
Effectiveness of fluoride in preventing caries in adults

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CRD summary

This review concluded that fluoride helps prevent caries in adults of all ages. The authors' conclusions appear to follow from the results presented, although the paucity of more recent studies and poor quality of the included studies limit their reliability and relevance to current populations.

Authors' objectives

To determine the effectiveness of topical fluoride for the prevention of coronal caries in adults (20 years and older) and root caries in older adults (40 years and older). A secondary aim was to determine the effectiveness of different fluoride delivery modes in preventing caries.

Searching

MEDLINE (1966 to October 2004), EMBASE (1988 to October 2004), and the Cochrane Controlled Trials Register were searched; the search terms were reported. References of relevant articles were also checked. The American Dental Association, the Food and Drug Administration, and manufacturers of topical fluoride products were contacted for any unpublished studies. Only articles published in English were included.

Study selection

Study designs of evaluations included in the review

For studies of self- or clinically applied fluoride, randomised controlled trials (RCTs) or studies of split-mouth design were eligible for inclusion. For studies of water fluoridation, cross-sectional studies were eligible if the participants had lived most of their lives in fluoridated or non-fluoridated communities, or if studies estimated the effect of exposure to water fluoridation controlling for potential confounding factors.

Studies lasting 1 year or more were eligible for inclusion. Studies had to use a concurrent control. RCTs, cross-sectional studies, prospective cohort studies and controlled (split-mouth) studies were included in the review.

Specific interventions included in the review

Studies that assessed topical self- or clinically applied fluoride (i.e. fluorinated water or fluoride-containing toothpaste, gel, varnish or rinse) were eligible for inclusion.

Participants included in the review

Studies in which the mean age of the participants was less than 20 years of age were excluded from the review. Where reported, the mean age in the included studies ranged from 20.7 to 75 years. Studies were conducted in the USA, Sweden, Australia, Canada and the UK.

Outcomes assessed in the review

The primary outcome of interest was coronal caries increment; this was measured by the number of teeth/surfaces becoming decayed or filled (DFT/S) or decayed, filled or missing (DMFT/S). Studies in which there was insufficient information to extrapolate the results to all 28 teeth were excluded.

How were decisions on the relevance of primary studies made?

Two reviewers independently selected papers for inclusion. Papers considered relevant by at least one reviewer were assessed in further detail.

Assessment of study quality

Studies were assessed in terms of: assignment and maintenance of comparable groups; loss to follow-up; whether reliable and valid outcome measurements were used; clearly defined intervention; and in cohort studies, adjustment for potential confounders. Each study was rated as 'good', 'fair' or 'poor'. It was unclear how many reviewers performed the validity assessment.

Data extraction

Four reviewers independently extracted data from the primary studies (each article was assigned to two reviewers); any disagreements were resolved by consensus. For studies that reported the absolute difference in caries increment, results for the follow-up examination that was closest to, but at least 1 year after the initial examination were used. For studies whose follow-up period exceeded 1 year, an annualised outcome measure was used. Root caries increment was estimated for adults over 40 years of age.

Methods of synthesis

How were the studies combined?

Fisher's inverse chi-squared method was used to calculate whether combined p-values were significant. The studies were combined in a random-effects meta-analysis for water fluoridation and modes of fluoride delivery; summary estimates were presented as the relative risk ratio (RR) and absolute reduction, respectively.

How were differences between studies investigated?

Statistical heterogeneity was assessed using the chi-squared test and the I-squared statistic. Sensitivity analyses looking at date of publication and the effect of including 2 cohort studies were performed. Separate analyses were conducted for older adults (aged 40 years).

Results of the review

Twenty studies (n=13,551) were included in the review: 10 RCTs, 8 cross-sectional studies, 1 prospective cohort study and 1 controlled trial (tooth pairs in split-mouth trial).

Twelve longitudinal studies were included. Among these studies nine reported drop-out rates (mean drop-out rate for 1 year was 10.9%), five reported that examiners were blinded, and eight reported using a placebo control group.

Coronal caries were higher in the control group than in the treatment group in studies of all adults (18 studies) and older adults (6 studies) for any fluoride. In all studies that compared root caries in older adults, caries were higher in the non-fluoride group than in the fluoride group (7 studies, combined).

Community water fluoridation was found to be effective in preventing caries (9 studies). Fluoridation was found to significantly reduce caries in lifelong residents of fluoridated water communities compared with controls (RR 0.654, 95% confidence interval, CI: 0.490, 0.874; equivalent to prevention fraction 34%, 95% CI: 12.6, 51.0). Evidence of statistical heterogeneity was found. When only studies published after 1979 were included in the analysis, the prevention fraction was 27% (95% CI: 19.4, 34.3); there was no evidence of statistical heterogeneity.

The difference in annual coronal caries increment for all adults by any mode of fluoride delivery was found to favour the fluoride group, 0.64 (95% CI: 0.35, 0.94), based on 11 studies. Evidence of statistical heterogeneity was found. A similar effect was found when only studies published after 1979 were included in the analysis (0.29, 95% CI: 0.16, 0.42); there was no evidence of statistical heterogeneity. The difference in annual root caries increment for older adults by any mode of fluoride delivery was found to favour the fluoride group (0.22, 95% CI: 0.08, 0.37), based on 5 studies. No evidence of statistical heterogeneity was found.

No statistically significant difference between self-applied fluoride and control was found in the annual coronal caries increment in all adults (0.72, 95% CI: 0.20, 1.24); evidence of statistical heterogeneity was found. When the analysis was restricted to solely self-applied fluoride, there was a benefit in favour of the fluoride exposed group (0.30, 95% CI: 0.09, 0.51) and no evidence of heterogeneity.

There were insufficient data to calculate summary measures for professionally applied fluoride delivery compared with another fluoride delivery.

Authors' conclusions

Fluoride helps prevent caries in adults of all ages.

CRD commentary

The review question was supported by clear inclusion criteria in terms of the study design, intervention and participants. Several sources were searched, although the search strategy was restricted by language; it is therefore possible that relevant papers might have been missed. The methods undertaken to select papers and extract the data were likely to have minimised reviewer error and bias. The quality of the primary studies was assessed and the results reported.

The analysis used to calculate whether the combined p-values were significant does not take account of individual studies. Studies of different designs were pooled in some of the meta-analyses, which might not have been appropriate. The authors assessed statistical heterogeneity and sensitivity analyses were performed. The authors highlighted a number of limitations, for example, the findings on the effectiveness of self-applied fluoride may not be generalisable to the current adult population as only 4 studies were published after 1979. The authors' conclusions appear to follow from the results presented, although the paucity of more recent studies and poor quality of the included studies limit their reliability and relevance to current populations.

Implications of the review for practice and research

Practice: The authors stated that the results support the development and implementation of fluoride programmes in adults.

Research: The authors stated the need for additional well-designed RCTs to evaluate the effectiveness of fluoride in adults.

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