Efficacy of preformed metal crowns vs. amalgam restorations: in primary molars: a systematic review

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Authors' objectives
To evaluate the treatment efficacy of preformed metal crowns vs amalgam restorations in primary molars.

Searching
MEDLINE was searched back to 1972 using the following keywords: 'preformed metal crown', 'stainless steel crowns', 'primary molar', 'deciduous molar' and 'clinical and in vivo'. Articles cited in the literature were obtained.

Study selection
Study designs of evaluations included in the review
Inclusion criteria for study design were not defined. Retrospective and prospective studies (including a non randomised clinical trial and a prospective evaluation) that provided data to compare treatment outcomes were included. Study durations ranged from 1.6 to 10 years.

Specific interventions included in the review
Comparisons of preformed metal crowns (PMC) in primary molars with and amalgam control in primary molars were eligible. Only restored control teeth were included and where differentiation was possible, Class II amalgam respirations were selected but where differentiation was not possible but amalgam had been used as the control combined data from Class I and II were used. The majority of treatments were carried out in a dental hospital or hospital pediatric clinic. Composite and glass ionomer restorative materials were excluded.

Participants included in the review
Inclusion criteria for participants were not defined. Patients receiving restoration treatment of primary molars were included. Where stated, patient age at placement ranged from an average of 3 to 7 years, variable risk of caries (second degree caries, possibly high, and medium to high), and variable endodontic therapy status (some, 32% of study teeth, and pulpotomies in all study teeth). Participants included children who had been referred for treatment because of behavioural problems. The authors report that, in general, details of patients' characteristics were not reported in the primary studies.

Outcomes assessed in the review
Eligible outcomes were either longevity or clinical success rates. False failures were excluded where possible and were indicated as orthodontic extractions, extractions due to pulp pathology apparently unrelated to the restoration, and caries occurring in a restored tooth remote from the restoration.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
The authors do not state that they assessed validity.

Data extraction
The following data were extracted: study design; unit of randomisation; type of control restoration; operators; patient source and treatment location; patient's caries susceptibility; sample size; duration of study; patient age at placement; endodontic status of study teeth; failure rate of preformed crown vs amalgam; main reasons for restoration failure; and
whether true or false failure rates were reported. A table of treatment outcomes was created comparing successful and failed restorations for each study. The odds ratio (OR) and 95% confidence intervals were calculated for each study outcome. The authors do not state how data were extracted for the review, or how many of the reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
An overall OR and 95% CI was calculated using the Mantel-Haenszel method (see Other Publications of Related Interest no.1).

How were differences between studies investigated?
Potential causes of heterogeneity were discussed and OR and 95% intervals for individual studies were compared and a forest plot (OR and 95% CI of each study) was displayed.

Results of the review
A total of ten studies were included (4410 patients) comprising eight retrospective studies, one non randomised clinical trial (188 patients) and one prospective evaluation (732 patients).

Included studies were published between 1975 and 1997 and involved patients from different countries and of different ages at restoration placement.

Potential causes of heterogeneity included differences: in patient populations; in methodology; in severity of caries risk; in levels of operator skill; in treatment methods or materials used; in study duration; in definitions of false failure; in changes in caries rates and materials used over the time span of the studies; or various combinations of these.

The following information was not consistently or comprehensively reported: characteristics of patients; and decision process by which an amalgam or PMC restoration was selected. Other problems included the difficulty in establishing the correct cause of failure. Four studies included failures due to pulp inflammation that were seemingly not directly associated with the restoration. In three studies all failures due to pulp inflammation were counted as failures of the restorations.

Reason for failure:

The main reason given for true restoration failure for PMC was loss of a crown leading to the need for recementation, and secondary caries and fracture for amalgam.

Failure rates for PMC vs amalgam:

Across all studies a consistently lower failure rate for PMC compared with amalgam was found. Failure rates ranged from 1.9% to 30.3% for PMCs and 11.6% to 88.7% for amalgam restorations.

Overall significantly lower failure rates were found for PMC compared with amalgam. Pooled OR = 0.23 (95% CI: 0.19, 0.28).

The forest plot did not indicate similar results between studies but showed heterogeneity between studies.

Authors' conclusions
Analysis of the literature, though mainly retrospective studies, demonstrated evidence of a more favourable outcome for preformed metal crowns than for amalgam in primary molars requiring multisurface restoration.

CRD commentary
The aims were stated and inclusion criteria defined in terms of intervention, participants, and outcome of interest though the definition of outcome appears to have varied between studies and it is unclear what influence the variability
of the definition had on results. Limiting the literature search to only one database and published studies may have resulted in the omission of other relevant studies and the possibility of publication bias. It was not reported whether any language restrictions were applied and methods used to select primary studies were not described. Validity of included studies was not assessed and results were not considered according to any indicator of quality such as study design. Some relevant information on the primary studies was presented in tabular format. No assessment of statistical heterogeneity was performed. The forest plot indicated heterogeneity and thus pooling of results from studies was not appropriate. Several potential sources of clinical heterogeneity between studies were discussed but no investigation of heterogeneity was undertaken. The discussion includes mention of some potential sources of bias in the evidence presented and the dubious ethics of involving children in a clinical trial of a dental procedure.

Evidence presented supports the authors' conclusions though, as the authors' rightly stated, caution is advised in view of the preponderance of evidence based on retrospective studies in which outcomes were variably defined.

Implications of the review for practice and research
Practice: The authors do not report any clinical implications of the review.

Research: The authors report that research is required to evaluate the relative ratio of benefit to harm in tooth removal for PMC versus a multisurface amalgam; to compare contemporary resin-modified glass ionomer cements with the conventional glass-ionomer or zinc phosphate cements in regard to long-term retention: and to evaluate the long-term effect of PMC on the permanent successor tooth.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.