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Effect of wide spread use of fluoride on general and oral health: A systematic review

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Abstract

Aim: This systematic review aims to summarize recent scientific literature concerning the potential risks and benefits associated with widespread use of fluoride either systematically through water, milk and salt fluoridation or topically via dentifrice, mouth rinse, gel and varnish.

Methods: Five reviewers independently screened sources, extracted data, and assessed validity. The search was limited to English language publications and the following electronic databases were searched: Cochrane Library, MedlinePlus, Embase, PubMed, and Saudi Digital Library. Inclusion criteria were a predefined hierarchy of evidence and objectives.

Results: Fluorosis is only linked to high fluoride intake or the high concentrations of fluoride in drinking water. There is inconsistency in evidence of efficiency of fluoride supplements in preventing dental caries in primary teeth. However, there is evidence that they prevent caries in permanent teeth. Fluoride toothpastes are effective in preventing caries in children below 6 years old.

Conclusion: The evidence to date of writing the article present weak and inconsistent evidence regarding any other general or oral health effect. Appropriate guidelines that are based on the evaluation of the risk and benefit of each component of fluoride exposure can lead to a more beneficial outcome.

Keywords: Fluoride, topical, dental caries, water, toothpaste

Introduction

The association of fluoride with the decrease of dental caries have constituted in its widespread use systematically through water, milk, and salt fluoridation or topically via dentifrice, mouth rinse, gel, and varnish. Water is the most common natural source of fluoride. The concentration of fluoride in seawater (1.2-1.5 ppm) is higher than freshwater (0.01 to 0.3 ppm). Water near hot springs of volcanic origin have even higher concentration ^[1]. The optimal concentration of fluoride for drinking water is that level which offers minimal risk of dental fluorosis while providing significant protection against caries. Concentration of 0.7-1.2 ppm is considered the optimal water fluoridation level ^[2]. A decline in the currently accepted optimal level would certainly result in an increase of dental caries ^[3].

The World Health Organization (WHO) has set a maximum concentration of 1.5 ppm fluoride in drinking water to avoid dental fluorosis ^[4]. According the recommendation by the ADA, although universal fluoridation of drinking water supplies is considered the most effective method in reducing dental caries, it exposes all member of the public to fluoride where it is primary beneficial to children, ergo it is important to address arisen concerns about the safety of widespread use of fluoride and its potential health and dental effects ^[5]. The beneficial effects of topical fluoride agents have been examined in a series of systematic reviews. The adverse effect with the use of topical fluoride is the development of dental fluorosis ^[6]. Hence, it is essential to achieve a balance between the beneficial and detrimental effects of topical fluoride ^[7]. The aim of this systematic review is to summarize recent scientific literature concerning the potential risks and benefits associated with widespread use of fluoride.

Methods

Data used in this review were systematically searched from articles published until 2016 utilizing the key words including combinations of "fluoride" or fluoridation" or "water fluoridation" or "fluoride exposure" or "fluorosis" or "dental fluorosis" or "caries" or "fluoride

toxicity. Five engines were searched according to the PRIZMA guide line of systematic review and the PRIZMA flow chart [8]. The following electronic databases were searched: Cochrane Library, Medline Plus, Embase, PubMed, and Saudi Digital Library. Only studies published in English were referenced. Further searches included the World Wide Web and bibliographies of all included studies. Six systematic reviews were included in this review.

Results and Discussion

Summaries of the findings are presented in table 1. One systematic review reported that water fluoridation at optimum levels does have an effect on preventing caries and may also lower the overall fracture risk [9]. Another systematic review revealed that fluorosis is only linked to high fluoride intake or the high concentrations of fluoride in drinking water [10]. A review found inconsistency in evidence of efficiency of fluoride supplements in preventing dental caries in primary teeth. However, there is evidence that they prevent caries in permanent teeth [11]. Two systematic reviews reported fluoride

toothpastes are effective in preventing caries in children below 6 years old [12-13]. The risk of developing fluorosis should be considered. Multiple sources of fluoride exposure should also be considered by practitioners [14].

Fluoride Use of fluoride have been advocated as the gold element in preventing caries among dentists and health specialist worldwide. However, concerns about safety of fluoridation are periodically raised. Fluoride has been a beneficial agent in caries prevention over the years. The effects of fluoride has been described in the late 19th and early 20th century [15]. Previous studies have reported that the maximum anti-caries benefits of fluoride are through topical application. Hence, Daily use of topical fluoride application is beneficial [16]. The effect of fluoride on caries progression is on demineralization and remineralization processes [17]. On the other hand, dental fluorosis a developmental disorder of enamel which occurs during enamel formation is caused by systemic overexposure to fluoride during the first six years of life during enamel formation [18].

Table 1: Characteristics of systematic reviews on fluoride

Study	Design	Level of Evidence	Year	Outcome
A systematic review of the safety and efficacy of fluoridation	Systematic review	Level I	2008	Studies included in this systematic review indicated that water fluoridation at optimum levels does have an effect on preventing caries and may also lower the overall fracture risk. Additional studies included suggested that there might be an increased risk of osteosarcomas in young males in water fluoridated areas.
Systematic review of water fluoridation	Systematic review	Level I	2000	Studies included in this article revealed that the occurrence of fluorosis is only linked to high fluoride intake or the high concentrations of fluoride in drinking water.
Fluoride toothpaste efficacy and safety in children younger than 6 years	Systematic review	Level I	2014	This systematic review concluded that fluoridated toothpastes shows effectiveness in preventing caries in children below the age of 6 but should be aware that mild fluorosis could take effect when children ingest fluoridated tooth pastes.
Fluoride supplements, dental caries and fluorosis: A systematic review	Systematic review	Level I	2008	Results show inconsistency in evidence of efficiency of fluoride supplements in preventing dental caries in primary teeth. There is evidence that such supplements prevent caries in permanent teeth. Dental fluorosis is a significant side effect.
Topical fluoride as a cause of dental fluorosis in children (Review)	Systematic review	Level I	2010	The risk of developing fluorosis should be considered, although most of the available evidence focuses on mild fluorosis. If the risk of fluorosis is of concern, the fluoride level of toothpaste for young children (under 6 years of age) is recommended to be lower than 1000 parts per million (ppm).
Evidence-based clinical recommendations regarding fluoride intake from reconstituted infant formula and enamel fluorosis	Systematic review	Level I	2011	The multiple sources of fluoride exposure should be considered by practitioners. Reducing fluoride intake from infant formula alone will not eliminate the risk of fluorosis development. It is also important to provide advice to the parents regarding the proper use of fluoride supplements.

Conclusion

The wide spread use of fluoride at an optimal level is proven to reduce the incidence of caries. However, mild fluorosis of esthetic concerns is a serious side effect. The evidence to date of writing the article present weak and inconsistent evidence regarding any other general or oral health effect. Appropriate guidelines that are based on the evaluation of the risk and benefit of each component of fluoride exposure can lead to a more beneficial outcome.

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