A systematic review and meta-analysis of the effects of fluoride toothpastes on the prevention of dental caries in the primary dentition of preschool children

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CRD summary
The authors concluded that standard fluoride containing toothpastes were effective in reducing dental caries in the primary teeth of preschool children and should be recommended for use with this age group. This conclusion appears overly strong given the reliance on a small number of potentially methodologically vulnerable studies.

Authors' objectives
To assess the effects of fluoride containing toothpastes in preventing dental caries in the primary dentition of preschool children.

Searching
Six electronic databases including MEDLINE and EMBASE were searched to January 2010. Registers of ongoing trials, meeting abstracts, dentistry journals and reference lists of potentially eligible studies were searched for additional studies. Search terms were reported, specialists were contacted, and no language restrictions were applied.

Study selection
Randomised and quasi-randomised studies that compared fluoride toothpaste only versus placebo or no intervention were eligible for inclusion. Observational and non-randomised studies had to report a minimum follow-up of one year. The population of interest was children in the primary dentition phase without special general or oral health conditions, aged no more than seven years at outcome assessment. Studies were required to report on the numbers of filled teeth, teeth or surfaces that were decayed or missing due to caries, and the proportion of children who developed dental caries in primary dentition. Caries had to be reported separately for enamel and dentine levels, and at cavitated and non-cavitated stages.

Included studies were conducted in China, England and Lithuania and published between 1998 and 2008. Most studies included oral health education as part of the intervention alongside fluoride toothpaste, most control groups received no interventions with only one study reported giving oral health advice to the control participants. Concentration of the fluoride toothpastes varied between 440ppm and 1450ppm. Water fluoridation was either not reported (two studies), not present or present at levels below 0.35ppm.

Two independent reviewers assessed the studies for inclusion. Any disagreement was solved by consensus after consulting a third reviewer.

Assessment of study quality
The Cochrane Collaboration's Risk of Bias Tool was used to assess the included studies. Two independent reviewers assessed the study quality. Any disagreement was solved by consensus after consulting a third reviewer.

Data extraction
Authors were contacted for incomplete data. Missing standard deviations were calculated where necessary. Prevented fractions and confidence intervals were calculated for each study by subtracting the mean caries increment in the fluoride group from the mean caries increment in the control group (placebo or no intervention) and then dividing by the mean caries increment in the control group.

Two independent reviewers performed data extraction; disagreement was solved by consensus after consulting a third reviewer.

Methods of synthesis
Pooled prevented fractions were estimated for: decayed, missing owing to caries and filled teeth; and for dental surfaces separately. Relative risks were estimated for the impact of fluoride toothpaste on the proportion of children who
developed caries. Analyses were conducted separately for studies that tested low fluoride toothpastes (<600 ppm) and those that tested standard fluoride toothpastes (1000–1500 ppm). Numbers-needed-to-treat were also calculated. Heterogeneity was assessed by visual inspection of forest plots with $X^2$ and $I^2$ tests. A random-effects model was used in the presence of heterogeneity ($X^2$ p<0.10 and $I^2$>50%).

**Results of the review**

Eight clinical trials were included, total number of participants was 3,207 (range 251 to 852). Sequence generation and allocation concealment were poorly reported, being absent in one study and judged to be unclear in half of the studies, selective outcome reporting was present in seven studies and most failed to provide information on diagnosis reliability, baseline balance and contamination.

When standard fluoride toothpastes were compared to placebo or no intervention, significant caries reduction at surface (PF 31%; 95% CI 18 to 43; 2,644 participants in five studies), tooth (PF 16%; 95% CI 8 to 25; 2,555 participants in one study) and individual (RR 0.86; 95% CI 0.81 to 0.93; 2,806 participants in two studies) levels were observed. Low fluoride toothpastes were effective only at surface level (PF 40%; 95% CI 5 to 75; 561 participants in two studies). Publication bias was not assessed due to the small number of included studies.

**Authors’ conclusions**

Standard fluoride containing toothpastes were effective in reducing dental caries in the primary teeth of preschool children and should be recommended for use with this age group.

**CRD commentary**

This review addressed a clear question with relevant inclusion criteria and comprehensive searches with no language or publication restrictions. Procedures to reduce reviewer error and bias were followed throughout the review. Included studies were detailed in the on-line appendices and assessed for methodological quality using a validated scale with results presented. Most of the studies were judged to be vulnerable to bias. Despite pooling studies of low dose and standard fluoride toothpastes separately, there was substantial heterogeneity across studies in several of the analyses. This heterogeneity seemed sufficient to question the suitability of the studies for pooling, in particular for the low dose fluoride toothpastes. Additionally, only one of the analyses included sufficient studies to inform the distribution of effect required for a random-effects model.

The authors explored the limitations of the evidence base, despite this the final conclusions appear overly strong given the reliance on a small number of potentially methodologically vulnerable studies.

**Implications of the review for practice and research**

**Practice:** The authors recommended that fluoride containing toothpastes should be used by pre-school children to reduce dental caries as this is a simple, safe, noninvasive and relatively inexpensive intervention.

**Research:** No specific recommendations were made.

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