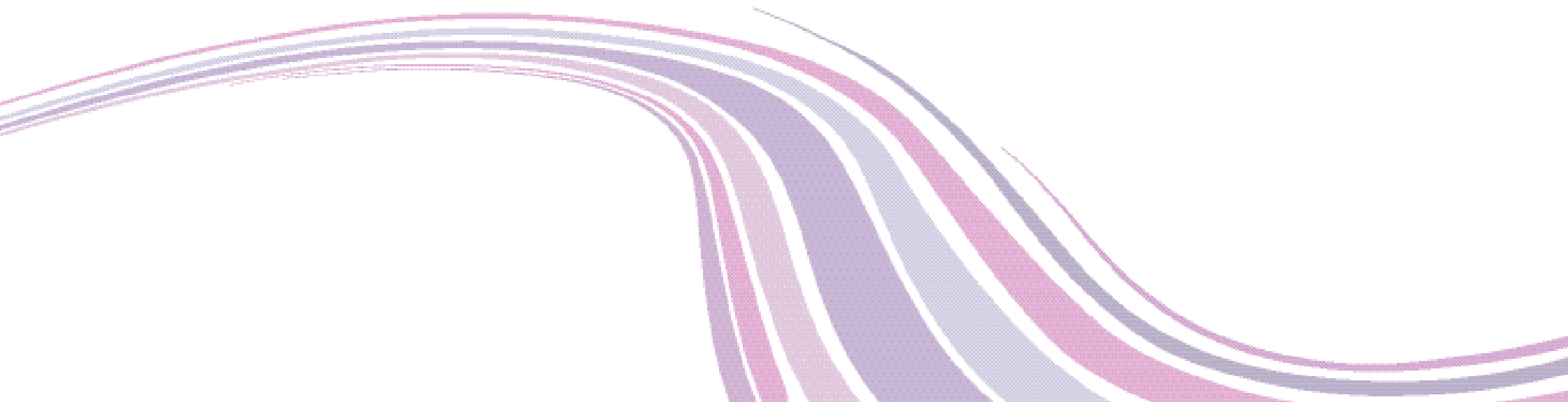


Clinical effectiveness of gold inlays versus fillings



This evidence summary aims to locate and summarise evidence to compare the clinical effectiveness of gold inlays against all types of filling materials used for restorations. It does not include detailed descriptions of the studies cited nor does it include information that was not presented in the literature.

The [Curious about](#) website encourages dental professionals to raise issues where a review of the available evidence would provide a useful resource for other dental professionals. Where there is a lack of evidence, the topic is considered for research and an award is made available.

These activities are sponsored by the Shirley Glasstone Hughes Fund, a restricted fund within the BDA Trust Fund. The focus of the fund is research into primary care dentistry and aims to generate a body of relevant research for practising dentists.

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Key findings

- Few studies have been undertaken to understand the clinical effectiveness of gold inlays versus other filling materials.
- Current evidence indicates that there are no significant differences between gold inlays and amalgam, composites and silicates.

Research question

What is the clinical effectiveness of gold inlays versus fillings?

Key terms

Clinical effectiveness:

A measure of the extent to which a particular intervention works.

Inlays:

Restorations of metal, porcelain, or plastic made to fit a cavity preparation, then cemented into the tooth. (Medline MeSH term)

Filling:

A quantity or piece of material that fills or is used to fill something⁽¹⁾

The case for action

Dental caries is one of the most common diseases affecting the UK population. Despite often being preventable it remains a sizable problem with a large proportion of the population being affected.^(2;3) Eighty five per cent of adults in England, Wales and Northern Ireland have a tooth affected by a restoration with the average number of restored but otherwise sound teeth being 6.7 (2009 figures).⁽²⁾ As dental health improves and more teeth are being retained, the demand for restorative treatments will be greater than in past years.^(2;4) In 2011 the population of England stood at 53 million⁽⁵⁾ and for the period 2011 - 2012 an estimated 7.9 million courses of treatment were reported to contain permanent fillings, sealant restorations or inlays.⁽⁶⁾ The financial burden this places on NHS resources is high with the cost of simple restorations having been reported as £173 million per year in England and Wales (1995 – 1996 figures).⁽⁷⁾

Evidence suggests that dental restorations have a limited life span and that once a tooth has been restored, the restoration is likely to be replaced several times during the patient's lifetime.⁽²⁾ Failure of dental restorations is a major problem,⁽⁸⁾ and their replacement is costly and can be destructive.⁽⁹⁾ Replacement of restorations forms a major part of a primary care practitioner's workload⁽⁸⁾ with one suggestion being that approximately 60 per cent of restorative work undertaken by UK practitioners is replacing existing restorations.⁽¹⁰⁾ Failure has been associated with:⁽¹¹⁾

- general patient factors such as socioeconomic status
- tooth factors such as occlusal load
- operation and restoration process factors such as quality of finish
- subjective factors such as clinical setting.

Of the restorative materials available, gold alloys used for inlays consist of gold, copper and other materials and create strong and effective restorations. Though this material has excellent durability, wears well and is resistant to corrosion, it is falling out of favour due to its aesthetic properties and high cost.⁽¹²⁾ Filling materials that can be utilised as alternatives to a gold inlay include composite materials, glass ionomers and amalgam. Composite resins and glass ionomers have the advantage of being tooth coloured while amalgam is strong, self-sealing and durable.⁽¹²⁾

Being aware of the clinical effectiveness of the dental materials available for restorations allows for the sensible use of resources and the ability to refine clinical practice. The usefulness of this information increases when factors such as cost effectiveness are considered⁽¹³⁾ In some cases, measuring clinical effectiveness is straightforward but in others, like dental restorations, where outcomes are more subjective and not based on universally accepted criteria, determining effectiveness becomes more problematic.

The evidence

Few studies have been undertaken to understand the clinical effectiveness of gold inlays versus other filling materials. The current findings indicate that there are no significant differences between gold inlays and amalgam, composites and silicates.

Three publications (Table 1) with the following comparisons were located measuring durability (comparisons 1 and 2), failure rates (comparison 3) and survival rates (comparison 4):

- Class I and Class II gold inlay to Class I and Class II amalgam⁽¹⁶⁾
- Class III gold inlay to Class III silicate⁽¹⁶⁾
- Class I and MOD gold inlay to Class I and MOD amalgam⁽¹⁷⁾
- Class IV gold inlay to Class IV resin composite⁽¹⁸⁾

The two studies comparing gold inlays with amalgam were more than 30 years old and neither demonstrated any significant differences between the two materials, with regards to durability or failure, over a ten year period.^(16;17) Comparison of gold inlays with resin composite at ten and 15 years⁽¹⁸⁾ and Class III gold inlays with Class III silicates over ten years⁽¹⁶⁾ demonstrated no significant differences in either survival rate (compared with resin composite) or durability (compared with silicate). Fifty per cent of gold restorations and 48 per cent of resin composite restorations survived to 15 years⁽¹⁸⁾ while 50 per cent of gold inlays and 17 per cent of silicate fillings survived to ten years.⁽¹⁶⁾

A systematic review was located covering the longevity of routine dental restorations in permanent posterior teeth and factors influencing its variability⁽¹⁹⁾ but, like many publications retrieved during the search stage, data for gold inlays was pooled with that for other cast restorations so no relevant data could be extracted. Overall, though not strictly relevant to this summary,

the systematic review was unable to reach a conclusion on how long routine dental restorations last as the studies available for analysis were imperfect in design and too limited to allow formal statistical exploration.

One retrospective study was located providing extractable data for the cost effectiveness of gold inlays in comparison to other dental filling materials.⁽¹⁸⁾ The study found that for gold inlays covering more than two surfaces to be cost effective after 15 years, in comparison with composite resins, the relative cost would need to be reduced from 7.4 to around 2.0.

The same study gave composite restorations a relative cost of 1.9 with (1 = A\$50). As with studies investigating the longevity, durability and other clinical features of restorative materials, the publications retrieved by the search covering the cost effectiveness of gold inlays often presented pooled data covering gold inlays, onlays and crowns preventing data extraction.

Ref	Study aim and type	Population	Experimental and control groups	Outcome measure	Summary of relevant results
Allan ⁽¹⁶⁾ (1969)	Compare amalgam fillings to noble metals. Survey	Patients (unselected) attending a UK dental school clinic.	<ul style="list-style-type: none"> • Class I and Class II gold inlay versus amalgam • Class III gold versus silicate • Placed in general practice and armed services. 	Length of restoration service charted in years	<ul style="list-style-type: none"> • No significant difference between failure rates for either group
Crabb ⁽¹⁷⁾ (1981)	Replacement or loss over a ten year period Retrospective study	UK dental hospital patients who had been attending for ≥10 years; n=15	<ul style="list-style-type: none"> • Class I and MOD gold inlay (n=146) versus amalgam (n=530) • Placed in UK dental hospital 	Cumulative failure	<ul style="list-style-type: none"> • No significant difference between failure rates. • Survival ≥10 years gold 41.4 % amalgam 37.2%
Smales ⁽¹⁸⁾ (1996)	Long term survival of dental materials. Retrospective study	Randomly selected patients of three city practices in Adelaide who had been regularly attending for ≥10 years; n=100	<ul style="list-style-type: none"> • Class IV gold inlay (n=18) versus resin composite (n=57) 	Restoration survival	<ul style="list-style-type: none"> • No significant difference between failure rates in the two groups • Gold survival 56.3% at 10 years, 47.7% at 15 years • Composite survival 64.9% at 10 years and 50.3% at 15 years

Due to the age of the included studies and the setting for restoration placement it is not clear how relevant the presented results are to current, and general, practice. Dental materials have evolved since the studies were performed and questions have been raised as to the applicability to general practice of studies carried out in teaching environments. Compared to general practice, procedures carried out in such environments follow gold standards and are carried out with fewer time pressures, patients attending are more loyal and are motivated to maintain good oral hygiene.⁽²⁰⁾ There is also evidence that restorations placed in the Armed Forces have a significantly longer functional life than those placed under NHS regulations.⁽²¹⁾

Though longitudinal studies in general practice exploring restoration failure are scarce due to factors such as cost and patient participation, retrospective studies of patient records can provide useful data.⁽²²⁾ Further research into the clinical effectiveness of gold inlays in comparison with other filling materials would provide a useful addition to practitioners' knowledge enabling them to utilise their resources in the most effective manner.

Methods

Search strategy

The following resources were searched:

- MEDLINE (Ovid and Pubmed)
- TRIP
- Cochrane library (DARE, NHS EED, HTA Database, Cochrane reviews)
- Scopus
- Web of Knowledge
- Centre for Reviews and Dissemination

Search terms for Ovid MEDLINE included: dental alloys and gold inlay. Equivalent searches were employed for other databases.

Searches were carried out from the earliest date possible and for Ovid was limited to systematic reviews, meta-analysis and clinical trials. There was no limit on article language for any search. Hand searching of reference lists and grey literature and further database searches specific for economic analysis and cost effectiveness were carried out.

Studies were included if they compared gold inlays with any filling material such as amalgam, glass-ionomers, composite resins or compomers. For the purpose of this summary, primary outcome measures for clinical effectiveness could be any of the following: durability of the restoration, survival of the restoration, adverse events, marginal integrity of the restoration, restoration failure or any other clinically important outcome (e.g. occlusion). Studies were excluded if they were not based on clearly stated decision-making criteria, based on estimated data or conducted on extracted teeth.

Searches were conducted in May 2013.

Results

Three publications were found to be relevant and two (additional) potentially relevant publications were not included as the articles were Japanese and full text could not be obtained.^(14;15) Appraisal indicated that all publications had some weaknesses. For example, information covering study design, study population, outcome factors and statistical analysis was incomplete and data covering confounding factors was absent.

The settings for data collection varied covering a UK undergraduate dental school,⁽¹⁶⁾ a UK teaching hospital,⁽¹⁷⁾ and three city centre practices in Adelaide, Australia.⁽¹⁸⁾ The clinical setting in which the restorations were placed varied from general practice,^(16;18) to the armed services⁽¹⁶⁾ and a dental school.⁽¹⁷⁾

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