Rules for survival
(of restorations & teeth)
“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”
Following attendance on this course, delegates should:

- Be aware of value of choosing the correct, high-quality material for a given clinical situation
- Be aware of the latest information on bonding to dentine and survival of resin composite materials, including bulk fill and optimum matrix systems
- Have a modest awareness of what Kaplan Meier statistical analysis is about
- Know the clinical situations when a crown (as opposed to a direct-placement restoration) might adversely affect the survival of the restored tooth
Choosing a reliable material
Choosing the “right” material
Bonding to dentine and survival of resin composite materials, including bulk fill and optimum matrix systems
A brief Kaplan Meier statistical analysis lesson
Applying that to clinical decision making
Cost

Materials’ costs in an average practice are 5% to 7% of total expenses.

Always speak to a sales rep before purchasing a material from a major manufacturer, as they know the deals.

While there is variety in pricing, the only materials that are significantly cheaper are the “Own Label” brands.
Own label brands: baked beans

Heinz was twice the price!

<table>
<thead>
<tr>
<th></th>
<th>Own Label</th>
<th>Heinz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>164 Kcal</td>
<td>165 Kcal</td>
</tr>
<tr>
<td>Protein</td>
<td>9.7g</td>
<td>9.0g</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>26.7g</td>
<td>29.6g</td>
</tr>
<tr>
<td>Fat</td>
<td>0.4g</td>
<td>1.1g</td>
</tr>
<tr>
<td>Fibre</td>
<td>7.7g</td>
<td>8.6g</td>
</tr>
</tbody>
</table>
You can save £40 by buying an own-label 5ml bottle of bonding agent.
There is no evidence base for “own label” Glass Ionomer materials
The evidence base for ‘own label’ resin-based dental restoratives

Abstract: There is anecdotal evidence that sales of ‘own-label’ (OL) or ‘private label’ dental products are increasing, as dentists become more cost-conscious in times of economic downturn. However, the purchase of such (less expensive) products could be a false economy if their performance falls below accepted standards. So, while the examination of a resin-bonded product under research conditions alone may not guarantee success, it could be considered that a material which has been subjected to testing under research conditions will demonstrate its effectiveness under laboratory conditions or reveal its shortcomings. If this was not the case, then the material should be removed from the market and replaced with one which is more suitable for the patient. This was therefore considered appropriate to determine the materials on which research was carried out, with particular reference to OL brands.

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

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Number of Mentions in Research Abstracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearfil SE Bond (Kurafay)</td>
<td>40</td>
</tr>
<tr>
<td>Scotchbond Multipurpose (3M ESPE)</td>
<td>39</td>
</tr>
<tr>
<td>Adper Easy Bond (3M ESPE)</td>
<td>17</td>
</tr>
<tr>
<td>Optibond Solo (Kerr)</td>
<td>17</td>
</tr>
<tr>
<td>Prompt L Pop (3M ESPE)</td>
<td>10</td>
</tr>
<tr>
<td>Optibond FL (Kerr)</td>
<td>10</td>
</tr>
<tr>
<td>Optibond all-in-one (Kerr)</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 1. Most frequently mentioned dentine-bonding agents in the ‘Bonding agent’ research abstracts.
Some own label materials performed as well in testing as those from manufacturers in the field.

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

Two own brand label (OBL) materials tested against 3M Z250.

The OBLs were, in general, outdone by the conventional composite.

Dentists are highly recommended to reconsider utilization of OBLs lacking sound scientific scrutiny.

Our findings warrant a legitimate concern regarding OBLs.
What is the cost of one failed adhesive restoration?

A % of your monthly charm quotient!

Replacement restoration = £XXX

At least 30 – 40 minutes of your time
Own label brands: Do they have any research evidence?
Avoiding adhesive failures

Use a material from a manufacturer with experience in the field
Follow the instructions!!
One bottle bonding (reduced risk of error)
Effective light curing (check your light regularly!)
Think seriously about selective enamel etching
Patients care more about the materials used in their mouths than we suspected!

10 members of the PREP Panel

CONCLUSIONS:

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

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- Patients care about the materials that we use
- Almost half did not wish “own label” materials to be used in their mouths
- One third expressed anxieties regarding the use of amalgam in their teeth
There is no (economic) sense in buying a material with no research to back it up.
What I plan to talk about

- Choosing a reliable material
- Choosing the “right” material
- Bonding to dentine and survival of resin composite materials, including bulk fill
- A brief Kaplan Meier statistical analysis lesson
- Applying that to clinical decision making
<table>
<thead>
<tr>
<th>Black</th>
<th>white?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-adhesive</td>
<td>adhesive</td>
</tr>
<tr>
<td>Tooth destructive</td>
<td>non-destructive</td>
</tr>
<tr>
<td>Non-aesthetic</td>
<td>aesthetic</td>
</tr>
<tr>
<td>Technique friendly</td>
<td>difficult</td>
</tr>
<tr>
<td>Longlasting</td>
<td>?longevity</td>
</tr>
</tbody>
</table>

The physical properties of amalgam and resin composite are suitable for restoration of loadbearing cavities in back teeth, but what about glass ionomer?
Reinforced Glass ionomer materials in loadbearing situations?

A crux question, because, if these work, they will be a cheaper replacement of amalgam than composite.

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

In clinical situations where there are no adverse situations at work (such as high occlusal loading or an acidogenic plaque), certain restorations in reinforced GI materials (such as Fuji IX) may provide reasonable longevity. However, the conditions for longevity are not readily identified. Two of the studies (Scholtanus and Huysmans, 2007: Basso, 2013) demonstrate higher than desirable failure rates for GI restorations in posterior teeth, especially in the longer term.
Until more high quality evidence becomes available, for practitioners using reinforced GI materials in loadbearing situations in posterior teeth, it is prudent to advise patients of the relative paucity of good quality evidence for the success of the restorations that they are placing.
GC EQUIA doing well at 4 years

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

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

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

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

Methods: A total of 140 (80 Class 1 and 60 Class 2) lesions in 59 patients were either restored with a glass ionomer restorative system (Equia, GC, Tokyo, Japan), which was a combination of a packable glass ionomer (Equia Fil, GC) and a self-adhesive nanofilled coating (Equia Coat, GC), or with a microfilled hybrid composite (Gradia Direct Posterior, GC) in combination with a self-etch adhesive (G-Bond, GC) by two experienced operators according to the manufacturer’s instructions. Two independent examiners evaluated the restorations at baseline and at one, two, three, and four-year post-treatment according to

Operative Dentistry, 2015, 40-2, 134-143
Do amalgam substitutes exist?

Are reinforced glass ionomers an alternative?

Not really, *at present*, because their wear resistance isn’t good enough and they are soluble in dilute organic acids.
GIs in posterior teeth – a medicolegal perspective

- Tell the patient that it *is* a glass ionomer that the evidence base is variable and limited. Definitive restoration or long-term provisional?
- The restorations may need re-surfacing with composite.
- Alternatives are more expensive.
- May not do harm.
But, reinforced glass ionomers are a Godsend to special care dentists
Equia Forte holds promise:
Differences from Fuji IX

- New ultrafine highly reactive glass particles added
- Higher molecular weight polyacrylic acid
- 20% improved flexural strength, 21% improvement in acid resistance, 40% wear resistance
- Improved fluoride release
Rules for survival
(of restorations & teeth)

There is a need for an improved Glass Ionomer: if we get that, it could be our amalgam substitute.
What I plan to talk about

- Choosing a reliable material
- Choosing the “right” material
- Bonding to dentine and survival of resin composite materials, including bulk fill
- A brief Kaplan Meier statistical analysis lesson
- Applying that to clinical decision making
Composites can be pretty!
and, bonding to enamel is easy
Bonding to dentine is therefore more difficult.
Why do dentists need adhesion?

- Cervical restorations
- Build up of fractured anterior and posterior teeth
- Short clinical crown for full or partial coverage restorations
- Resin retained bridges
Previous strategies to treat the smear layer

Etch & Rinse/
Total etch

Self etch/
No Rinse
introducing

a new group of dentine bonding agents

Universal bonding agents
Treatment of the smear layer

- REMOVE (Etch & Rinse/Total etch)
- LEAVE/PENETRATE (Self etch)
- UNIVERSAL MATERIALS (Etch & Rinse, Selective enamel etch, Self etch) (use for direct and indirect)
Bonding agents: The first “Universal”
Scotchbond Universal Adhesive

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

- BisGMA
- MDP
- Vitrebond Copolymer
- HEMA
- Ethanol
- Water
- Filler
- Silane
- Initiators
My guess is that this applies to all Universals
## Clearfil Universal Bond: What’s in it?

<table>
<thead>
<tr>
<th>Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-MDP</td>
</tr>
<tr>
<td>Bis-GMA</td>
</tr>
<tr>
<td>2-HEMA</td>
</tr>
<tr>
<td>Hydrophilic aliphatic dimethacrylate</td>
</tr>
<tr>
<td>Colloidal silica</td>
</tr>
<tr>
<td>Silane coupling agent</td>
</tr>
<tr>
<td>Di-Camphorquinone</td>
</tr>
<tr>
<td>Ethanol</td>
</tr>
<tr>
<td>Water</td>
</tr>
</tbody>
</table>
Futurabond U

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

Liquid 2:
Ethanol, water, catalyst

pH.................2.3
(i.e. selective enamel etching indicated)
A new Universal from GC: Premio Bond

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

<table>
<thead>
<tr>
<th>Monomer Name</th>
<th>Type</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDP</td>
<td>Phosphoric acid methacrylate</td>
<td>Forms strong bond to hydroxyapatite surfaces. Promotes adhesion to tooth surface by formation of non-soluble Ca²⁺ salts.</td>
</tr>
<tr>
<td>MCAP</td>
<td>Methacrylated carboxylic acid polymer</td>
<td>Carboxylic acid functional polymer reacts with and bonds to hydroxyapatite. The presence of many carboxylic acid groups along a polymeric backbone/chain allows multiple bonds to the tooth surface.</td>
</tr>
<tr>
<td>HEMA</td>
<td>Hydrophilic monofunctional methacrylate</td>
<td>Promotes wetting of polar / inorganic and moist surfaces. Assists penetration of liquid filled dentinal tubuli.</td>
</tr>
<tr>
<td>Bis-GMA</td>
<td>Hydrophilic / hydrophobic crosslinking dimethacrylate</td>
<td>Facilitates compatibility of hydrophilic HEMA and hydrophobic D3MA in the presence of water, thereby preventing phase separation of adhesive. Imparts high mechanical strength and resilience to adhesive layer.</td>
</tr>
<tr>
<td>D3MA</td>
<td>Hydrophobic crosslinking dimethacrylate</td>
<td>Enables the reaction of the adhesive with the less polar monomers of the filling or luting composite.</td>
</tr>
</tbody>
</table>
Cotene One-Coat 7 Universal
What’s in it?

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

No silane: does that matter?
All-Bond Universal

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

pH 3.1
A new Universal from Dentsply

What’s in it?

10-MDP
PENTA
Initiator
Isopropanol
Water

pH=2.5
10-MDP seems to be the resin molecule of choice for bonding with HAP.
SUMMARY: Universal bonding agents:

- Can be used in total etch, self etch, selective enamel etch modes
- Are compatible with direct & indirect procedures
- Can be used with self & dual cure luting materials (with separate activator)
- Can bond to different substrates
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 undergone 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.

CPI/Clincal Relevance: New Universal Bonding Agents appear to present a promising advance in bonding to dentine.

Dent Update 2017; 44: 777–778

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. Bonding to dentine is also central to the practice of minimally invasive dentistry, given that bonded restorations do not require macro-mechanical restoration features such as slots and keys, which are a feature of non-adhesive (amalgam) cavity preparations.

A dentine-bonding agent should perform the following functions:

1. Provide a strong, immediate and permanent bond to dentine;
2. Seal the cavity and minimize leakage;
3. Resist microbial or enzymatic degradation;
4. Provide adhesion per se at the resin/dentine interface (this is necessary);
5. Prevent post-operative sensitivity;
6. Reduce the risk of recurrent caries;
7. Prevent marginal staining;
8. 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.

A brief history of bonding to dentine

In the past, dentine-bonding agents were classified into generations. However, this means of classifying different groups of bonding agents fell into disuse because of the failure of authorities in the subject to agree on the types of bonding agent which fitted a given ‘generational’ label. Recently, the classification has therefore been simplified, 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.

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

1. Glass ionomer materials (GICs) – glass-ionomer cements which were developed in the 1960s, initially being derived from the Resin Aluminate.
2. 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

Want to read more?
New “Universal” dentine bonding agents hold great promise.
What I plan to talk about

Choosing a reliable material
Choosing the “right” material
Bonding to dentine and survival of resin composite materials, including bulk fill
A brief Kaplan Meier statistical analysis lesson
Applying that to clinical decision making
without re-attendance for \( i \) months will eventually re-attend. Then

\[
P(i) \text{ can be estimated as } P(i) = \frac{E_i}{\sum_{j=i+1}^{M} (N_j + R_j)}
\]  

(1)

\( E_i \) satisfies the following recurrence relation:

\[
E_i = \sum_{j=i+1}^{M} R_j + \sum_{j=i+1}^{M} P(j)N_j
\]  

(2)

Furthermore, because non-attendance for \( M \) months is regarded as indicative of eventual non-attendance

\[
E_M = 0
\]  

(3)

Equations (1), (2) and (3) can now be used recursively to calculate \( E_i \) and \( P(i) \) for all values of \( i \) from \( M \) down to 0.

An algorithm was developed, using the statistical package SPSS, to calculate \( P(i) \) for the total population of patients, and for a range of sub-populations, defined by such characteristics as age and sex.

**Adaptation of Kaplan-Meier**

The interval between successive interventions on the same tooth will now be considered. If a tooth is restored at time 0, then various standard functions can be defined concerning the probability that certain events will occur before, on, or after any subsequent time \( T \).

Let the total number of observed tooth restoration events be \( N \).

that the tooth will receive an intervention at time 0, or strictly between 0 and just less than 0, conditional on it not having received an earlier re-intervention.

Define \( H(T) = \sum_{t=1}^{T} h(t) \), the Cumulative Hazard function.

By taking progressively smaller units of time \( H(T) \) can be expressed as

\[
H(T) = \int_{0}^{T} h(t) dt,
\]

but for practical purposes it is sufficient to approximate time as composed of discrete one day units.

Standard theory shows that the relationship between \( S \) and \( H \) is given by

\[
S(T) = \exp(-H(T))
\]

(4)

The function \( h(t) \) can be estimated at each value of \( t \) for which a re-intervention has occurred within the observed data.

Let there be \( V(t) \) observed interventions at exactly \( t \) units of time since restoration.

If no cases have been censored, then \( h(t) \) can be estimated as

\[
V(t) = \frac{V(t)}{N - \sum_{u=1}^{t} V(u)}.
\]

If the number of cases known to be censored at exactly \( t \) units of time since restoration is \( C(t) \), then the Kaplan-Meier estimate of \( h(t) \) is

\[
V(t)(N - \sum_{u=1}^{t} V(u) - \sum_{u=1}^{t} C(u)).
\]

The denominator is the number of restored teeth 'available' for re-intervention.

Suppose now that is not known, but that \( L(t) \) is the number of restored teeth which reached the end of the observation period at time \( t \) without
SN7024, available from UKDataService.ac.uk contains anonymized longitudinal data on patients attending the General Dental Services in England and Wales (UK).

- Over three million different patients
- Over 25 million courses of treatment, between 1990 & 2006
- Modified version of Kaplan-Meier methodology used to plot survival curves for different subgroups
Because of the vast size of the dataset, we can now look at the effect of the restoration on survival of the tooth.
I can give you lots of tables & figures!

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>1 year</th>
<th>5 years</th>
<th>10 years</th>
<th>15 years</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Incisor</td>
<td>98</td>
<td>91</td>
<td>82</td>
<td>74</td>
<td>358,959</td>
</tr>
<tr>
<td>Lower Incisor</td>
<td>99</td>
<td>94</td>
<td>87</td>
<td>81</td>
<td>41,233</td>
</tr>
<tr>
<td>Upper Canine</td>
<td>98</td>
<td>86</td>
<td>74</td>
<td>63</td>
<td>74,059</td>
</tr>
<tr>
<td>Lower Canine</td>
<td></td>
<td></td>
<td>84</td>
<td>76</td>
<td>17,043</td>
</tr>
<tr>
<td>Upper Premolar</td>
<td>99</td>
<td>92</td>
<td>85</td>
<td>77</td>
<td>241,686</td>
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<tr>
<td>Lower Premolar</td>
<td>99</td>
<td>93</td>
<td>86</td>
<td>80</td>
<td>129,724</td>
</tr>
<tr>
<td>Upper Molar</td>
<td>99</td>
<td>94</td>
<td>88</td>
<td>82</td>
<td>138,340</td>
</tr>
<tr>
<td>Lower Molar</td>
<td>99</td>
<td>94</td>
<td>89</td>
<td>84</td>
<td>200,889</td>
</tr>
<tr>
<td>All Restorations</td>
<td>99</td>
<td>92</td>
<td>84</td>
<td>77</td>
<td>1,202,005</td>
</tr>
</tbody>
</table>
First, a brief lesson in Kaplan Meier

The goal is to estimate a population survival curve from a sample. If every patient is followed until death, the curve may be estimated simply by computing the fraction surviving at each time. However, in most studies patients tend to drop out, become lost to follow up, move away, etc. A Kaplan-Meier analysis allows estimation of survival over time, even when patients drop out or are studied for different lengths of time.
First, a brief lesson in Kaplan Meier

For restorations, the observation time starts at time 0 in the graph. Restorations that fail result in a drop in the graph. Restorations that have not failed by the end of the study are called *censored* observations and these are included for only as long as they are observed. Since information of both failed and non-failed restorations is used, the Kaplan Meier method is considered the gold standard in longevity assessment.
Kaplan Meier

Vertical axis represents estimated probability of survival for a hypothetical cohort, not actual % surviving.

n=10 hypothetically

40% survival rate
Direct placement restorations: amalgam

7,425,049 amalgam cases included, of which 2,537,331, of which had a re-intervention
Size matters – big fillings last less well than small. Keeping fillings as small as possible is therefore important.

This is only possible with adhesive dentistry.
...a few more words on amalgam
RESEARCH

IN BRIEF

- One hundred and eighty dental surgeries were tested for environmental mercury.
- Sixty eight per cent had environmental mercury readings over the occupational exposure standard.
- Greater emphasis is needed in the safe handling of mercury.
- Dentists were more likely to have suffered a kidney disorder than the control group.

Mercury vapour levels in dental practices and body mercury levels of dentists and controls


Aim: A study of 180 dentists in the West of Scotland was conducted to determine their exposure to mercury during the course of their work and the effects on their health and cognitive function.

Design: Data were obtained from questionnaires distributed to dentists and by visiting their surgeries to take measurements of environmental mercury.

Methods: Dentists were asked to complete a questionnaire including items on handling of amalgam, symptoms experienced, diet and possible influences on psychomotor function such as levels of stress significantly associated with their level of mercury exposure as measured in urine. One hundred and twenty two (67.8%) of the 180 surgeries visited had environmental mercury measurements in one or more areas above the Occupational Exposure Standard (OES) set by the Health and Safety Executive. In the majority of these surgeries the high levels of mercury were found at the skirting and around the base of the dental chair. In 46 surgeries (25%) the personal dosimetry measurement (ie in the breathing zone of dental staff) was above the OES.
122 surgeries had mercury levels higher than the Occupational Exposure Standard
In 45 surgeries the personal dosimeter measurement was above the OES
Dentists were 4 times more likely to have kidney disease
Urinary mercury levels of dentists were 4 times greater than controls
Dentists’ reported short-term memory worse than controls
CONCLUSIONS

- Dentists short-term memory worse than controls
- Periodic health surveillance of DHCWs indicated
- Kidney disorders not correlated with surgery Hg vapour levels
- Safer handling of amalgam needed
- Further studies indicated on all members of the dental team
Contemporary UK dental practice 2015/16: Comparison with previous results: premolars

Br.Dent.J.2018

Amalgam for Class II, 2002....86%
Amalgam for Class II, 2008....59%
Amalgam for Class II, 2015....40%
Amalgam has maintained dental public health in the developed world for 125 years, but its days are numbered.
And, don’t forget that patients seem to like tooth-coloured restorations in their back teeth!

Burke FJT.
Are success rates for posterior composite as good as for amalgam?

Some studies from general dental practice
12-year Survival of Composite vs. Amalgam Restorations

- **Composite resin**
  - P > 0.05

- **Amalgam**
  - P = 0.013

- 5 year
- 12 year
22 year retrospective evaluation of posterior composites

- Retrospective, practice-based design
- 80 adult patients selected (from 980) – continuous attenders for 22 years, invited to attend for examination: 19 declined
- The remaining patients had 362 restorations
- Full dentition and normal occlusion
- Examined by 2 independent examiners using USPHS criteria
22 year retrospective evaluation of posterior composites

- All cavities lined with Ketac Fil
- Two materials: P50 (3M) and Herculite (Kerr)

Restorations in premolars survive better!!

Overall failure was \textit{circa} 2\% per annum
Dentists undertook a course on posterior composite placement

Exclusion criteria were deep subgingival margins and inability to isolate

Cavity outline determined by caries lesion

Isolation with cotton rolls and suction

Etch & rinse bonding agent, 2mm oblique increments of composite
8 year evidence from dental practice

- 2881 children, mean age 13.7 years
- 4335 restorations placed by 115 dentists
- 49% of cavities were class I
- 3507 in molars
- Spectrum APH used for 88%, bonding agent Prime & Bond used for 94%

Overall failure rate: 2% failure per annum
34 papers, each with evaluation periods of >5 years.

RESULTS:
Poorer survival rates in molar teeth than in premolars
Multiple surface fillings more likely to fail than class I

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

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

Electronic patient files from 24 dental practices

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

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

Restorations in molars had higher AFR

AFR of composites was 4.4%, amalgam 5.1%, and GI 11.1%
• 10 year failure rate was 3.8%, but varied between practices (2% to 5%)
• Composite showed higher survival than amalgam
• Age of patient, gender, number of surfaces, operator, tooth type and endodontically treated teeth significantly influenced survival.
finally

The ultimate evidence

1,551 papers identified
25 met inclusion criteria
12 authors agreed to provide raw data
A total of 2,816 restorations included, of which 569 had failed.
Conclusions

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

Restorations in premolars do better than those in molars.

Caries risk plays a dominant role in restoration survival.

Liner or base in Glass Ionomer had negative effect on survival.

Overall, AFR of 1.8% at 5 years and 2.4% at 10 years.
Are success rates for posterior composite as good as for amalgam?

YES – and we aren’t even comparing composite in its best situation
Time taken for posterior composites = X2.5 time for amalgam

Burke F.J.T.
Attitudes to posterior composite filling materials: A survey of 80 patients.

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

Time required for placement of composite vs amalgam restorations
Dilley DC, Vann WF et al
J.Dent.Child 1990:May-June:177-181
Perhaps the new bulk fill materials are the answer?

Longevity of posterior composite restorations is at least as good as amalgam, but they take longer to place.
My new classification for **BULK FILL** materials:

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

**BULK FILL RESTORATIVE MATERIALS**
(satisfactory wear resistance)
Bulk fill base materials needed a topping because their wear resistance wasn’t good enough.

So, the bulk fill base materials are now history!
My new classification for **BULK FILL** materials:

**BULK FILL RESTORATIVE MATERIALS**
(satisfactory wear resistance) which don’t need a topping
Bulk fill (with no topping)

Sonic Fill (Kerr)
Viscosity change when sonic energy applied
More are appearing:
For example…

- Aura Bulk Fill (SDI)
- VOCO Admira Fusion x-tra

NEW! BEAUTIFIL-Bulk Restorative

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

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

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

For some:
More potent/efficient initiator systems

For all:
Increasing the translucency of the filler

For some:
Improved resin systems
Perhaps the new bulk fill materials are the answer for restorations in back teeth, at least in the medium term.
Placing a dentine pin reduces the life of the filling and the tooth, but a confounding factor could be that the restoration may be large. The same applies to root fillings.
The effect of root filling on survival of the tooth

The message therefore is... prevention, and educating patients that restoring a tooth before the pulp is involved is a good idea! Or, sealing in caries in a vital, asymptomatic tooth.

The effect of patient treatment volume/need on survival of the tooth

Be careful what you promise to a patient with history of high treatment need!

Future treatment need is closely correlated with past treatment need
The effect of patient age on survival of restorations

Be careful what you promise when restoring teeth for older patients

Restorations in older patients perform less well than those in younger patients
The effect of patient age on survival of restored teeth

Again, be careful what you promise when restoring teeth for older patients, and, plan for failure.

The effect is even more dramatic when time to extraction is measured!
The effect of patient age on survival of restored teeth

- Younger patients’ teeth are less likely to be weakened by previous restorations.
- Younger patients will potentially be more dextrous than older patients when it comes to oral healthcare maintenance.
- Younger patients may be less likely to be on the multiple medications, with some of these potentially reducing salivary flow.
- Some teeth may be lost in older patients because of periodontal disease: the dataset is unable to ascertain the reason for loss of a tooth.
Is survival of teeth and restorations improving?

One would expect that improvements in materials and bonding agents would have a positive effect, but it has not!

Survival of composite restorations to reintervention in relation to year of placement
Glass Ionomer Restoration Survival Overall

1,598,698 glass ionomer restorations included, of which 689,532 had a re-intervention over the duration of the dataset.

Kaplan-Meier analysis indicated that 28% had survived without reintervention at 15 years.

We think that clinicians place GIs in teeth of suboptimal prognosis, almost as temporary restorations.
Whichever way we look, Glass Ionomer restorations perform less well than any other restoration type. Therefore use in compromise situations where you need adhesion but not strength.
Molar teeth
It’s only in older patients that crowning a molar tooth is a good idea!
In general, keeping an incisor tooth going with a direct placement filling is a better option than reducing a tooth for a crown. The same applies to tooth wear cases.
Results from the old database for veneers

- Data on 2,562 porcelain veneers, placed for 1,177 adult patients (18 years or older) between 1991 and 2002
Survival without re-intervention:

- 89% at 1 year
- 67% at 5 years
- 53% at 10 years

Is this good enough for an elective restoration?
Conclusions

- 53% of porcelain veneers were present without re-intervention at ten years.
- Veneers placed in male patients had less time to re-intervention than those in female patients.
- Patients with high annual treatment, & those exempt from charges were associated with shorter time to re-intervention.
- When re-intervention occurs, the most common is a direct restoration, replacement veneer or crown.

Now, to some degree, I’m eating my hat!

Thomas Brydges’ Homer Travestie, 1797

For though we tumble down the wall,
And fire their rotten boats and all,
I’ll eat my hat, if Jove don’t stop us,
Or play some queer rogue’s trick to stop us.

Charles Dickens, the Pickwick Papers, 1837

If I knew as little of life as that, I’d eat my hat
and swallow the buckle whole!
Longevity of veneers is poor, but, the life of the tooth is not compromised.
Premolar teeth, 3,591,372 restorations

Broadly similar to molars in terms of survival of restorations, including crowns

No differences in time to survival, but lower premolars perform better in terms of time to extraction
Premolar teeth: the effect of MODs

MOD restorations in premolars don’t do well, no matter how you look! Therefore..
Avoid cusp fracture by........
Crowning a premolar tooth leads to a reduced lifespan of the crowned tooth, in all age groups other than the over-60s. MOD restorations perform badly.
Canine teeth: 1,232,041 restorations

Regarding re-intervention, veneers and crowns outperform other restoration types, with 45% and 40% respectively surviving to re-intervention at 15 years and with glass ionomer restorations performing least well.

However, regarding to time to extraction of the restored canine tooth, veneers continue to perform optimally (around 93% cumulative survival at 15 years) but crowns represent the worst performing restoration at 15 years (66% cumulative survival),
Canine teeth: effect of root fillings

Root fillings in upper canine teeth perform worse than in any other tooth!

WHY?

<table>
<thead>
<tr>
<th>Tooth type</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Incisors</td>
<td>69%</td>
</tr>
<tr>
<td>Canines</td>
<td>61%</td>
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<tr>
<td>Premolars</td>
<td>71%</td>
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<tr>
<td>Molars</td>
<td>70%</td>
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</table>
Canine teeth: effect of crowning

Crowns in canine teeth perform worse than in any other tooth (time to extraction)

<table>
<thead>
<tr>
<th>Tooth type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incisors</td>
<td>75%</td>
</tr>
<tr>
<td>Canines</td>
<td>66%</td>
</tr>
<tr>
<td>Premolars</td>
<td>78%</td>
</tr>
<tr>
<td>Molars</td>
<td>83%</td>
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</tbody>
</table>
Crowning a canine tooth leads to a reduced lifespan of the crowned tooth. Root fillings perform worse than for any other tooth. Patients must be told!
Summary:
Drilling isn’t great for teeth!
Implants – will they be found out?
Ashbjorn Jokstad
0088 IADR Cape Town

- 364 dental implant manufacturers in 2014
- 254 have no clinical trials
- 110 have no documentation

Is this sustainable?
New words in the dental dictionary  
Sims and Chapple 2012

*Peri-implant mucositis*: Reversible inflammatory process in the soft tissue surrounding a functional implant

A new word in the dental dictionary!

1 in 5 implants placed today will lose bone!  P Weston

By kind permission of Paul Weston
Incidence

Mir-Mari (2012)
9.1% of implants with peri-implantitis
Implant in service 6.0 years (+/-3.9)

Systematic review:
10% of implants and 20% of patients affected (Montelli, 2012)
Jan Lindhe’s view

'THERE IS AN OVERUSE OF IMPLANTS IN THE WORLD AND AN UNDERUSE OF TEETH AS TARGETS FOR TREATMENT'

Professor Jan Lindhe is an emeritus professor at the University of Gothenburg, where he was previously Chair of Periodontics and Dean of the School of Dentistry. Lindhe graduated from the Royal School of Dentistry in Malmö, Sweden. He is now one of the world’s most renowned researchers in periodontology and is well known for his book Clinical periodontology and implant dentistry as well as hundreds of other publications. Jan Lindhe acted as editor of the Journal of Clinical Periodontology for over 30 years and continues to contribute to scientific debate and research.

Research has linked periodontal disease to countless systemic illnesses. Is this the best way to stress the significance of good periodontal health to the public? I believe there is some sort of association between periodontal disease and some general systemic conditions, but it is not yet clarified. It is important to make the public aware of the importance of maintaining good oral health.

‘We try to manage infections all over the body, why should we ignore them in the oral cavity?’

than a physician, but the responsibility should not be with the dentist to diagnose diabetes or other inflammatory diseases. On the other hand, communication between the dentist and patient is often very open and consequently if the dentist suspects something is wrong, they may recommend their patient see a physician for further investigations.

suspected a long time ago and there was indirect proof that this was the case. During the last 50 years it has been documented that if we don’t allow bacteria to form plaque/biofilm on teeth, then gingival inflammation does not develop. In addition, if patients with advanced periodontal disease have their teeth cleaned and suspected a long time ago and there was indirect proof that this was the case. During the last 50 years it has been documented that if we don’t allow bacteria to form plaque/biofilm on teeth, then gingival inflammation does not develop. In addition, if patients with advanced periodontal disease have their teeth cleaned and
A missing tooth is irreversibly gone and a tooth should only be removed after worthwhile deliberation.

There is no lifetime guarantee for either a natural tooth or an implant.
Implants

Will patients wise up?
Not while there are dentists around who are only in it for the money
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 sued!)
- We now have the materials to make this work
“The day is surely coming when we will be practising preventive rather than reparative dentistry”

G.V. Black, 1896
If you want to read it rather than listen to it...

BDJ 2018

And, another nine