

What concentration of fluoride toothpaste should dental teams be recommending?

R. S. Levine^{1,2}

A Commentary on

Walsh T, Worthington H V, Glenny A M, Marinho V C C, Jeroncio A.

Fluoride toothpastes of different concentrations for preventing dental caries (Review). *Cochrane Database Syst Rev* 2019; CD007868. DOI: 10.1002/14651858.CD007868.pub2.

Abstract

Data sources A total of 96 studies reported in peer reviewed journals between 1955 and 2014

Study selection The systematic review selected randomised controlled trials that compared toothbrushing with fluoride toothpaste with toothbrushing with a non-fluoride toothpaste or toothpaste of a different fluoride concentration, with a follow-up period of at least one year. The primary outcome was caries increment measured by the change from baseline in all permanent or primary teeth.

Data extraction and synthesis Two members of the review team, independently and in duplicate, undertook the selection of studies, data extraction, and risk of bias assessment. They graded the certainty of the evidence through discussion and consensus. The primary effect measure was the mean difference or standardised mean difference caries increment. Where it was appropriate to pool data, they used random-effects pairwise or network meta-analysis.

Results In the primary dentition of young children, 1500 ppm fluoride toothpaste was found to reduce caries increment when compared with non-fluoride toothpaste. In the adult permanent dentition, 1000 or 1100 ppm fluoride toothpaste was found to reduce DMFS increment when compared with non-fluoride toothpaste in adults of all ages, however, the evidence for DMFT was of low certainty.

Conclusions This Cochrane Review supports the benefits of using fluoride toothpaste in preventing caries when compared to non-fluoride toothpaste. Evidence for the effects of different fluoride concentrations was found to be more limited, but a dose-response effect was observed for D(M)FS in children and adolescents. For many comparisons of different concentrations the caries-preventive effects and the confidence in these effect estimates are uncertain and could be challenged by further research.

Commentary

This systematic review is an update of the 2010 review from the same Manchester University based Cochrane Oral Health Group. With a new co-author and an expansion of the scope to include adults it covers 13 new studies bringing the total to 96 reported

Practice point

This study confirms the conclusion of the 2010 systematic review that toothpastes containing at least 1000 ppm of fluoride are effective for caries reduction when compared to non-fluoride toothpaste. Any decision to advise the use of toothpaste containing more than 1500 ppm must balance the potential risk of increased fluoride ingestion with any benefits of caries reduction that might follow.

between 1955 and 2014 for this meticulously constructed and presented review.

Over the last 60 years the quality of the design, methodology, statistical analysis and reporting of studies in this field has greatly improved and in comparison to more recent studies many of the earlier ones suffer from a variety of limitations that in retrospect have degraded the reliance that can be put on their conclusions. While few studies, especially the more recent ones, are free of limitations, this systematic review gives us a better understanding of the effect of different concentrations of fluoride in toothpastes. The overall conclusion remains similar to the 2010 review that there is some evidence for a dose response relationship between the fluoride concentration in the toothpaste and caries reduction with strong evidence for a benefit in caries reduction compared with non-fluoride formulations. The conclusion from previous studies showing that the low-fluoride toothpastes, primarily marketed for use by children are either non-effective or provide little benefit, is again supported by this review. There is weak evidence of increasing benefit from concentrations in the range 1000 ppm upwards to the high concentration toothpastes containing 2500ppm or more, that in most countries are only available on professional prescription.

The explanation for only weak evidence of increasing benefit with fluoride concentrations in the reviewed studies may be due to a wide range of factors. Methodological variations in diagnostic criteria, population characteristics and sampling methods are important factors. However, variations in different formulations having the same total fluoride concentration can have an impact on caries reduction. It must be remembered that in some studies specially produced standardised toothpaste formulations differing only by fluoride concentrations have been compared, while other studies have compared differently formulated toothpastes with differing fluoride concentrations. The first fluoride containing toothpaste used stannous fluoride as the active ingredient while earlier European pastes used sodium mono fluoro-phosphate (MFP) with an abrasive base of calcium carbonate. Over the years there has been a trend to use sodium fluoride as the active ingredient, sometimes in combination with MFP or stannous fluoride, with silica as the abrasive base. While the wide range of commercially available toothpastes available world-wide use all three fluoride compounds, sometimes in combination, the most commonly

GRADE rating



used base remains silica, but some formulations include dicalcium phosphate dihydrate or titanium oxide, often in combination. Added to this there are variations in the quality grades of the ingredients used in different manufacturing facilities, some of which may contain trace impurities and some formulations include anti-nucleation agents such as pyrophosphates, aimed at reducing the formation of calculus (tartar).

Since it is the concentration of bioavailable free fluoride ion that is the theoretical determinant of caries reduction, the complexity and variation between different commercially available toothpastes becomes a confounding factor in comparing effectiveness. Furthermore some studies have shown that formulations can

lose some of their ionic fluoride with storage while at least one formulation has been reported to increase ionic fluoride concentration with storage.

Author Affiliations

¹Hon. Senior Research Fellow in Child Health

Academic Unit of Obstetrics, Gynaecology and Paediatrics

University of Leeds

²Department of Oral Surgery

University of Leeds

Evidence-Based Dentistry (2019) 20, 74-75. doi: 10.1038/s41432-019-0040-7