REVIEW ARTICLE

Fluorides in Caries Prevention: A Review

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ABSTRACT

The process of dental caries is determined by a delicate balance between pathological factors that lead do demineralization and protective factors that lead to remineralisation. The aetiology of dental caries is quite complex involving interaction between the agent, host and environmental factors. Dental fluorosis is clearly indicates over-exposure to fluoride when the teeth were in developing stage. While peroxide is the primary agent found in products that bleach and remove intrinsic sources of discoloration, several ingredients are engaged within formulations to remove and inhibit extrinsic sources of tooth discoloration, ie, tooth stain. Professionally applied topical fluoride varnish, solutions and gel, have been effective in preventing and in arresting dental caries.

KEYWORDS: Caries, Demineralization, Remineralization, Early Carious Lesions, Desensitizing Agents.

INTRODUCTION

Dental caries is a localized and progressive destructive disease of the teeth. Acids produced by bacteria, especially *Streptococcus mutans* and possibly *lactobacilli* that ferment dietary carbohydrates, because the de-mineralization.[1] The growth of a carious lesion appears in three stages. The first stage is the incipient lesion; the second stage involves the progress of the demineralization that toward the dentinoenamel junction while the final phase is the growth of a frank lesion which is indicated by a cavitation.[2] About 96% of fluoride is found in bones and teeth of humans, and fluorine is the great element in nature. Fluorine is required for the normal mineralisation of bones and development of dental enamel. The suggested level of fluoride in India is 0.5 to 0.8 mg/l in drinking water. Through drinking water continued ingestion of excess fluoride in daily requirement is related with dental and skeletal Fluorosis.[3] Dental caries is a 'pandemic' disease indicated by a high percentage of untreated carious lesions which causes pain, discomfort and functional limitations. Re-mineralisation of white-spot lesions may be attainable with presently available agents possessing fluoride, calcium and phosphate, and casein phosphoprotein-amorphous calcium phosphate.[4] Dentinal hypersensitivity is indicated by short sharp pain emerging from exposed dentine in reaction to stimuli typically evaporative, thermal, osmotic, tactile or chemical. Various materials such as varnishes, liners, restorative materials, dentinal adhesives, dentifrices and mouthwashes are used to decrease dental sensitivity.[5] In most developed countries, dental caries persists to show an important public health problem, where it outcomes 60%-90% of school children and most of the adults.[6] Dental fluorosis is indicated by lusterless, white opaque, patches which causes yellow to dark brown discoloration in severe forms within the enamel and noted pitting and brittleness of teeth.[7] In the prolonged time, the irradiated patients are influenced to atrophy and fibrosis of the muscles of mastication that can show trismus and xerostomia leading to considerable dental caries and osteoradionecrosis. Topically applied fluorides remineralises tooth structure by altering the saliva and buffers pH of saliva decreases oral cariogenic flora.[9] Fluoridation has been assisted in many countries to encounter the health, economic, and societal challenges of dental caries. This approach helps in clinical interventions to manage dental caries and addition other self-applied fluoride procedure.[10] The sudden develop and extensive favour of tooth whitening and other esthetics raising products has allowed that consumers are less willing to obtain discoloured teeth or offensive breath by products of dietary habits/lifestyle choices or aging.[12] Tooth colour is influenced by both internal and external properties. Intrinsic tooth discoloration is defined as chromogen found below the enamel and related with natural aging of the dentition, fluorosis, tetracycline damage, or use of tobacco. Extrinsic discoloration occurs when stain forms on the tooth surface. Chromogens staining the surface often arise from dietary sources, tobacco, or certain oral therapeutics like chlorhexidine.[13] Fluoride toothpastes, rinses and other forms of fluoride delivery have become well accepted and these products are used by most of our patients in the past decades.[14] The remineralisation observed in clinically arrested lesions, and the change of clinically active to inactive lesions assist the nonrestorative management of carious

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lesions. The great availability of fluoride in community water supplies, fluoride based oral hygiene aids, as well as increased public awareness of oral hygiene.[16] Evidence-based dentistry (EBD) is an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant and evidence related to the patient oral and medical conditions, with the dentist's expert opinion and the patient's treatment needs and preferences.[18] Both systemic and topical has been advised by the World Health Organization means to obstruct dental caries. Topical fluoride agents can be either self-applied, such as toothpaste and mouthwashes, or professionally applied, *like* varnish and gel.[19] The preventive care providers have aim to prevent beyond the scope of providing hygiene therapy and oral hygiene instructions. Dental decay is generally due to demineralization which is caused by acids producing bacteria, such as *Mutans Streptococci* and *Lactobacilli* that ferment dietary carbohydrates.[21]

The dental caries occurs in children due to poor quality and quantity of saliva, malocclusion, poor oral hygiene, plaque accumulation, compromised host immunity, dietary factors and oral infections. It reduces the rate of enamel demineralization and lowers the solubility of enamel under acidic conditions.[22] Remineralisation technologies are playing a basic role in preventative care. ACP forms on the tooth enamel within the dentinal tubules and gives a reservoir in the saliva. ACP liberates calcium and phosphate ions to convert to apatite and remineralise.[23]

BACKGROUND

About 100 years ago, the effects of fluoride on oral health initiated. For about the first 50 years, it concentrated on the link between waterborne fluoride – both natural and adjusted and dental caries and dental fluorosis.[6] Beta-thalassemia is a genetic blood disorders caused by decreased synthesis of the beta chains of haemoglobin, which are conduct for transportation of oxygen and carbon dioxide in the body. Patients suffering from beta thalassemia show anaemic condition, retarded growth, and skeletal deformities during infancy.[8] Dental caries is a disease of the hard tissues of the teeth. There are several causes that make the linkage between certain micro-organisms and dietary carbohydrates that create plaque acids, and tooth substance. Children with lower socio-economic status have higher dental caries levels than those in, the higher socio-economic status. Water fluoridation act as a primary preventive and a public health measure for control of caries. The suggestion of milk fluoridation initially by a Swiss paediatrician, act as a dental caries prevention medium.[15] Risk assessment methods have adequate data of person's disease and allow for protective measures in medical practice. In dentistry, caries-risk data are not adequate to models, the process of risk should be a part in the clinical decision-making process.[17]

The use of fluoride varnish to inhibit dental caries in children and adults is developing in both public and private dental practices that integrate health risk assessments and counselling.[24]

CONSERVATIVE APPROACHES IN TREATMENT OF DENTAL CARIES

Among many dentists have a focus to appraise conservative approaches in the treatment of dental caries. The dentistry as a whole is focusing to develop the framework of viewing and holding the subject of dental caries and persisting on a non-invasive and pre-emptive intervention. The understanding of the effect of dental caries event increases and the shift towards a multi-factorial, multistage process, which extends from infection to demineralization to cavitation.

RISK FACTORS AND RISK INDICATORS IN DENTAL CARIES

If *Streptococcus mutans* is obtained at an early age, then the children are likely to evolve caries and may be partly compensated by other factors such as good oral hygiene and anti-cariogenic diet. Risk factors recognition and groups will help in the preservation of health, and the social structures indicated to support to preserve their programs in order to enhance oral health.[1]

FLUORIDES IN DEMINERALIZATION AND REMINERALIZATION OF ENAMEL

Topical fluoride therapy defines as the use of large concentration of fluoride that is applied locally to the erupted tooth surfaces to prevent formation of dental caries. Fluoroapatite and fluorohydroxyapatite are more resistant to acid dissolution, so the tooth surfaces are more resistant to the growth of dental caries. Long-time exposure of the enamel to low accumulation of fluoride will result in development of calcium fluoride deposits on the enamel surface. Calcium fluoride may supply as a fluoride reservoir for enamel remineralisation. During periods of cariogenic attack, the release of fluoride increases the mineral saturation of saliva, and can help the repair of lesions and decrease demineralization.

REMINERALIZATION OF DENTINE ADJACENT TO FLUORIDE RELEASING RESTORATIVES

Studies of carious dentine reported that it contains two layers that have different biochemical properties, structures and physiological properties. The superficial outer layer is indicated by extensive decalcification and irreversibly denatured collagen fibers. The inner layer appears intermediate decalcification, regularly arranged collagen fibbers, and living odontoblastic processes. The concept of treatment of dentine caries is to eliminate only the outer, permanently damaged 'infected' layer of

carious dentine, but to protect the demineralised 'affected' dentine which can be cured.[2]

MODES OF FLUORIDES DELIVERY

DENTIFRICES: Dentifrices are the most common agent for desensitizing agents. They are showed because of their low cost, ease of use and home application. Having complex formulae with several ingredients, among desensitizing agents such as strontium chloride, potassium nitrate, dibasic sodium citrate, formaldehyde, sodium fluoride, sodium mono fluorphosphate and stannous fluoride.

WATER FLUORIDATION: The inception of a community water fluoridation was initiated at Grand Rapids in the United States of America (USA) in 1945, and first results were produced by Arnold et al.

SALT FLUORIDATION: There are very few options for the consumer other than to obtain bottled drinking water that does not contain fluoride when the public water supply is fluoridated. The efficacy of salt fluoridation approximates that of water fluoridation, when most salt for consumption is fluoridated.

MILK FLUORIDATION: The milk fluoridation is an example by public health dentistry to produce the use of fluoride without involving the consumers to take on specific responsibilities or change their behaviour.

FLUORIDE TOOTHPASTES: The most important vehicle used for fluoride has been toothpastes. During 1970s and 1980s, the initiation of fluoride toothpastes was the single factor most conducted for the immense decrease in dental caries seen in developed countries.[6]

Diffusion Effect: The advantage of fluoridation is that persons in non-fluoridated areas also obtain fluoride through beverages and foods initially managed in fluoridated areas. In recent years, the distribution of fluoride through beverages and foods is to produce description for a difference in caries noticed between fluoridated and non-fluoridated communities. The diffusion effect has been expressed by the differences in mean DMFS between communities with dissimilar diffusion exposures. This analysis presented that a comparison of mean DMFS between fluoridated and non-fluoridated communities underestimated the efficacy of water fluoridation.

PROFESSIONALLY APPLIED FLUORIDES

Fluoride Gel/Foam: Different compounds have been used in fluoride gels. Sodium fluoride can be used in a neutral pH environment or it can be acidulated and buffered with phosphate to form an acidulated phosphate fluoride (APF). In the application, a sufficient amount of gel to cover the teeth in a dental arch is distributed into a disposable tray and inserted into the mouth. The time for application is 4 min, and the patient should spit the gel afterward.

Fluoride Varnish: Fluoride varnish is a non-aqueous form of topical fluoride. The direct application onto tooth surfaces is easy with a mini-brush. It attaches to tooth surfaces in the presence of saliva. Various compounds such as difluorosilane and sodium fluoride, have been used at different concentrations, but the most studied varnishes carry 5% sodium fluoride in an alcoholic solution of natural varnish substances.

Fluoride Solution: For many years, application of silver fluoride or silver diamine fluoride (SDF) solution at concentrations of 38 to 40% to inhibit active cavitated caries lesions in primary teeth has been used in Australia and Japan. A recent review found that around 70% for new caries in both primary and permanent teeth in children can be acquired through applications of SDF solution, and the success rate for caries inhibit can be over 90%.[19]

CONCLUSION

The focus in dentistry has transferred towards a conservative approach. Dental research is essential to the future of the oro-dental health especially and the general health of the population in general. Professionally applied topical fluoride varnish, gel, and solution have been appeared to be effective in caries. With the growth of new dental restorative materials and advances in adhesive dentistry, an understanding of the caries process and the tooth's potential for remineralisation and changes in caries prevalence and progression, the management of dental caries has developed from G.V. Black's "extension for prevention" to "minimally invasive."

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