Dental flossing and interproximal caries: a systematic review
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CRD summary
This review systematically assessed the effect of dental flossing on interproximal caries risk and found that professional flossing in children with low fluoride exposure is effective in reducing it. The poor reporting of review methods, poor quality of the included studies and uncertainty about the appropriateness of statistical pooling mean that the reliability of the authors’ conclusions is uncertain.

Authors' objectives
To systematically assess the effect of dental flossing on interproximal caries risk.

Searching
MEDLINE, the Cochrane CENTRAL Register, Web of Science and Current Controlled Trials were searched up to December 2004; the search terms were reported. The authors contacted selected investigators to obtain missing information and grey literature.

Study selection
Study designs of evaluations included in the review
Studies of controlled clinical trials were eligible for inclusion.

Specific interventions included in the review
Studies of dental flossing compared with no dental flossing, or comparisons of different frequencies of flossing, were eligible for inclusion. Studies where the effect of flossing could not be separated from the effects of other treatments were excluded. The included studies evaluated professionally performed dental flossing (5 days per week during term time for 10 months, or once every 3 months), supervised flossing at school and unsupervised flossing.

Participants included in the review
The inclusion criteria specified no restrictions with respect to the study population. The participants in the included studies were aged from 4 to 13 years.

Outcomes assessed in the review
Studies that assessed a measure of caries incidence were eligible for inclusion.

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

Assessment of study quality
Quality was assessed on the basis of the Delphi list, which covers random allocation, treatment allocation concealment, blinding of the outcome assessors, presentation of point estimates, intention-to-treat analysis, report of baseline characteristics by treatment group, eligibility criteria, loss to follow-up and missing values. The authors did not state how many reviewers performed the validity assessment.

Data extraction
The authors did not state how many reviewers performed the data extraction. Data on the outcome of interest were extracted and the relative risk (RR) and risk difference (RD), together with their respective standard deviations, were calculated. Imputed values were used where the variance could not be extracted.
Methods of synthesis
How were the studies combined?
The studies were pooled in fixed-effect and random-effects meta-analyses. Two analyses were conducted, one for RR and one for RD. The studies were stratified based on the flossing method (professional flossing on schooldays, professional flossing every 3 months and self-performed flossing) and were also pooled overall.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the I-squared test. An I-squared value of 50% or more was defined as moderate to high heterogeneity. The effect of study characteristics on the effectiveness of flossing was investigated using meta-regression.

Results of the review
Six controlled trials were included (the number of participants in the analysis was 732, ranging from n=35 to n=174). The duration of follow-up ranged from 1.7 to 3 years.

All the included studies showed evidence of a moderate to high risk of bias and were poorly reported. The methods of random allocation and allocation concealment were either unclear or inadequate in all studies. In the 4 studies reporting baseline caries rates there were differences between groups, with those assigned to flossing having fewer cavities. Two split-mouth studies did not take into account within-mouth clustering effects in their analysis, therefore the meta-analysis was based on imputed values for the clustering effect for these studies.

Using the fixed-effect model there was a lower risk of caries on flossed surfaces compared with control: RR 0.86 (95% confidence interval, CI: 0.76, 0.97, p<0.01) and RD -0.03 (95% CI: -0.05, -0.02, p=0.001). There was moderate to high heterogeneity for the RR analysis (70%, p<0.001) and moderate heterogeneity for the RD analysis (47%, p=0.10).

When a random-effects model was used, there was a lower risk of caries on flossed surfaces but for RR the difference was no longer statistically significant: RR 0.79 (95% CI: 0.61, 1.01, p=0.06), RD -0.03 (95% CI: -0.06, -0.01, p=0.02).

Subgroup analyses.
Professional flossing on school days (2 studies).
There was a statistically significant reduction in caries risk with flossing compared with control: RR 0.60 (95% CI: 0.48, 0.76, p<0.001) and RD -0.05 (95% CI: -0.07, -0.03, p<0.001). However, there was moderate to high statistical heterogeneity for both analyses.

Professional flossing every 3 months (2 studies).
There was no statistically significant reduction in caries risk: RR 0.93 (95% CI: 0.73, 1.19, p=0.56) and RD -0.02 (95% CI: -0.04, 0.01, p=0.32).

Self-performed flossing (2 studies).
There was no statistically significant reduction in caries risk: RR 1.01 (95% CI: 0.85, 1.20, p=0.93) and RD 0.00 (95% CI: -0.04, 0.04, p=0.96).

Authors' conclusions
Professional flossing in children with low fluoride exposure is effective in reducing interproximal caries risk, but the study findings may not be applicable to a wider population as self-flossing failed to show an effect.

CRD commentary
The review addressed a broad question in terms of the interventions, participants and outcomes. The inclusion and exclusion criteria were clearly stated. Several relevant databases were searched but only limited attempts were made to
locate unpublished studies, therefore not all relevant data may have been included. The authors did not report how the study selection, data extraction and quality assessment processes were carried out, therefore the efforts made to reduce error and bias cannot be judged. The number of included studies was small and they were of poor quality. Given the presence of statistical heterogeneity, the overall pooling and the pooling of the two studies of professional flossing on schooldays might not have been appropriate. The stratified analysis suggested findings that were inconsistent with the overall results. In summary, the lack of complete reporting of the review methods, the poor quality of the included studies, and the uncertainty about the appropriateness of statistical pooling mean that the reliability of the authors’ conclusions is uncertain.

Implications of the review for practice and research
Practice: The dental professional should determine whether professional-quality flossing for individual patients is an achievable goal.

Research: Factorial designs that examine the effects of novel fluoride toothpastes and flossing devices need to be evaluated simultaneously and may provide an opportunity to determine what proportion of interproximal cavities can be prevented by dental floss in a 'fluoridated world'.

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