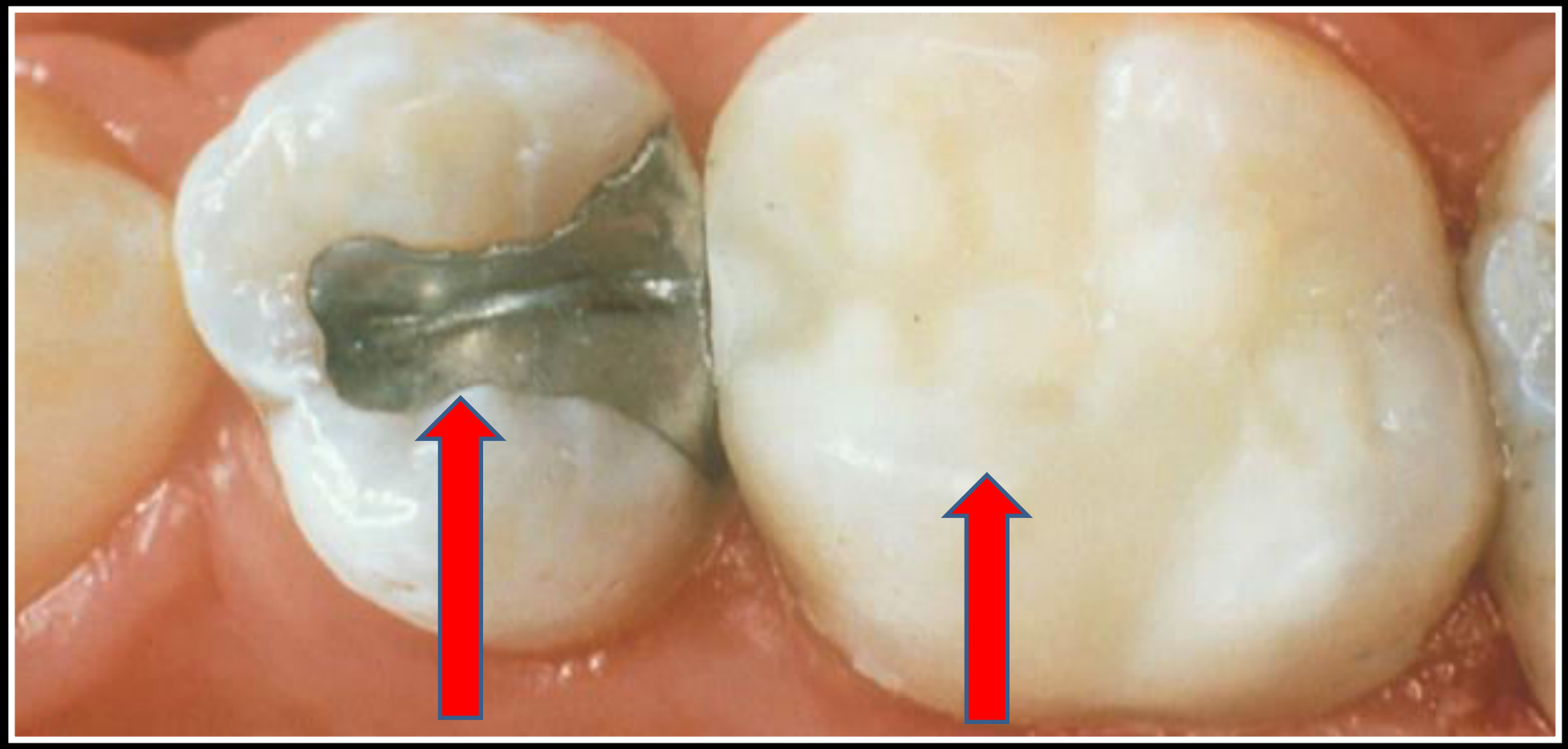


The Amalgam *vs* Composite Debate
The future of amalgam

The history of silver amalgam

…after Shortall ACC, 2003

- 1819 English chemist Charles Bell invents Silver Amalgam
- 1826 Auguste Onesime Taveau “Pate d’Argent” (France)
- 1833 – 1841 Crawcour brothers “Royal Mineral Succedaneum” to the USA
- 1840 American Society of Dental surgeons (ASDS) founded
- 1843 ASDS declared the use of amalgam to be malpractice
- 1848 ASDS suspended 11 members

“I hereby certify it to be my opinion and firm conviction that any amalgam whatever is unfit for the plugging of teeth or fangs and I pledge myself never under any circumstances to make use of it in my practice as a dental surgeon, and furthermore, as a member of the American Society of Dental Surgeons, I do subscribe and write with them in this protest against the use of the same.”

The history of silver amalgam

- 1850 ASDS rescind their resolution - Profession split for 50 yr.
- 1926 Professor Stock : Hg release → disease symptoms
- 1941 Stock reverses his view on “Silver” Amalgam
- 1973 Hal Huggins - Amalgam causes many diseases

The history of silver amalgam

- 1976 U.S. FDA “grandfathers” mercury based fillings when it began regulating medical devices
- 1979 Gay et al. (Lancet) Hg release on chewing
- 1985 Intl. Academy of Oral Med & Toxicology
- 1985-90 Lorscheider & Vimy studies published

Vimy MJ, Lorscheider FL. Intra-oral mercury released from dental amalgam. J.Dent.Res.1985:64:1069-1071
Vimy MJ, Lorscheider FL. Serial measurements of intra-oral air mercury:estimation of daily dose from dental amalgam. J.Dent.Res.1985:64:1072-1075

- By 1995, these studies were totally discredited, but are still quoted today by the anti-amalgam lobby

SUMMARY: Amalgam restorations release small amounts of mercury, but well below threshold levels considered dangerous for occupational exposure.

The history of silver amalgam

- 1990 CBS – TV 60 minutes - toxins in amalgam
- 1991 US NIH –funded Alzheimer's study
- 1993 Summers et al. Reported that Hg induced antibiotic resistance
- 1994 Panorama "Poison in your mouth"

The history of silver amalgam

- 1994 NIDR invite research in children
- 1995 Lorscheider & Summers Hg in foetal tissues
- 1996 Huggins licence revoked
- 1999 Saxe –no Alzheimer's link to amalgam

The history of silver amalgam

- 1999 US Agency for Toxic Substances & Disease Registry concluded no health hazard but urged further study
- 2001 California Dental Board disbanded (DW)
- 2002 New Board fact sheet prepared
- 2002 Lawsuits against ADA & State boards

The history of silver amalgam

- 2002 FDA proposes dental Hg class 2 Device
- 2002 House Bill 2221 Arizona; 1715 Georgia; 4870 Illinois; 2786 Washington; (pending).1251 New Hampshire passed
- 2002 (April) US Congress Rep. members Dan Burton (Ind) & Diane Watson (D) co-sponsor modified legislation “Mercury in Dental Filling Disclosure & Prohibition Act”

Why the Amalgam debate just won't go away

- Two US members of congress want to abolish amalgam
- They demand full disclosure re the alleged dangers
- Anti-amalgamists (scientists, lobbyists, evangelists & litigators) are durable people
- They have enlisted the American Civil Liberties Union to defend their freedom of speech
- (Safe Drinking water & Toxic Enforcement Act of 1986)

Rep. Congresswoman Diane Watson (D.-Calif)

Extracts from statement by Congresswoman Diane Watson
"Mercury in Dental Filling Disclosure & Prohibition Act"
Los Angeles, California. November 5th 2001

- Mercury now removed from all but one health care uses.
- USPHS agency Toxic Substances & Disease registry (1999 report (transplacental Hg → developing child's brain).
- 1997 Dentsply (USA) advise dentists not to use amalgam for children, & pregnant women, Hg hypersensitivity or kidney problems.
- Fillings are falsely called "Silver" & ADA gags dentists from talking about the risks.

Extracts from statement by Congresswoman Diane Watson
"Mercury in Dental Filling Disclosure & Prohibition Act"
Los Angeles, California. November 5th 2001

- In 1992 I wrote a law requiring the Dental Board of California to write a "Fact sheet" about the risks and efficacies of fillings
- The occupational risk is significant.
- We have abandoned other remnants of pre-Civil War medicine.
- If mercury amalgam is dangerous before placement and after removal who can conclusively say it's safe in between.

Summary: amalgam has had a turbulent history

MERCURY INTOXICATION IN A DENTAL SURGERY FOLLOWING UNREPORTED SPILLAGE

Brit. dent. J., 1976, 141, 179.

D. P. MERFIELD[1], B.D.SC., L.D.S.
A. TAYLOR[2], M.SC.
D. M. GEMMELL[3], B.SC., M.B.B.S.
J. A. PARRISH[4], M.D., F.R.C.P.

An unreported spillage of mercury in a dental surgery resulting in four non-fatal cases of mercury intoxication by inhalation of mercury vapour is described and clinical symptoms in relation to urine mercury levels noted and discussed. The method of detection and decontamination of the mercury vapour source is reported, and suggestions for preventing spillage of mercury and for reducing the risk of intoxication from such accidental spillage are made. Continued vigilance by all persons handling mercury is stressed.

The Surrey incident 1975

FIG. 1.—Plan of dental surgery premises.

Dental Materials

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

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

Take home message:

There is no evidence of mercury toxicity for patients

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

K. A. Ritchie,[1] F. J. T. Burke,[2] W. H. Gilmour,[3] E. B. Macdonald,[4] I. M. Dale,[5] R. M. Hamilton,[6] D. A. McGowan,[7] V. Binnie,[8] D. Collington[9] and R. Hammersley[10]

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.

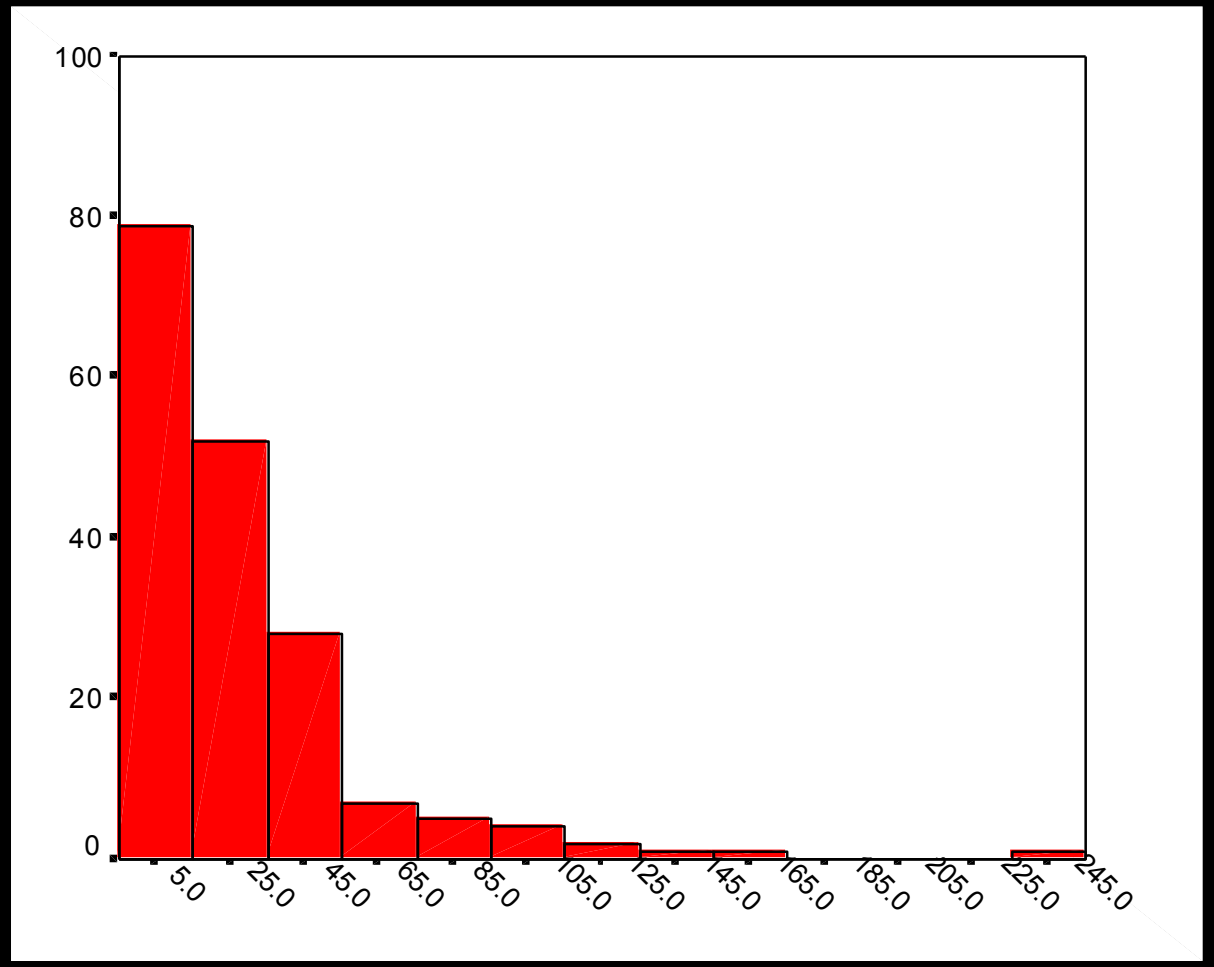
Methods Dentists were asked to complete a questionnaire including items on handling of amalgam, symptoms experienced, diet and possible influences on psychomotor function such as levels of stress

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 45 surgeries (25%) the personal dosimetry measurement (ie in the breathing zone of dental staff) was above the OES.

- 180 dentists in the W of Scotland
- Questionnaire on handling of amalgam, diet, health
- Urine, hair & nail samples tested
- Environmental mercury measurements made in 8 areas of the surgery
- 180 controls tested

- 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

Environmental Hg (micrograms/$m^{3)}$ readings around dental chair



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

Trends in amalgam use in the US, early ‘90s to ‘98 Brown et al.,2000

One surface restorations

Early ‘90s:Amalgam 62%, resin 38%

‘98: Amalgam 53%, resin 47%

Trends in amalgam use in the US, early ‘90s to ‘98 Brown et al.,2000

Three surface restorations

Early ‘90s:Amalgam 50%,

‘98: Amalgam 29%

Contemporary UK dental practice 2015/16: Comparison with previous results: premolars

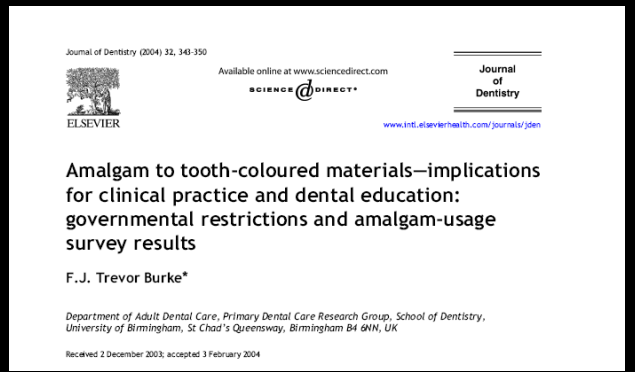
Amalgam for Class II, 2002….86%
Amalgam for Class II, 2008….59%
Amalgam for Class II, 2015….40%

Worldwide…

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

CONCLUSION: From the responses received, it would appear that there are few restrictions worldwide to the placement of dental amalgam

AND,composite use is increasing worldwide



Journal of Dentistry (2004) 32, 343-350

Available online at www.sciencedirect.com

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Amalgam to tooth-coloured materials—implications for clinical practice and dental education: governmental restrictions and amalgam-usage survey results

F.J. Trevor Burke*

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Received 2 December 2003; accepted 3 February 2004

Conclusion:
Amalgam use
is decreasing
and composite use
increasing in many
countries across
the world

Amalgam:Summary

- Satisfactory physical properties
- Cost effective in £s but not in tooth substance
- Good clinical performance, but potential for cusp fracture
- ***Not*** minimally invasive
- Un-aesthetic

Amalgam:Summary

- No governmental restrictions
- Has maintained dental public health for 120 years
- Environmental concerns…YES
- Toxicity issues for patients:NO

…. For dentists???

Patient Acceptance of Posterior Composite Restorations

F.J.T. Burke

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

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

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

F.J.T. Burke, BDS, MDS, FDS, MGDS, RCS (Ed), Part-Time Lecturer, Department of Conservative Dentistry, University of Manchester Dental School and General Practitioner, Manchester.

POSTERIOR COMPOSITES

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

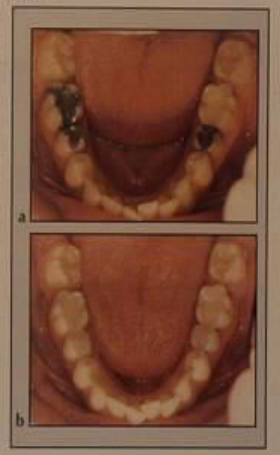
Studies are available which show satisfactory behaviour of these materials in clinical use.[9-11] From further studies, it can be seen that Occlusin restorations performed their intended purpose satisfactorily for periods of at least five years.[12]

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

PATIENT AWARENESS OF DENTAL AESTHETICS

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

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



Patient & dentist attitudes to amalgam are changing

2017:
Patient & dentist attitudes to amalgam *WILL HAVE TO* change

Diplomatic Conference for the Minamata Convention on Mercury

Annex A, Part II; Measures to be taken to phase down the use of dental amalgam

- ☠ Set national objectives for caries prevention
- ☠ Set national objectives aimed at minimising the use of amalgam
- ☠ Promote use of cost-effective and clinically effective Hg-free alternatives
- ☠ Promote R&D into quality Hg-free materials

Diplomatic Conference for the Minamata Convention on Mercury

Annex A, Part II; Measures to be taken to phase down the use of dental amalgam

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

Professor Chris Lynch

“… the now inevitable discontinuation in the use of amalgam”

“… the phase down is an inevitable trend”

Norway did it!

How?

1991, Directorate to reduce amalgam use
2003, National clinical guidelines - encouragement to reduce amalgam use. Amalgam no longer the material of choice for posterior teeth, informed consent needed from the patient if amalgam used
2007, Restrictions on mercury vapour emissions from crematoria
2008, Partial ban on amalgam use
2011, Complete ban, although dentists can apply for exemptions

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

Authors' Information

Dental Update invites submission of articles pertinent to general dental practice. Articles should be well-written, authoritative and fully illustrated. Manuscripts should be prepared following the Guidelines for Authors published in the April 2005 issue *(additional copies are available from the Editor on request)*. Authors are advised to submit a synopsis before writing an article. The opinions expressed in this publication are those of the

Trevor Burke

Minamata four years on

Readers will be aware that The Minamata Convention on Mercury is a global treaty, signed by the UK and over one hundred countries from all over the world in October 2013, with the intention of protecting human health and the environment from the adverse effects of mercury, for example, by limiting the use of mercury from all sources, including LED light bulbs, fluorescent tubes, fertilizers, thermometers and, of course, dental amalgam. The agreement indicated that the mercury limitation would commence within four years, and Annex A part II dealt specifically

ratification'. The arrangements sealed within the Convention were that it would enter into force on 15 August 2017 in the ratifying countries, that being 90 days after the fiftieth ratification was received.[1] Regulation (EU) 2017/852 of the European Parliament was agreed on 17 May this year, the implication of this being that, from 1 July 2018, dental amalgam *'shall not be used for dental treatment of deciduous teeth, of children under the age of 15 years and for pregnant or nursing women, except when deemed strictly necessary by the dental practitioner, based on the specific medical needs of the patient'*. I cannot think of anything falling into that category, with the exception of allergy to a constituent of an alternative

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specific retention level of 95% of amalgam particles. Chuck Palenik's article on this subject in the current issue helps shed some light on the situation in the US.

Despite all of this, the European Parliament voted, earlier this year, in favour of a gradual phase down in dental amalgam use rather than the total ban which was rumoured to be made in 2022. Indeed, a British Dental Association press release in May 2017 proudly announced that they had campaigned against a ban on amalgam and that the phase out of amalgam was unlikely to take place until 2030. Apart from the mercury argument, this ignores the benefits of using an adhesive material such as resin composite – one being less invasive cavities, which are less likely to result in fracture of posterior teeth, and apart from the fact that patients appear to prefer tooth-coloured restorations in their back teeth. Furthermore, results of a survey of the views of a convenience sample of 249 regularly attending dental patients in relation to the materials used in their teeth, indicated that 31% had anxieties about use of amalgam in their mouth and provoked anti-amalgam comments from 66 respondents, principally those who had worries regarding amalgams on health grounds:[2] even I was astounded by their depth of feeling!

I can understand the Department of Health in the UK being anxious about having to fund an alternative to dental amalgam, given that restorations in the main alternative, resin composite, were estimated to take 2.5 times longer to place than amalgam.[3] However, those data were published a long time ago, and it could be that

Do amalgam substitutes exist?

Indirect

Cast alloys

Ceramics

Resin-based materials

All of these are more than X4 as expensive as amalgam

Do amalgam substitutes exist?

Direct – small cavities

Resin composite

Glass ionomer

Does GI require more development for this indication?

FJ Trevor Burke

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

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

8 papers on GI in posterior teeth included

Conclusions

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

However, the conditions for longevity are not readily identified.

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

Myths about posterior composites

- They shrink on polymerisation
- They are technique sensitive
- Problems achieving good contact point
- Problems in deep boxes
- They take longer to place because of incremental placement and etching/bonding
- Dentists aren't trained to place them
- Perceived longevity less than amalgam

Polymerisation contraction

A longstanding problem with resin composite – polymerisation contraction STRESS

Five ways:

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

The Filtek™ Silorane System

The first composite to achieve 1% shrinkage

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

Perceived difficulties with Silorane

and, some dentists didn't realise the benefits of low shrinkage stress!

- Needed its own dedicated 2-stage adhesive
- Only 2.5mm depth of cure
- Large filler particles
- Aesthetics suboptimal, other than A2
- Poor radiopacity
- Difficult manufacturing process

Filtek One Bulk Fill Posterior Restorative

- One-step placement
- Fast and easy procedure
- No additional (expensive) dispensing devices
- Stress relief to enable 5 mm depth of cure
- Better in vitro wear resistance than market-leading bulk fill materials
- Excellent handling and sculptability
- Nanofiller technology
- Two innovative methacrylate monomers act to lower polymerization stress without compromising wear

Novel Stress Relieving Monomer System

AUDMA

High molecular weight dimethacrylate– acts to lower volumetric shrinkage

AFM

Addition-fragmentation (AF) monomer

– Reacts into developing polymer network through terminal methacrylate bonds like other dimethacrylate monomers

– Central AF group can fragment and release stress

– Fragment may then polymerize into network in a lower stress orientation compared to its pre-fragmented state.

Filtek One Bulk Fill Posterior Restorative: Advantages over Silorane

- One-step placement
- 5 mm depth of cure
- Can use dentine bonding agent of choice
- Therefore, faster than Silorane Bond
- Easier polishing due to nanofiller
- Potentially better aesthetics

BUT

- Still excellent stress relief
- Still excellent handling and sculptability

3MESPE Filtek Bulk Fill shows low shrinkage stress Palin W, Watts D 2014

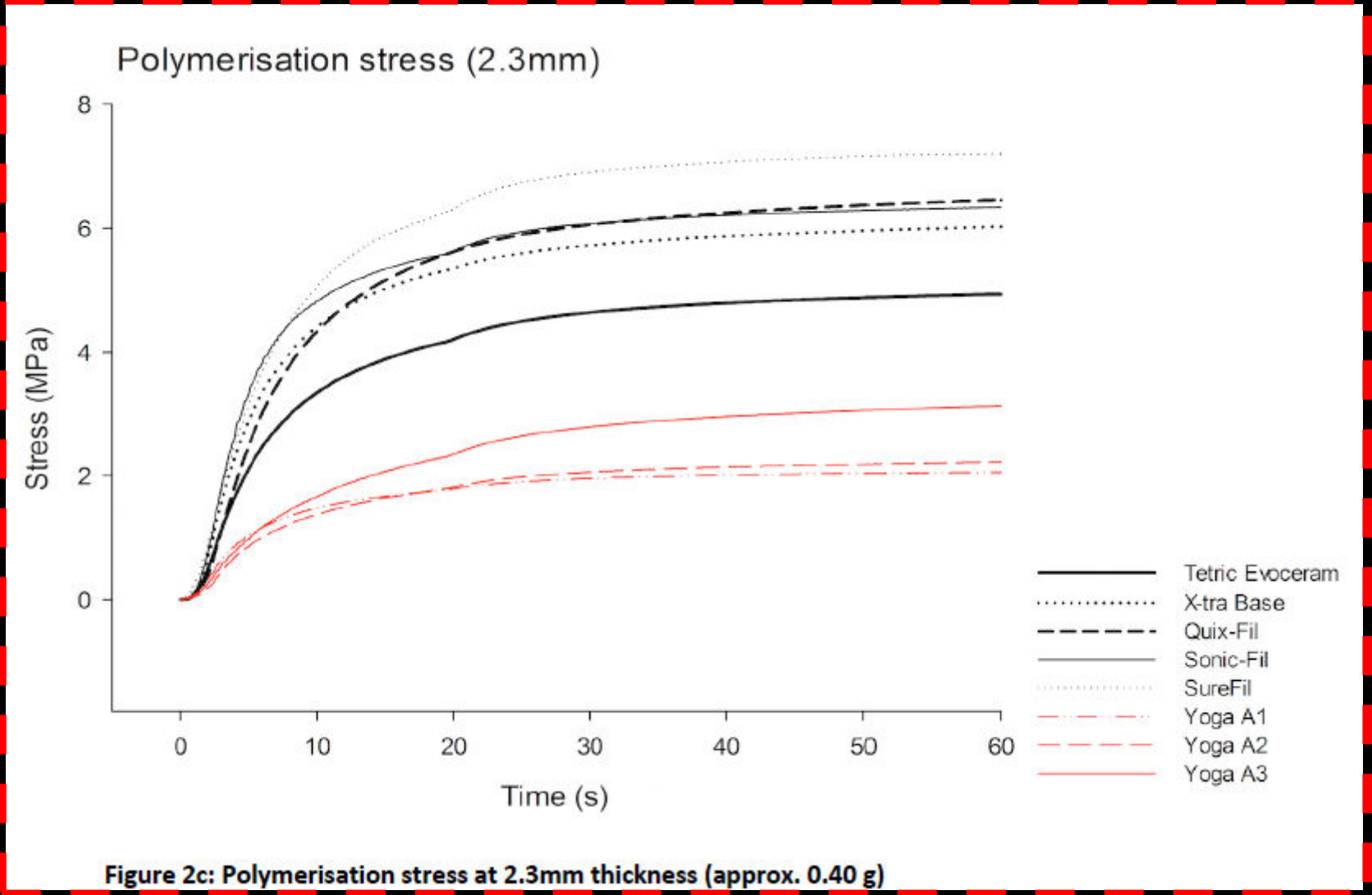

Figure 2c: Polymerisation stress at 2.3mm thickness (approx. 0.40 g)

Myths about posterior composites

- They shrink on polymerisation
- They are technique sensitive
- Problems achieving good contact point
- Problem
- They take longer to place because of incremental placement and etching/bonding
- Dentists aren't trained to place them
- Perceived longevity less than amalgam

Not a problem!

Myths about posterior composites

- They shrink on polymerisation
- They are technique sensitive

With new matrix techniques, new materials, and proper training, this not a problem

- They take longer to place because of

Indeed, King's students who place large numbers of posterior composites, struggle with amalgam

Myths about posterior composites

- They shrink on polymerisation
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For larger cavities

Supermat (Kerr-Hawe) is what you need

Sectional matrices: Do they work?

A randomised clinical trial on proximal contacts of posterior composites
Loomans BAC, Optam NJM, Roeters FJM, et al
J.Dent.2006:34:292-297

- 71 Class II composite restorations
- Randomly assigned to one of 3 groups
- One circumferential (Tofflemire) , 2 sectional matrices

- RESULT
- Sectional matrices with separation rings resulted in stronger contact strength

Myths about posterior composites

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No enamel at the margin

Don’t tell me that amalgam will work well here!

Take home message

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

Amalgam is not a good idea in this situation.

Myths about posterior composites

- They shrink on polymerisation
- They are technique sensitive
- Problems achieving good contact point
- Problems in deep boxes
- They take longer to place because of incremental placement and etching/bonding
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- Perceived longevity less than amalgam

Bulk Fill Flowables provide:

- Potentially faster restorations in back teeth
  - Fewer steps than incrementally placed composites
- Potentially easier restorations in back teeth
  - Flowable viscosity provides easy adaptation
  - Potentially fewer voids

BULK FILL IS IN!

Bulk fill is *IN*!

Other bulk fill flowable materials are now available from 3MESPE, Voco, Ivoclar etc

But, these materials need a conventional composite topping because their wear resistance isn't good enough!

A new generic type has been created

The state of things to come!

New bulk fills that don’t need a topping!

Myths about posterior composites

New bulk fill materials are considerably faster than the materials which required incremental placement

- Problems in deep boxes
- They take longer to place because of incremental placement and etching/bonding
- Dentists aren't trained to place them
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Myths about posterior composites

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Myths about posterior composites

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- Perceived longevity less than amalgam

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

Some studies from general dental practice

RESEARCH REPORTS
Biomaterials & Bioengineering

N.J.M. Opdam*, E.M. Bronkhorst,
B.A.C. Loomans,
and M.-C.D.N.J.M. Huysmans

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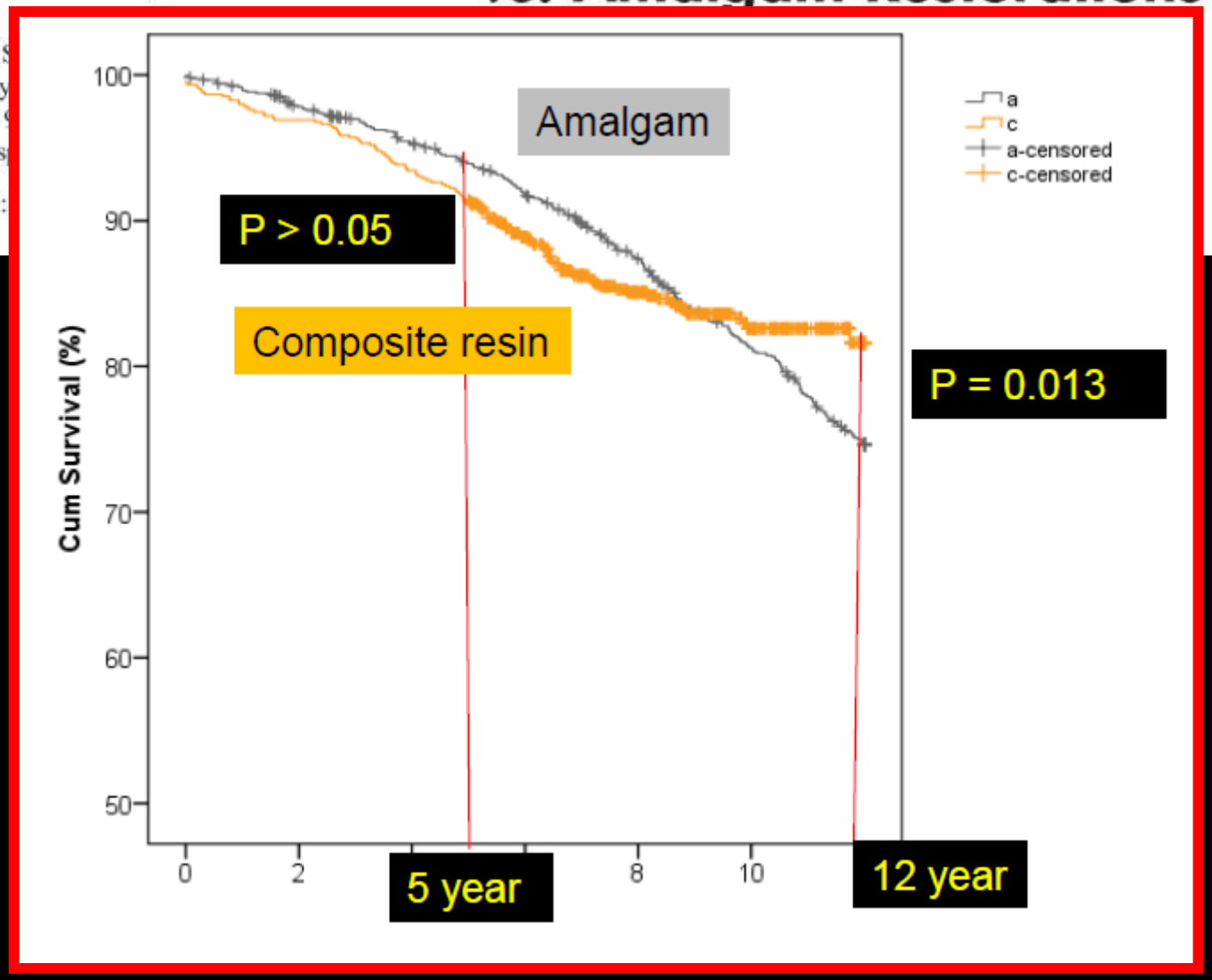
J Dent Res 89(10):

12-year Survival of Composite *vs.* Amalgam Restorations



22 year retrospective evaluation of posterior composites

DENTAL MATERIALS 27 (2011) 955–963

available at www.sciencedirect.com

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journal homepage: www.intl.elsevierhealth.com/journals/dema

22-Year clinical evaluation of the performance of two posterior composites with different filler characteristics

Paulo A. Da Rosa Rodolpho[a], *Tiago A. Donassollo*[b], *Maximiliano S. Cenci*[b], *Alessandro D. Loguércio*[c], *Rafael R. Moraes*[b], *Ewald M. Bronkhorst*[d], *Niek J.M. Opdam*[d], *Flávio F. Demarco*[b,*]

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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 examiners (not the dentist who placed the restorations!) using USPHS

22 year retrospective evaluation of posterior composites

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

22 year retrospective evaluation of posterior composites

Results. 110 failures were detected. Similar survival rates for both composites were observed considering the full period of observation; better performance for the midfilled was detected considering the last 12 years. There was higher probability of failure in molars and for multi-surface restorations.

Significance. Both evaluated composites showed good clinical performance over 22 years with 1.5% (midfilled) and 2.2% (minifilled) annual failure rate. Superior longevity for the higher filler loaded composite (midfilled) was observed in the second part of the observation period with constant annual failure rate between 10 years and 20 years, whereas the minifilled material showed an increase in annual failure rate between 10 years and 20 years, suggesting that physical properties of the composite may have some impact on restoration longevity.

Overall failure was *circa* 2% per annum

8 year evidence from dental practice

- 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 13.7years
- 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%

8 year evidence from dental practice

Overall failure rate: 2% failure per annum

DENTAL MATERIALS 28 (2012) 87–101

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journal homepage: www.intl.elsevierhealth.com/journals/dema

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

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

Keywords:
Clinical trials
Failure
Long-term evaluations
Longevity
Posterior restorations
Resin composites
Survival

that annual failure rates between 1% and 3% can be achieved with Class I and II posterior composite restorations depending on several factors such as tooth type and location, operator, and socioeconomic, demographic, and behavioral elements. The material properties showed a minor effect on longevity. The main reasons for failure in the long term are secondary caries, related to the individual caries risk, and fracture, related to the presence of a lining or the strength of the material used as well as patient factors such as bruxism. Repair is a viable alternative to replacement, and it can increase significantly the lifetime of restorations. As observed in the literature reviewed, a long survival rate for posterior composite restorations can be expected provided that patient, operator and materials factors are taken into account when the restorations are performed.

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%”.

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

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ABSTRACT

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

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

Results: A wide variation in annual failure rate (AFR) exists between the different dental practices varying between 2.3% and 7.9%. Restorations in elderly people (65 years and older, AFR 6.9%) showed a shorter

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

The ultimate evidence

CLINICAL REVIEW

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J Dent Res 93(10):943-949, 2014

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

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.

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

LAST,
The myth that amalgams do well in patients with high caries activity…..

Garbage!

The Evidence Base

- 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
- 1990 to 2006

Methods

- Modified Kaplan Meier survival methodology was used to create survival curves of restorations formed in differing restorative materials and different cavity designs, by tooth position, age, gender and charge-paying status of patient, and by age and gender of dentist.

Results

- More than three million different patient IDs and more than 25 million courses of treatment were included in the analysis, each of which includes data down to individual tooth level. All records for adults (aged 18 or over at date of acceptance) were included.

Amalgam:Time to re-intervention: Effect of average annual treatment need

The effect is similar for time to extraction

Restorations in patients with high treatment need survive 40% less well at 10 years

Myths about posterior composites

- They shrink on poly[illegible]tion
- They are techni[illegible]nsitive
- Problems a[illegible]g good contact point
- Problems in deep boxes
- They take longer to place because of incremental placement and etching/bonding
- Dentists aren't trained to place them
- Perceived longevity less than amalgam

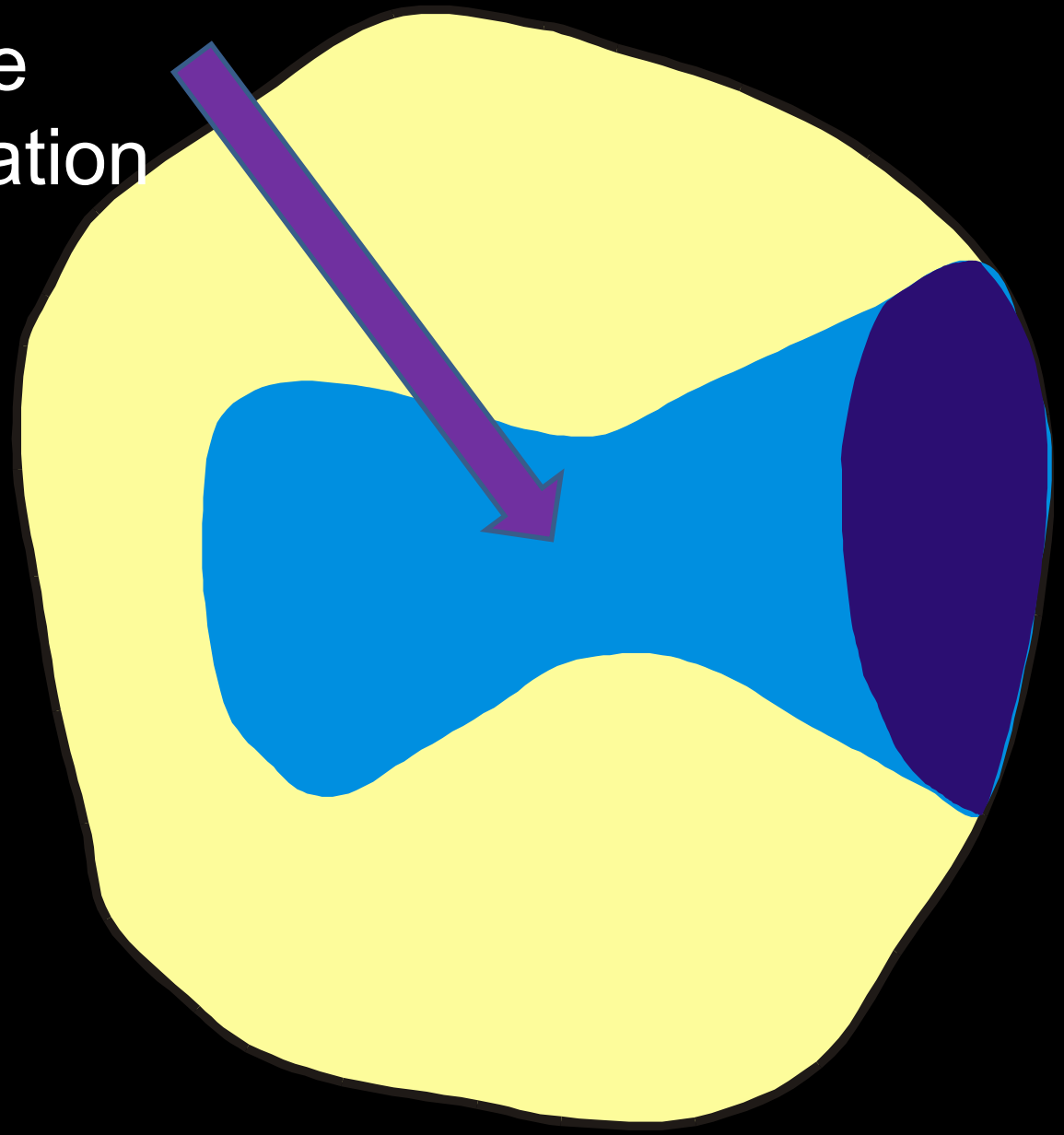
All sorted!

Massive advantages of composite

Why white?

- Tooth coloured
- Minimal risk to the patient
- No risk to the dentist
- Adhesive cavity preparation possible

Massive tooth substance saved by using adhesive composite restoration



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

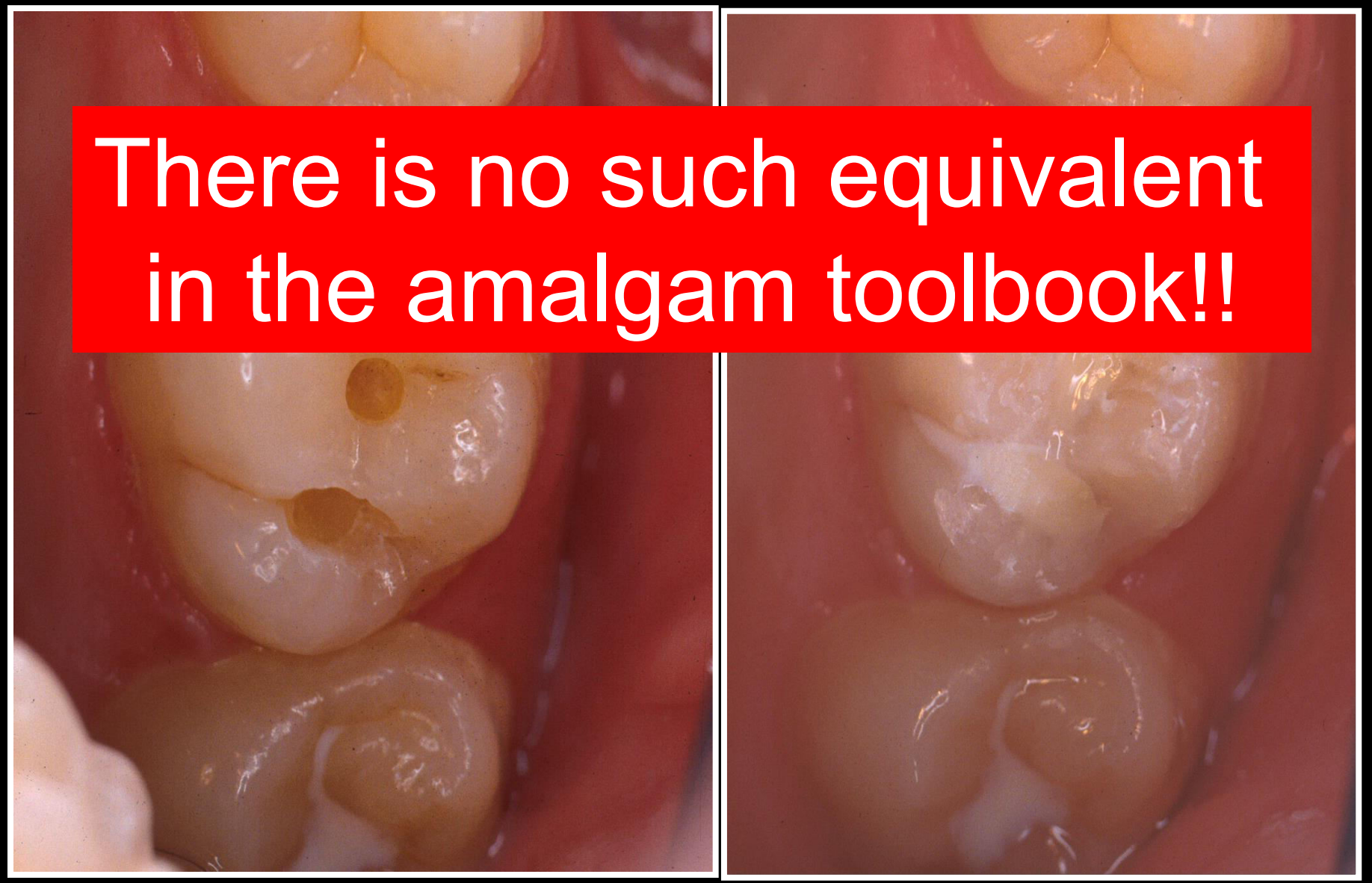
Wilson & McLean, 1988

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

The Preventive Resin Restoration makes this possible



There is no such equivalent in the amalgam toolbook!!

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)

Excellent survival rates

Ultraconservative and cariostatic sealed restorations: Results at year 10

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

JADA.1998:129:55-65

156 pairs of restorations,85 evaluated at 10 years
Three groups of restorations in “frankly cavitated” lesions :

Split mouth design

- Conventional amalgam,
- Conservative amalgam/sealed,
- Cariostatic sealed composite

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

Ultraconservative and cariostatic sealed restorations: Results at year 10

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

JADA.1998:129:55-65

Restorations assessed using USPHS criteria

- 12 failures from 85 sealed composites (14%) (caries only at margin of 1 restoration)
- 1 failure from 44 sealed amalgams (2%)

(caries only at margin of 1 restoration)

- 7 failures from 41 unsealed amalgams (17%) (caries at margins of all 7 failed restorations)

Ultraconservative and cariostatic sealed restorations: Results at year 10

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

JADA.1998:129:55-65

CONCLUSIONS, verbatim from paper

- "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 the lesions at 10 years"

Black or white?

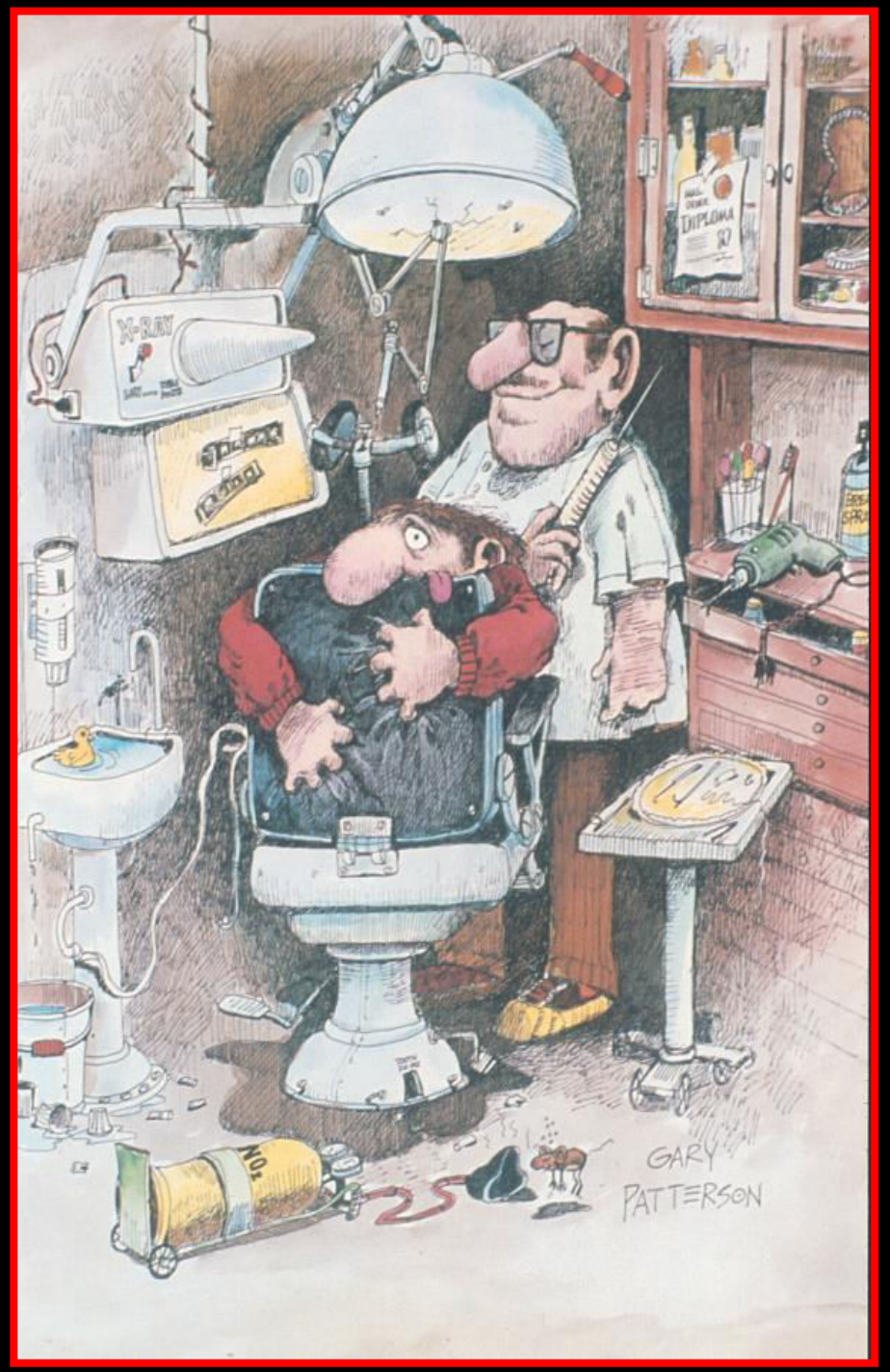
Non-adhesive	Adhesive
Tooth destructive	Non-destructive
Non-aesthetic	Aesthetic
Technique friendly	Satisfactory
Longlasting	Longlasting

The evidence in favour of non-amalgam restorations is overwhelming

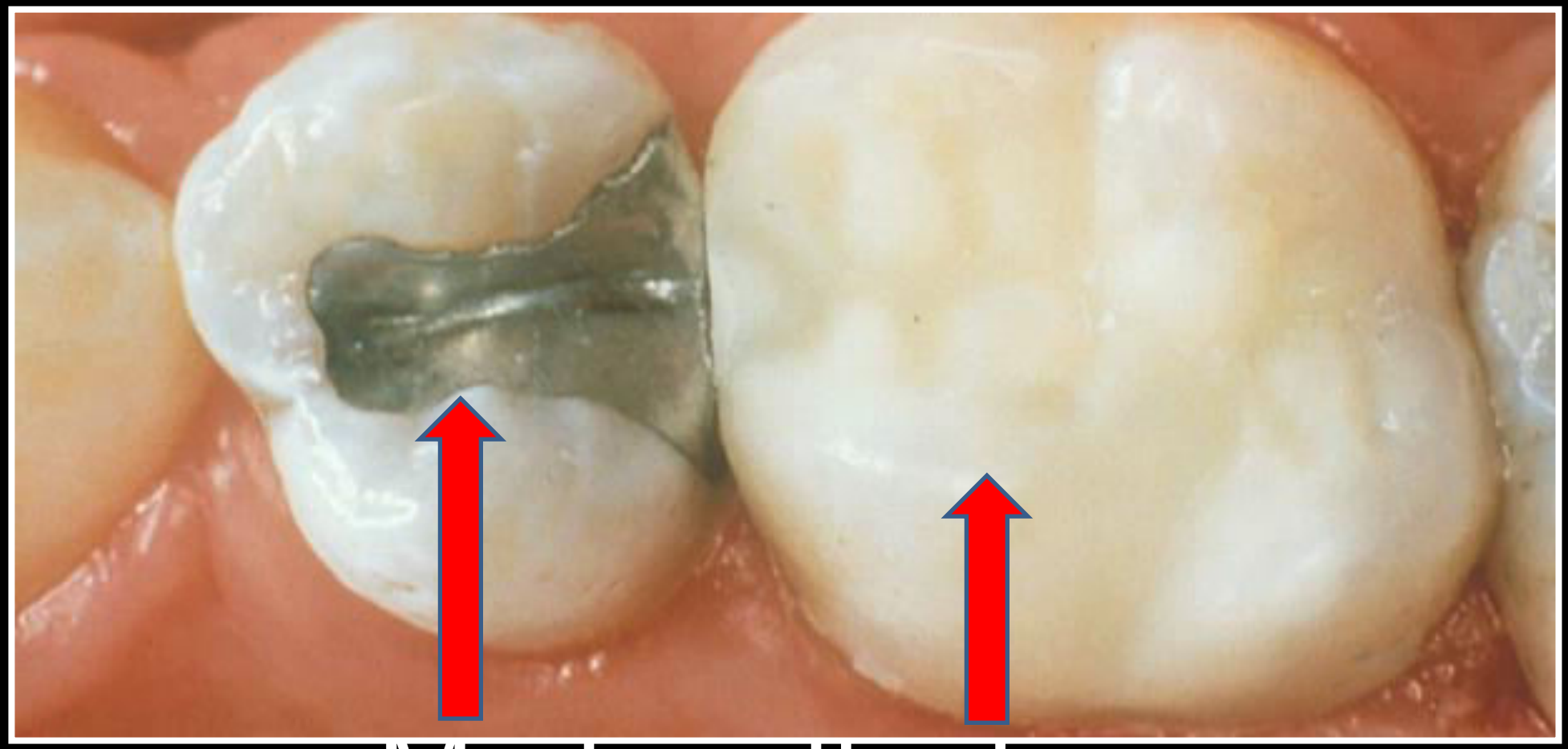
120 years of amalgam

For how much longer?

It is not environmentally friendly!



Shall we stay in the dark ages forever?



Modern thinking
vs The Amalgamists!