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Review Article

Flouride and dental health in twenty – first century –A review

Kuljeet Kaur^{1,*}, Shiva Prasad Kyasanoor²

¹Maharishi Markandeshwar (deemed to be University), Mullana, Ambala, Haryana, India

²Kamineni Institute of Dental Sciences, under Dr. NTR University of Health Sciences, Nalgonda, Andhra Pradesh, India



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ABSTRACT

Tooth decay is one of the most common infectious microbiological diseases in the world. Dental cavities are now less common than it was before water fluoridation was put into place. Fluoride toothpastes are of a high calibre and excellent at preventing tooth decay. Fluoride therapy administered by a specialist helps prevent dental caries. Common fluoride agents include sodium fluoride (NaF), sodium monofluorophosphate, stannous fluoride, and silver diamine fluoride. Fluorides are essential in the prevention of dental caries because they are therapeutically used to inactivate early carious lesions. Dental fluorosis brought on by unintentional ingestion has also been connected to early exposure to fluoride toothpaste.

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1. Introduction

Despite significant advancements, oral health issues still exist, especially among the underprivileged and disadvantaged in both developed and developing nations. Dental caries, which affects 60–90% of students and the vast majority of adults worldwide, is still a serious public health issue in the majority of industrialised nations, according to the Global Oral Health Report 2003. Although it seems that dental caries is less widespread and less severe in developing African nations, it is predicted that the incidence of caries will rise in several of those nations as a result of changing living conditions, food preferences, and inadequate exposure to fluorides.¹ Flouride is the thirteenth most abundant terrestrial substance and makes up 0.06 to 0.09% of the crust's mass. The lithosphere, atmosphere, hydrosphere, and biosphere all contain fluorine. Volcanic rocks contain a significant amount of fluorine. It enters the environment as a result of several human activities, rock erosion, and volcanic eruptions (coal burning, ore

processing, production and use of fertilizers, and industrial plants).^{2–4}

The use of fluoride in caries prevention has its roots in epidemiological research conducted more than 70 years ago. They demonstrated the unmistakable link between fluoride exposure from fluoridated water and the frequency and severity of dental fluorosis and dental caries. Following the introduction of water fluoridation programmes and the development of efficient toothpastes and other fluoride delivery systems by the industry, successful experiments were conducted. Due to the extensive usage of fluoride, decreased caries rates have been observed in several nations. This is a noteworthy success story; the oral health of many people was significantly enhanced. There are now numerous substantial sources of fluoride as opposed to just water in the past, which has increased the prevalence of dental fluorosis. Ingestion of toothpaste with fluoride was recognised as a risk for dental fluorosis.⁵

* Corresponding author.

E-mail address: 657doctor45@gmail.com (K. Kaur).

2. Dental Caries

One of the most prevalent microbiological infectious disorders worldwide is tooth decay. According to estimates from the World Health Organization (WHO), between 60% and 90% of all children of school age have dental caries.^{6,7} Dental caries is a multifactorial condition that can affect both children and adults and cause the tooth structure to become demineralized. Endogenous cariogenic bacteria, consuming fermentable carbohydrates often, having a susceptible tooth and host are the key contributing factors.^{7,8} Dental caries can advance if untreated, although it can also be stopped, reversed, or arrested in its early stages.^{7,9} The modern approach to managing dental caries is prevention and less invasive therapy after early lesion diagnosis.^{7,10}

3. Fluorides and Dental Caries

Fluoride can adsorb to the surface of apatite crystals when it is present at low, persistent amounts (sub-ppm range) in oral secretions during an acidic challenge, preventing demineralization. Fluoride residues in the solution will cause it to become extremely supersaturated in relation to fluorhydroxyapatite when the pH is restored, hastening the remineralization process. The enamel will become more resistant to future acidic challenges because the mineral generated under the nucleating action of the partially dissolved minerals will then preferentially include fluoride and exclude carbonate. Moreover, topical fluoride has antibacterial properties. Although important virulence components of *S. mutans*, including acid generation and glucan synthesis, are biologically affected by fluoride concentrations observed in dental plaque *in vitro*, the consequences of this *in vivo* are still unclear. When fluoride is absorbed into these teeth before they erupt, evidence also supports fluoride's systemic mechanism of caries inhibition in the pit and fissure surfaces of permanent first molars.¹¹

New information on the methods by which fluoride prevents or delays tooth cavities has recently come to light. The natural dissolving and reprecipitation processes that occur at the tooth-oral fluid interface are sped up or slowed down depending on the amount of fluoride in the oral fluids. Fluoride concentrations in the sub-ppm range prevent the demineralization of enamel. Similarly, tiny levels of fluoride speed up the remineralization of incipient caries lesions, the first stage of enamel caries. Fluoride favourably shifts the physiological balance between hard tissue breakdown and repair since these two processes make up tooth caries. The driving force behind both occurrences is thermodynamic, meaning that when fluoride is provided in low amounts, fluorapatite or a fluoridated hydroxyapatite may form.¹²

4. Water Fluoridation

One of the most frequently offered local public goods in the US is community water fluoridation (CWF). Dental caries and CWF exposure have been shown to have a definite inverse association, especially in children. Less is known regarding the long-term effects of CWF exposure on adult oral health.¹³ CWF's effects are far less severe today than they were fifty years ago. The availability of other fluoride sources, such as fluoridated toothpaste, and the spillover effects of fluoridation from increased use of fluoridated water in the manufacturing of consumer goods are some of the factors for a reduced impact.^{13,14}

5. Fluoride Sealants

Fluorides are therapeutically utilised to inactivate early carious lesions and are crucial in the prevention of dental caries. Fluoride works best when given topically, and its effects are amplified when combined with good oral hygiene.¹⁵

6. Fluoride Varnish

Dental cavities can be prevented with professional fluoride therapy. Sodium fluoride (NaF), which can be buffered and acidulated to create acidulated phosphate fluoride (APF), sodium monofluorophosphate, stannous fluoride, and silver diamine fluoride are all common fluoride agents (SDF). They have high fluoride levels between 12,300 ppm (APF) to 44,800 ppm (SDF).¹⁶ Fluoride agents like NaF varnish are frequently used in dental care. Fluoride content in varnish with 5% NaF is 22,600 ppm. Patients enjoy using it since it is easy, quick, and has little negative effects. Although NaF was approved as an antihypersensitivity agent by the US Food and Drug Administration (FDA) in 1994, it has since emerged as the most often utilised professional fluoride product for caries control.^{17,18} SDF includes high silver concentration (253,900 ppm), which prevents the formation of cariogenic bacteria, in addition to high fluoride content, which encourages the remineralization of enamel and dentine.¹⁹

7. Fluoride Toothpastes

In communities with a caries increase of 2.6 D(M)FS each year, 1.6 children must brush their teeth with fluoride toothpaste (as opposed to non-fluoride toothpaste). 3.7 children will need to use fluoride toothpaste in populations whose caries increase is 1.1 D(M)FS per year in order to prevent one D(M)FS. The advantages of fluoride toothpastes have been well studied and have been backed up by more than 50 years of research. When considered collectively, the studies show conclusively that fluoride toothpastes are effective at preventing tooth decay and are of a pretty high calibre.²⁰

8. Dental Fluorosis

Since the implementation of water fluoridation, there has been a decrease in the prevalence of dental caries. The risk of dental fluorosis is mainly related to the systemic consumption of fluorides during the first six years of age. However, early exposure to fluoride toothpaste has also been linked to dental fluorosis due to unintended swallowing. This risk should be considered when selecting the concentration of fluoride toothpaste for young children. Fluoride-containing products, including toothpaste, rinses solutions, gels, foams, and varnishes, are indicated according to age and risk of caries.¹⁵

9. Conclusion

Dental cavities are now less common than it was before water fluoridation was put into place. Fluoride toothpastes are of a high calibre and excellent at preventing tooth decay. Fluoride therapy administered by a specialist helps prevent dental caries. Common fluoride agents include sodium fluoride (NaF), sodium monofluorophosphate, stannous fluoride, and silver diamine fluoride. NaF can be buffered and acidulated to form acidulated phosphate fluoride (APF). Fluorides are essential in the prevention of dental caries because they are therapeutically used to inactivate early carious lesions. Dental fluorosis brought on by unintentional ingestion has also been connected to early exposure to fluoride toothpaste.

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11. Conflicts of interest

There are no conflicts of interest.

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Author biography

Kuljeet Kaur, Dentist

Shiva Prasad Kyasanoor, Dentist

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