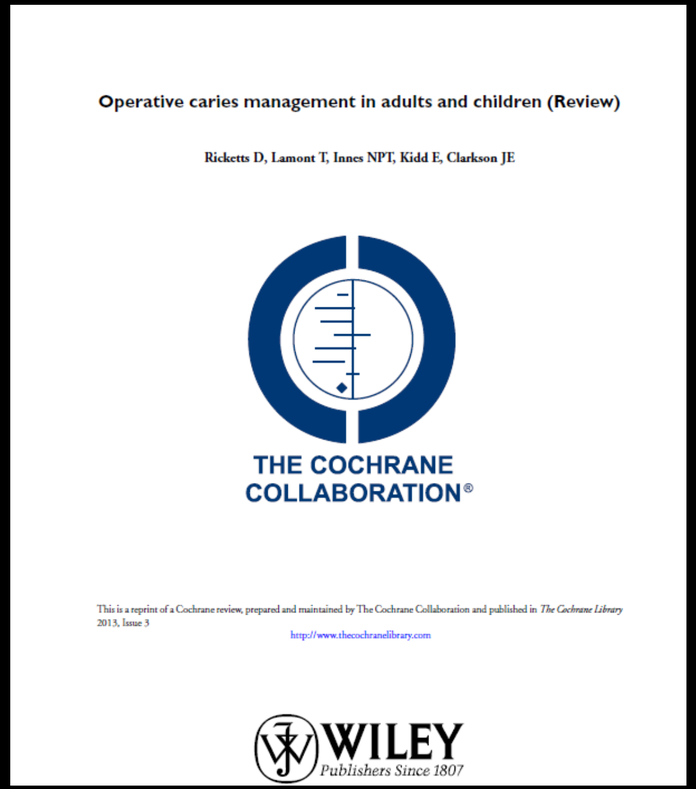
Complete or ultraconservative removal of decayed tissue in unfilled teeth
Ricketts DNJ, Kidd EAM, Innes N, Clarkson
Cochrane Database of Systematic Reviews 2006

4 studies, of 529 eligible, met the inclusion criteria, two stepwise excavation studies and two ultraconservative caries removal studies stepwise excavation: (Leksell 1996; Magnusson 1977), non reintervention studies: (Metz-Fairhurs 1987; Ribeiro1999) **Partial caries removal in symptomless 1ary or permanent teeth reduces the risk of pulp exposure. No detriment found to the patient in terms of pulpal symptoms in this procedure & no reported premature loss or deterioration of the restoration**

CONCLUSIONS

Partial caries removal is preferable to complete caries removal

Insufficient evidence to determine whether it is necessary to re-enter and excavate further, but studies that have not re-entered do not report adverse circumstances



Conclusions:

Stepwise and partial excavation reduced the incidence of pulp exposure in symptomless, vital, carious primary as well as permanent teeth. Therefore these techniques show clinical advantage over complete caries removal.

There was no evidence of a difference in signs or symptoms of pulpal disease between stepwise excavation, and complete caries removal, and insufficient evidence to determine whether or not there was a difference in signs and symptoms of pulp disease between partial caries removal and complete caries removal, and in the risk of restoration failure.

Cariology


Edwina Kidd


Ole Fejerskov


Bente Nyvad

Infected Dentine Revisited

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

Once a cavity has formed, the lesion continues to progress as a result of bacterial metablism. The dentine is softened.The dentist should remove the infected dentine & leave affected dentine which is capable of remineralisation

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

Trevor's view:

- Seal caries in when you feel that the pulp will be exposed in an asymptomatic, vital posterior tooth (occlusal cavities only).
- Fewer teeth will require RCT.
- Be sure to tell the patient about the concept and write it in the notes.
- Be sure that it is you who takes the next bitewing!

Trevor's view:

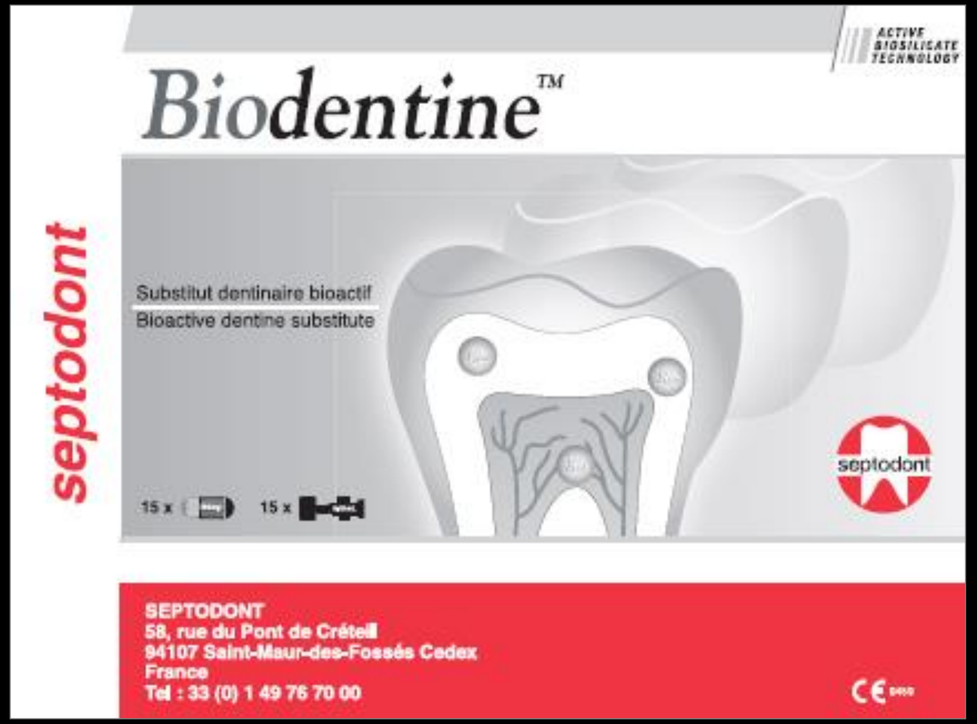
- Seal caries in when you feel that the pulp will be exposed in an asymptomatic, vital posterior tooth (occlusal cavities only).
- Fewer teeth will require RCT.
- Be sure to tell the patient about the concept and write it in the notes.
- Be sure that it is you who takes the next bitewing!

CONCLUSION

The seal’s the deal !

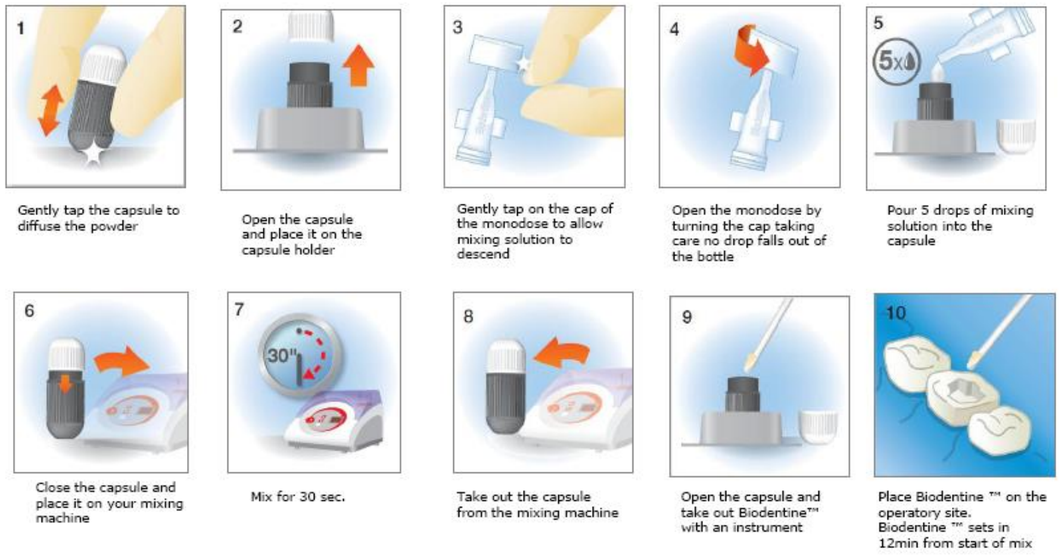
…but only proven for occlusal lesions

Another way of managing deep caries in a vital tooth



Tricalcium silicate technology

Instructions for use



Powder liquid ratio is critical

The  evidence base is building

ARTICLE IN PRESS

Clinical Research

Response of Human Dental Pulp Capped with Biodentine and Mineral Trioxide Aggregate

Alicja Nowicka, DDS, PhD, Mariusz Lipski, DDS, PhD,† Mirosław Parafiniuk, MD, PhD,‡ Katarzyna Sporniak-Tutak, DDS, PhD,† Damian Lichota, DDS, PhD,* Anita Kosierkiewicz, MD, PhD,‖ Wojciech Kaczmarek, DDS, PhD,* and Jadwiga Buczkowska-Radlińska, DDS, PhD**

Abstract

Introduction: Biodentine is a new bioactive cement that is similar to the widely used mineral trioxide aggregate (MTA). It has dentin-like mechanical properties, which may be considered a suitable material for clinical indications of dentin-pulp complex regeneration such as direct pulp capping. The purpose of the present study was to compare the response of the pulp-dentin complex in human teeth after direct capping with this new tricalcium silicate–based cement with that of MTA. **Methods:** Pulps in 28 caries-free maxillary and mandibular permanent intact human molars scheduled for extraction for orthodontic reasons were mechanically exposed and assigned to 1 of 2 experimental groups, Biodentine or MTA, and 1 control group. Assay of periapical response and clinical examination were performed. After 6 weeks, the teeth were extracted, stained with hematoxylin-eosin, and categorized by using a histologic scoring system. **Results:** The majority of specimens showed complete dentinal bridge formation and an absence of inflammatory pulp response. Layers of well-arranged odontoblast and odontoblast-like cells were found to form tubular dentin under the osteodentin. Statistical analysis showed no significant differences between the Biodentine and MTA experimental groups during the observation period. **Conclusions:** Within the limitations of this study, Biodentine had a similar efficacy in the clinical setting and may be considered an interesting alternative to MTA in pulp-capping treatment during vital pulp therapy. *(J Endod 2013;■:1–5)*

Key Words

The application of biocompatible materials on exposed pulp protects the pulp-dentin complex against chemical irritation by operative procedures, toxicity of the material used, and bacterial penetration due to microleakage (1–5). Numerous studies have shown that $Ca(OH)_2$ should be the material of choice among the available pulp-capping materials (6–8). However, it has been reported that $Ca(OH)_2$ does not adhere to dentin and dissolves over time, and dentin bridges adjacent to the material may contain multiple tunnel defects (9–12).

Studies have shown that mineral trioxide aggregate (MTA) may be used as an alternative to $Ca(OH)_2$ for treating pulp wounds (2, 13). MTA stimulates formation of dentin bridges faster than calcium hydroxide (2, 11, 13–15), consequently leading to pulp healing, and results in high success rates in clinical procedures (13–16). However, in research by Iwamoto et al (6), no significant differences in clinical and histologic results between MTA and calcium hydroxide were noted. Also, 2 randomized controlled studies have shown that MTA may result in similar clinical outcomes as calcium hydroxide after capping caries pulp exposures (7, 8). MTA is a bioactive, biocompatible, antibacterial material with unique stability and high sealing ability (6, 11, 13–17). However, MTA is reportedly difficult to use because of its long setting time, poor handling properties, high material costs, and the discoloration potential of dental tissue (17, 18). Many attempts have been made to improve the clinical manageability of MTA by adding a setting accelerator or a dual functional modifier (19, 20). The addition of $CaCl_2$ to MTA enables an increased immediate pH value and decreased setting time and improves the mechanical properties (1, 19, 20). To prevent discoloration, the manufacturer introduced a new MTA formula with an off-white color (18), but white MTA has a significantly slower setting time compared with gray MTA (21).

Biodentine (Septodont, Saint Maur des Fossés, France) is a new calcium silicate–based restorative cement with dentin-like mechanical properties, which can be used as a dentin substitute on crowns and roots similar to how MTA is used (3, 4, 22–26). It has a positive effect on vital pulp cells and stimulates tertiary dentin formation (3, 4, 26, 27). In direct contact with vital pulp tissue, it also promotes formation of reparative dentin (3, 26). Biodentine consists of a powder and liquid. The powder mainly contains

In Vitro Microleakage of Biodentine as a Dentin Substitute Compared to Fuji II LC in Cervical Lining Restorations

Anne Raskin[a] / Geoffroy Eschrich[b] / Jacques Dejou[c] / Imad About[d]

Purpose: 1) To evaluate the marginal sealing efficacy of Biodentine at the cervical margins of approximal cavities placed in molars; 2) to evaluate and compare the use of Biodentine in combination with resin-based adhesives and a resin composite, compared with a resin-modified glass-ionomer cement (Fuji II LC).

Materials and Methods: Sixty approximal cavities were prepared on mesial and distal surfaces of 30 extracted human third molars. The teeth were randomly assigned into 6 groups of 10 cavities each: (G1) Biodentine, (G2) Fuji II LC as a filling material, (G3) Biodentine as a base + Optibond Solo Plus + silane + Filtek Z250, (G4) as in G3 without silane, (G5) Biodentine as a base + Septobond SE + Filtek Z250, (G6) Fuji II LC as a base + Optibond Solo Plus + Filtek Z250. The materials were applied according to the manufacturers' instructions. Biodentine required no dentin or enamel surface conditioning treatment. The teeth were thermocycled 2500x (5°C to 55°C). The specimens were then sealed with a 1-mm window around the marginal interface. Samples were immersed in a 50% w/v silver nitrate solution and exposed to a photodeveloping solution. The teeth were embedded in resin (Sody 33) and sectioned through the restorations. The silver penetration was directly measured using a light microscope. The results were expressed as ordinal scores from 0 to 3 at cervical, interfacial, and enamel margins. The data were analyzed with the nonparametric Kruskal-Wallis, Games Howell, and Wilcoxon signed rank tests ($p < 0.05$).

Results: No statistically significant differences were found between the 6 groups, neither for the dentin cervical margins nor for cervical lining (Biodentine or Fuji II LC)/resin composite interfaces. Statistically significant differences were observed between G5 (median score = 2.0) and the other groups (median score = 1.0) for the enamel margins. Statistically significant differences were found between enamel and dentin cervical margins in G2 (enamel median score = 1.0; dentin median score = 1.5) and G5 (enamel median score = 2.0; dentin median score = 1.0).

Conclusion: Within the limits of this in vitro study, Biodentine as dentin substitute in cervical lining restorations or as a restorative material in approximal cavities when the cervical extent is under the CEJ seems to perform well without any conditioning treatment. However, the operating time is longer than when a RMGIC (Fuji II LC) is used.

Keywords: Ca_3SiO_5-based dentin substitute, resin-modified glass-ionomer cement, microleakage.

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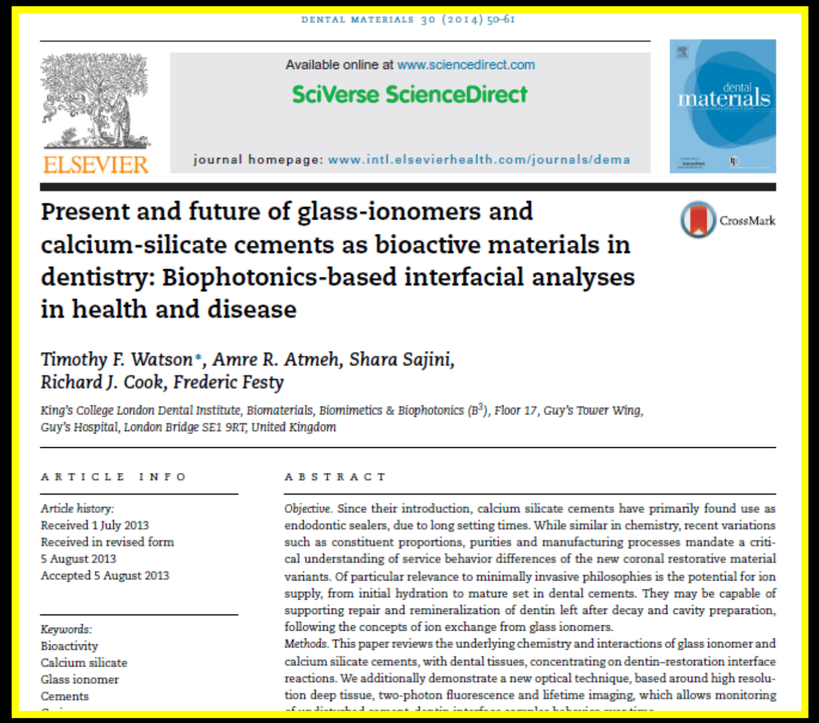

DENTAL MATERIALS 30 (2014) 50–61

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Present and future of glass-ionomers and calcium-silicate cements as bioactive materials in dentistry: Biophotonics-based interfacial analyses in health and disease

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Calcium silicate
Glass ionomer
Cements

ABSTRACT

Objective. Since their introduction, calcium silicate cements have primarily found use as endodontic sealers, due to long setting times. While similar in chemistry, recent variations such as constituent proportions, purities and manufacturing processes mandate a critical understanding of service behavior differences of the new coronal restorative material variants. Of particular relevance to minimally invasive philosophies is the potential for ion supply, from initial hydration to mature set in dental cements. They may be capable of supporting repair and remineralization of dentin left after decay and cavity preparation, following the concepts of ion exchange from glass ionomers.

Methods. This paper reviews the underlying chemistry and interactions of glass ionomer and calcium silicate cements, with dental tissues, concentrating on dentin–restoration interface reactions. We additionally demonstrate a new optical technique, based around high resolution deep tissue, two-photon fluorescence and lifetime imaging, which allows monitoring

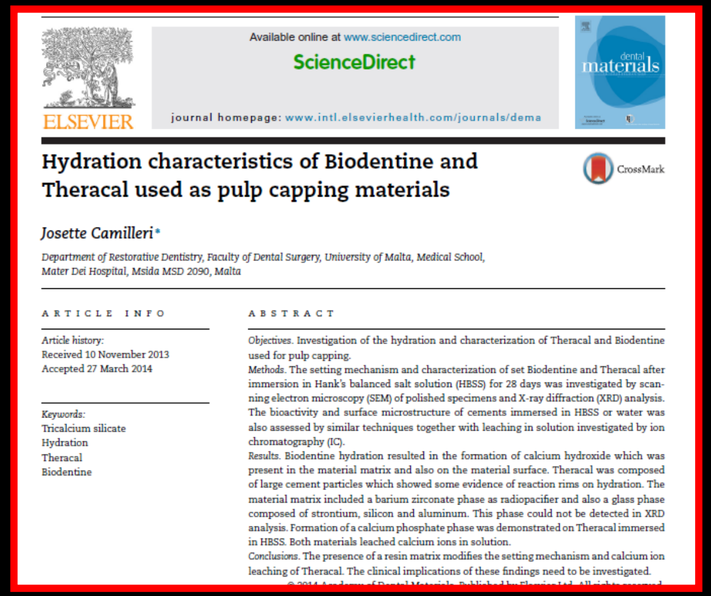
Bioactivity of Biodentine

Literature review of chemistry and
interactions of calcium silicate cements

New optical technique, two-photon fluorescence introduced

"The local bioactivity of the calcium silicate materials has been shown to produce mineralisation within the dentine substrate, extending deep into the tissues"
"Local ion-rich alkaline environment is more favourable to mineral repair compared with glass ionomer materials." "The advantages of this for minimally invasive management of carious dentine are self-evident"

Biodentine *vs* Theracal



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dental materials
ELSEVIER

Hydration characteristics of Biodentine and Theracal used as pulp capping materials

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Theracal
Biodentine

ABSTRACT

Objectives. Investigation of the hydration and characterization of Theracal and Biodentine used for pulp capping.
Methods. The setting mechanism and characterization of set Biodentine and Theracal after immersion in Hank's balanced salt solution (HBSS) for 28 days was investigated by scanning electron microscopy (SEM) of polished specimens and X-ray diffraction (XRD) analysis. The bioactivity and surface microstructure of cements immersed in HBSS or water was also assessed by similar techniques together with leaching in solution investigated by ion chromatography (IC).
Results. Biodentine hydration resulted in the formation of calcium hydroxide which was present in the material matrix and also on the material surface. Theracal was composed of large cement particles which showed some evidence of reaction rims on hydration. The material matrix included a barium zirconate phase as radiopacifier and also a glass phase composed of strontium, silicon and aluminum. This phase could not be detected in XRD analysis. Formation of a calcium phosphate phase was demonstrated on Theracal immersed in HBSS. Both materials leached calcium ions in solution.
Conclusions. The presence of a resin matrix modifies the setting mechanism and calcium ion leaching of Theracal. The clinical implications of these findings need to be investigated.

- The leaching of Calcium ions was much lower in Theracal than in Biodentine
- Theracal did not exhibit any formation of $Ca(OH)_2$ on hydration
- The presence of a resin matrix modifies the setting mechanism and calcium ion leaching of Theracal
- The clinical implications of these findings need to be investigated

Biodentine™

Advantages

Maintains pulp vitality
Biocompatibility
Long working time
Suitable for use with the “thumb”technique

Disadvantages

Technique sensitive
Long working time
Idiosyncratic handling
Mixing sensitive
Finding it in the capsule

Technique Tips – A 'Get Out of Jail' Material

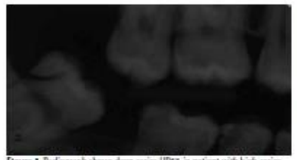

Figure 1. Radiograph shows deep caries URs7, in patient with high caries activity.

Figure 3. Biodentine restorations at placement.

Figure 2. Deep caries with exposure risk.

Figure 4. Restorations at 9 month review.

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*,[1] but the recent introduction of a material (*Biodentine*, Septodont, UK), which has demonstrable dentine repair properties,[2,3] 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 symptom-free teeth in a 22-year-old female patient with high caries activity. The maxillary 1st and 2nd molar teeth tested 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 *Biodentine* placed in the cavities and, after 15 minutes' setting time, basic carving could be carried out (Figure 3). After 9 months, the restorations were intact (Figure 4) and the tooth symptom free. A decision 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 resurfaced with resin composite.

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My conclusion: A "get out of jail" material

Information for patients with sealed caries restorations

Research indicates that, if the filling is sealed that the decay
will not grow further and the tooth will survive.
A subsequent X-Ray of the tooth will show where the decay was.
Your dentist will check, after 6 to 12 months, that it is not getting worse.
However, if you change dentists and you have subsequent X-Rays,
your new dentist could therefore advise that the previous dentist has left decay in a tooth,
when, in fact, (s)he has done this based on good clinical research.

Information for patients with sealed caries restorations

Placing a well-sealed filling over the decay will ensure that it doesn't come back.

There is a small chance that the tooth will die and a root filling will be needed..

That you have had deep decay in your tooth means that you have a problem with your diet and/or oral hygiene/tooth brushing.

You will therefore need to address this – your dentist or his/her hygienist will give you advice.

I removed these slides from my lecture because it seemed that nothing was happening!

In situ transformation of glass ionomer into an enamel-like material

Van Duinen, Davidson, DeGee & Feilzer
Am.J.Dent.2004:17:223-227

Straightforward application of conventional glass ionomer restorative materials can lead to the formation of an extremely hard, glassy material, which remains in the fissures as a hard, enamel like structure well integrated with the tooth

Glass Carbomer™

GCP Glass Fill

What is it?

- liquid silica and fluor/hydroxyapatite crystals (reduce solubility, improve flexural and compressive strengths)
- fluoroapatite (aid to remineralisation).
- fluoride aluminium-silicate glass
- liquid silica

GCP Fill physical properties

Glass Carbomer® Properties

BioSafe®

- Aesthetics are not as good as composites
- Aesthetics improve over time as fluoro/ hyddroxy apetite crystals grow
- For enhanced aesthetics, a composite can be bonded onto the Glass Carbomer using standard acid etch/ bond techniques
- Using Fluoride toothpaste, the Glass Carbomer will be continuously recharged

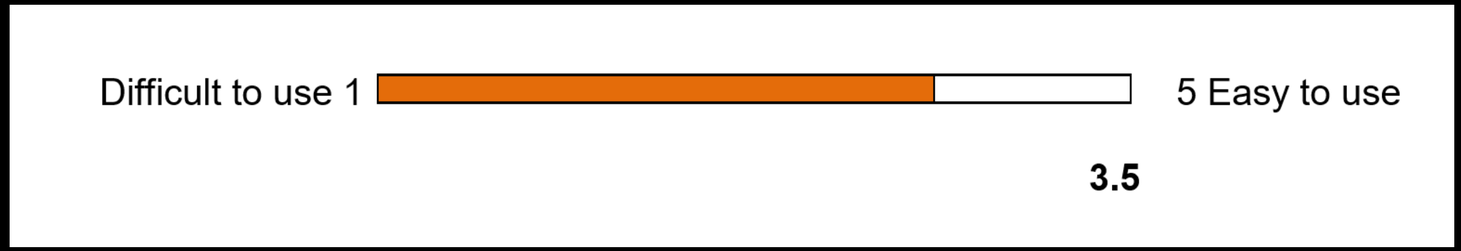
	Conventional Glass Ionomer (Fuji IX)*	Composite**/***	GCP Glass Fill*
Flexural strength	35 Mpa	60-150 Mpa	**122.3 Mpa**
Compressive strength	250 Mpa	195-320 Mpa	**260 Mpa**
Enamel shear bond	6.7 Mpa	10-30 Mpa decreasing over time	**13.7 Mpa** **increasing over time**
Acid solubility (pH=4)	0.13 %	0 % (n.a.)	**0.03 %**

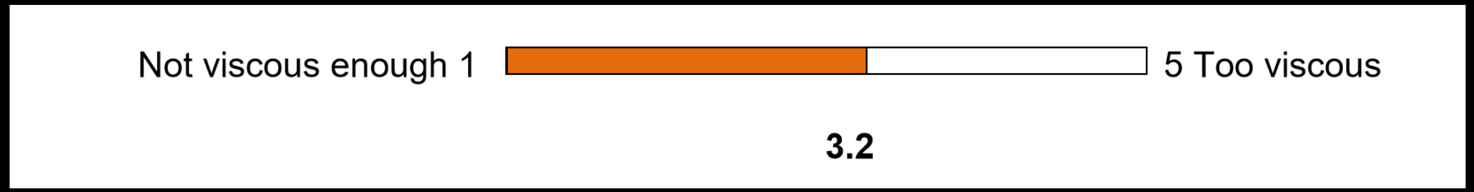
of. D. Glavina. Department of Paediatric and Preventive Dentistry, School of Dental Medicine, University of Zagreb, Croatia.
**In vitro Comparative Study of Compressive Strength of Different Types of Composite Resins in Different Periods of Time, Sepideh Banava, Saman Salehyar - Dental Faculty, Tehran Azad Dental School, Tehran , Iran
***Manufacturers data
(ANSI/ADA) Specification 27 for permanent restoratives: Flexural Strength >50Mpa

Handling evaluation of GCP Fill by the PREP Panel

- 13 evaluators
- 580 restorations (35% Class I, 41% Class II & MOD, 18% in primary teeth, and others such as core build ups).
- 62% (n=8) of the evaluators stated they used GCP Glass Fill in deep cavities and that it had performed satisfactorily in the short term.
- Rated material on visual analogue scales
- Had they not had GCP Glass Fill available for use, over half of the evaluators would have used a glass ionomer or GI derivative instead.

Handling evaluation of GCP Fill by the PREP Panel





Handling evaluation of GCP Fill by the PREP Panel

- Easy to use and good hardness”
- “Heat caused mild discomfort & could be felt through gloves if holding a matrix strip”
- “If enough curing time then harder than RMGI”
- “Aesthetics secondary for decision to use ”
- “Better than GI or Amalgam. It’s great as a base plus composite. Patients did not object as they understood the therapeutic value”

Handling evaluation of GCP Fill by the PREP Panel

http://shop.gcp-dental.com/

- GCP Glass Fill II behaved like a glass ionomer. Thermocure set a real advantage. ”
- “Great material for posterior teeth where I used RGMI in the past. Easy to use & shape although longer to cure it is still better than self-cures”
- “Have used it for 2 years – excellent in deep cavities with minimal sensitivity and good results”

Handling evaluation of GCP Fill by the PREP Panel

http://shop.gcp-dental.com/

CONCLUSIONS

The satisfactory reception for this new type of posterior restorative material, requiring a different technique to posterior composite and RMGI materials, is indicated by the number of evaluators stating they would both buy and recommend the system to colleagues (62%). Its indication as a suitable material for use in deep cavities in vital asymptomatic teeth appears to have been upheld. In addition, there were no reported cases of post-operative sensitivity.

CONCLUSION: Shows promise but I will await the results of long term clinical trials

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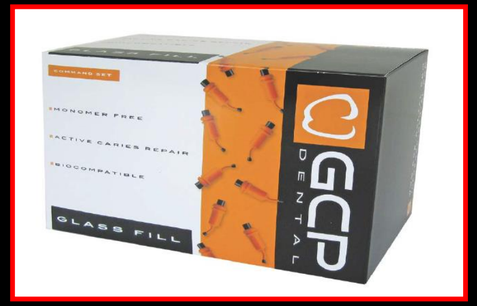

http://shop.gcp-dental.com/

Journal of Dentistry (2005) 33, 335–342

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An in vitro investigation of microtensile bond strengths of two dentine adhesives to caries-affected dentine

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KEYWORDS
Caries;
Dentine;
Adhesives;
Bonding;
Carisolv;
Microtensile testing

Summary *Objectives.* To compare the micro-tensile bond strengths of two different adhesive systems (ABF (Clearfil Protect Bond), Kuraray Medical Inc., Tokyo, Japan) and Prime & Bond NT (PBNT, Dentsply, Konstanz, Germany) bonded to caries-affected dentine retained after chemo-mechanical caries removal using Carisolv™ gel, with that retained after excavation using conventional hand instrumentation.

Method. Twenty, adult, human extracted carious teeth were used in this split tooth study with bur-cut cavities in sound dentine acting as controls. After clinical caries excavation, the occlusal cavities in each experimental group were restored with either bonding system plus composite. Matchstick-shaped samples through the bond interfaces were sectioned and microtensile bond strengths recorded. Scanning electron microscopy (SEM) was used to ascertain the mode of failure at the restoration-dentine interface.

Results. Statistical analysis of the bond strength data showed that for the ABF group, there was no difference in bond strengths between the controls and Carisolv group but these values were significantly higher than those for the hand-excavated samples. PBNT samples showed no significant differences in any of the three test groups, with wider ranging data sets. SEM analysis indicated a variety of failures at the interface including cohesive failures within the caries-affected dentine itself.

Conclusions. From the data generated by this study it could be concluded that microtensile bond strengths of PBNT/composite restorations to caries-affected dentine in clinical cavities were statistically comparable to those to sound dentine. In the ABF/composite restored group (self-etched), the use of conventional hand excavation appeared to weaken the bond strength to the remaining caries-affected dentine. However, the use of Carisolv™ gel excavation did not compromise bond strengths to caries-affected dentine in either group tested.

Conclusions:
Microtensile bond strengths of PBNT/composite
restorations to caries-affected dentine in clinical cavities were statistically comparable to those to sound dentine.

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Patients' preferences for selective versus complete excavation: A mixed-methods study

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ABSTRACT

Objectives: Despite increasing evidence supporting selective caries tissue removal, the technique is not adopted by most dentists, one possible reason being that patients might reject it. We aimed to assess patients' preferences for selective versus complete excavation, and to identify predictors of this preference.

Methods: A sequential mixed-methods approach was taken. First, semi-structured focus group discussions on two convenience samples were performed. Verbatim transcripts were evaluated using content-analysis to inform quantitative study design. The subsequent survey employed convenience, snow-ball and deviant-case sampling, yielding 150 respondents. The relevance of treatment attributes (risks of nerve damage, root-canal treatment, recurrent caries, restorative complications, treatment costs, aesthetic consequences) on patients' treatment preferences was measured using case-vignettes. Dental experience and anxiety as well as patients' personality and socio-demographic details were recorded. Association of predictor variables (age, gender, education, partnership status, personality items, dental experience, anxiety) with treatment preference was assessed using regression analysis.

Results: Focus group participants perceived complete excavation as reliable, but feared endodontic

Focus group with two vignettes

The caries lesions has deeply entered your tooth. Your dentists wants to **completely remove carious tissue** and then restore the tooth.

Using this approach, he will also drill close to the nerve, which bears the risk of hitting and **damaging the nerve**.

Your dentists informs you, that **root canal treatment** is often required for teeth with damaged nerves.

This might lead to **discoloration** of the tooth, e.g. when you smile.

By completely removing carious tissue, **it is unlikely to get caries again** in this area.

The resulting hole will be filled. The filling has a certain **longevity**, but might require renewal at some point.

The treatment might generate some **costs** for you.

The caries lesions has deeply entered your tooth. Your dentists wants to only **selectively remove carious tissue**, leaving some caries to avoid damaging the nerve. He will then restore the tooth, sealing the caries beneath the filling.

Your dentists informs you, that **root canal treatment** is often required for teeth with damaged nerves.

This might lead to **discoloration** of the tooth, e.g. when you smile.

There will be some caries left beneath the restoration. By placing the filling, this caries will be sealed, preventing any remaining bacteria to receive sugar from outside. This should arrest the caries, i.e. avoid it getting bigger. However, there is a certain risk of **getign caries again** in this area.

The resulting cavity will be filled. The filling has a certain **longevity**, but might require renewal at some point.

The treatment might generate some **costs** for you.

Fig. 1. Case vignettes for complete (left) and selective (right) carious tissue removal.

Used to develop questionnaire

Sent to 150 patients

"better risk the nerve than have to come back"
"better a frightening end than endless frightening"
"better do it properly"

Shock!! Horror!!!!!!!!!

83% preferred complete excavation!!!!!!!

Preference for partial excavation was increased among respondents who had a University degree &

Negatively related to those with dental anxiety & those who frequently changed dentist.

Innes NP, Evans DJP, Stirrups DR. J.Dent.Res.2011:90:1405-1410

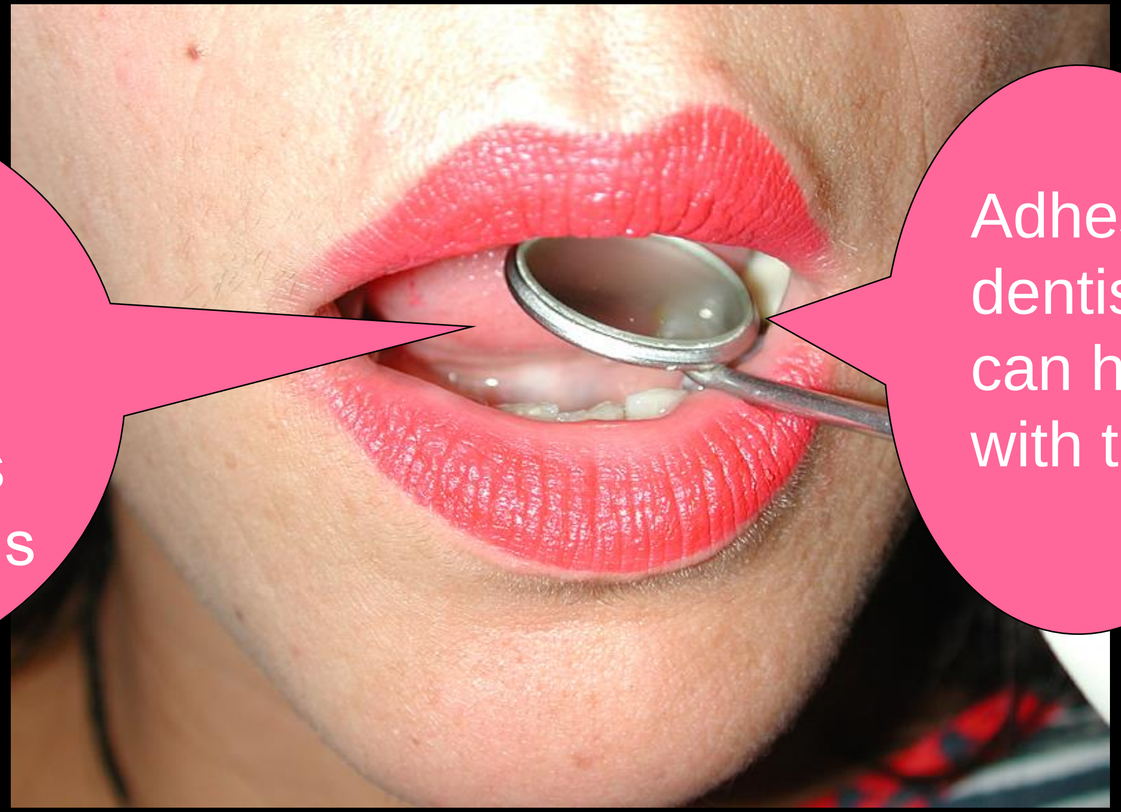
CONCLUSIONS

Hall technique preferred by majority of children & carers

After 5 yrs, Hall PMCs showed more favourable outcomes for pulpal health & restoration longevity than conventional restorations.

The Hall technique appears to offer an effective option for carious primary molar teeth.

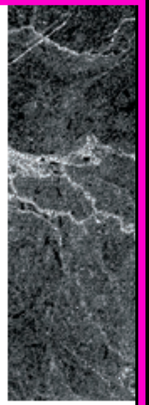
Best treatment is the simplest treatment that adequately meets the patient’s needs



Adhesive dentistry can help with this

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 the materials to make this work



THE "DAUGHTER TEST" IN ELECTIVE ESTHETIC DENTISTRY

We read with interest the excellent overview of the 25-year status of porcelain laminate veneers by Dr. Mark Friedman[1] and agree with his statement "It is unfortunate that some members of our profession misrepresent porcelain veneer restorations as if they were completely innocuous to the dentition." It is not our intention to initiate a witch hunt on the porcelain veneer technique but to express considerable disquiet regarding the seemingly

dentate patients adapt well to modest changes in vertical dimension without problems, a concept originally demonstrated by Anderson[2] and later by Dahl.[3] It is our view that, in many cases, long-term composite build-ups should be the preferred line of treatment and that these have shown demonstrable success with an excellent "fallback position".[4] These provide esthetic restorations—as demonstrated by the mock-up for a 43-year-old patient in the recent article by Chen

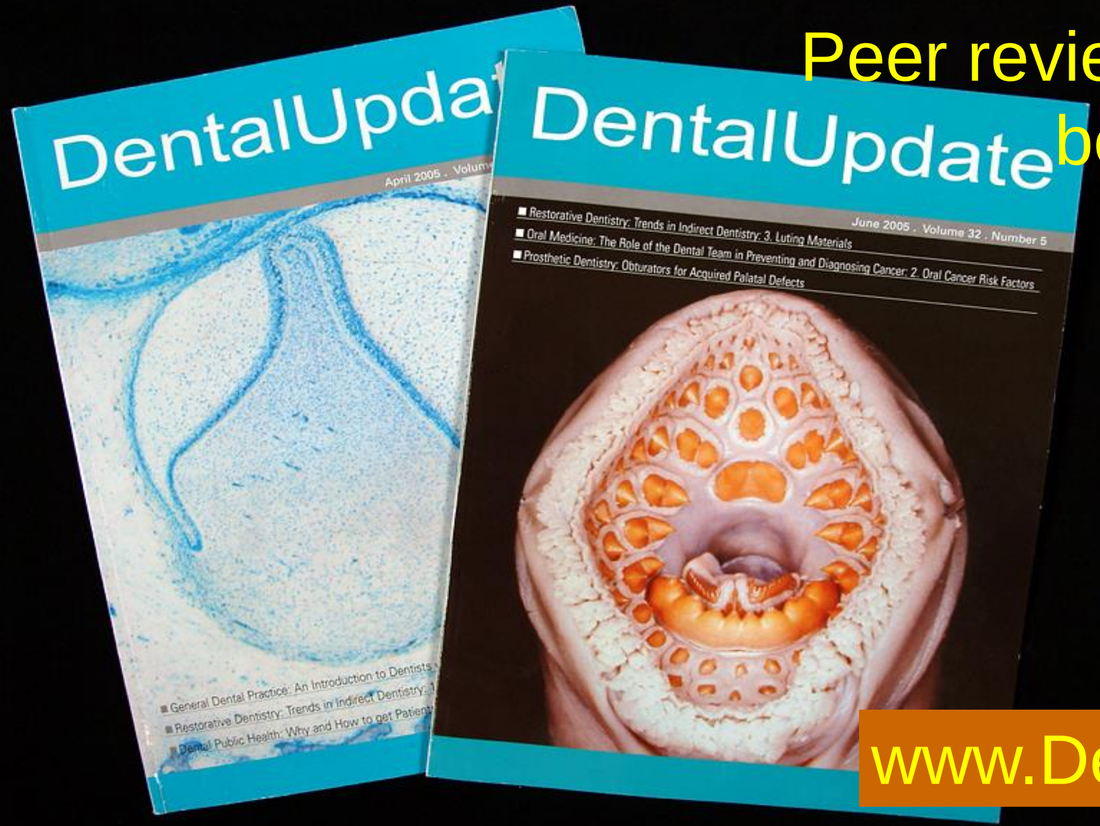
conservative treatment modalities available."[5] Many preparations that we see, originating from the United States, involve dentine, with the potentially deleterious effects on longevity of the restoration.[6] In this respect, the results from Dumfahrt and Schaffer indicated that the failure rate increased ($p < 0.01$) when the finish line crossed an

Burke FJT, Kelleher MGD J.Esthet.Restor.Dent.2009:21:143-145

Whatsoever you would,
that men should do to you,
do ye even so unto them.”
The Bible: Matthew ch7 v12.

“In everything,
do unto others what you
would have them do to you.”
New International Version,
1980, New York Int. Bible Society

Peer reviewed for increased believability



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Has been running for 14 years

Final take home messages

- Nothing lasts forever
- Prevention should always therefore be considered
- There is a demonstrable incidence of pulp death following tooth preparation
- Some minimal methods for caries treatment show promise
- Dentine bonding facilitates minimal intervention
- Sealing caries into a vital, asymptomatic tooth is no longer considered dodgy dentistry
- Pulp capping doesn’t work well
- The “daughter test” should always be remembered

Dentistry is changing!

Thinking “Minimal Intervention” treatment of deep caries is part of the process

Dentistry is changing!

Thinking “Minimal Intervention” treatment of deep caries is part of the process

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