

# Recent Advances in Caries Prevention – A Review Article

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## Abstract

Dental caries is a preventable infectious disease, and the early identification of risk factors and implementation of oral health preventive measures at a young age can reduce or even avoid this lesion progression. Some of the important changes that have taken place over the last few years that have influenced caries prevention are changes in disease level among different populations, increased understanding of caries pathogenesis process, material and operative technique development. We have a variety of new agents, which can be used to prevent dental caries, but the application of these agents in clinical trials is still limited in the developing countries. Moreover, dental caries is multifactorial and all preventive measures should be evaluated properly in human trials so that they can be introduced at the community level for the prevention of dental caries.

**Keywords:** Caries prevention, dental caries, new advances

## INTRODUCTION

Dental caries occurs as an imbalance in the demineralization-remineralization process favoring demineralization. Although acid-generating bacteria present in plaque biofilm are often considered the etiologic agents, dental caries is also influenced by dietary and host factors. The caries process is dependent on the interaction of protective and pathologic factors in saliva and plaque biofilm as well as the balance between the cariogenic and noncariogenic microbial populations that reside in saliva.<sup>[1]</sup> Dental caries is a preventable infectious disease, and the early identification of risk factors and implementation of oral health preventive measures at a young age can reduce or even avoid this lesion progression.<sup>[2]</sup> The key to caries management and disease prevention lies with modifying the behavior of complex dental biofilm as well as transforming factors to favor health.<sup>[3]</sup> Dental caries results from the environmental changes in the oral cavity. It has adverse effects on the oral health due to acid production from fermentable carbohydrates. The acidogenic and acid-tolerating species such as mutans streptococci and lactobacilli will survive under low pH condition.<sup>[4]</sup> This paper provides an overview of the recent advances on caries prevention.

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understanding of caries pathogenesis process, material and operative technique development.

## THE NEED FOR PREVENTION

As the symptomatic treatment is intensive and of high cost, prevention of diseases to be taken into consideration. Furthermore, caries at its later stage compromises nutrition causes severe pain and suffering. Goals of prevention are to reduce the number of cariogenic bacteria, early detection of the incipient lesion, limitation of caries activity, identification of high-risk patients, and evaluation of overall resistance of the patient to the infection.

## CARIES PREVENTION

### Dietary control

For children at moderate or high risk, a dietary diary should be completed and discussed. Based on this dietary diary, a

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**How to cite this article:** Kalaivani V, Ramiya R. Recent advances in caries prevention – A review article. Int J Community Dent 2021;9:66-9.

**Received:** 03-01-22; **Accepted:** 30-01-22; **Web Published:** 26-03-22

### Access this article online

#### Quick Response Code:



**Website:**  
[www.ijcommdent.com](http://www.ijcommdent.com)

**DOI:**  
10.4103/ijcd.ijcd\_2\_22

specific dietary counseling should be given to the child and family, and initially, limited obtainable targets are set. Then, the compliance should be monitored in the recall visits.

### Oral hygiene

Tooth brushing is efficient in removing dental plaque. Skills of tooth brushing should be taught to children of all ages, and they should be encouraged to brush their teeth at least twice a day, especially before bedtime. The proper brushing technique should be demonstrated during the dental visit. The use of fluoridated toothpaste should be emphasized.

### Topical antimicrobials

Topical antimicrobials aim at reducing the burden of bacteria:

#### *Chlorhexidine*

It is an antibacterial agent that helps in caries prevention by reducing the mutans streptococci levels. To date, chlorhexidine remains the gold standard of antiplaque agents. A number of over-the-counter and professionally administered chlorhexidine-based preparations are available in a variety of formulations and a range of strengths. It is available in the form of toothpastes, mouth rinses, varnishes, gels, and gums and sprays.

#### *Xylitol*

It is a naturally occurring sugar substitute that can reduce levels of caries-forming mutans streptococci in the plaque and saliva. Xylitol can be administered as a syrup or topically through wipes for young children. It can be administered in gum, lozenges, or snack foods, in older children.<sup>[5]</sup>

### Pit and fissure sealants

Sealant is a low viscous material that is placed in the pits and fissures on occlusal, buccal, and lingual surfaces of teeth to prevent or arrest the development of caries. Sealant polymerizes into a hard material to act as a physical barrier between the sealed area of the tooth and the bacteria and make pit and fissures easier to clean by brushing and mastication. Sealants have been used for over 30 years as a caries preventive measure, and evidence from clinical trials has demonstrated their effectiveness. Applying a fissure sealant decision should be made on clinical basis, after a full clinical examination that is supported by a caries risk assessment. If doubt exists over the caries status of a susceptible site, a bitewing radiograph should be taken. If it is certain that, the carious lesion is confined to the enamel surface a sealant should be placed and monitored closely. As applying a sealant over an incipient carious lesion (noncavitated carious lesion) does not lead to progress, if this sealant remains intact. However, if caries is found to the extent to dentine, a restoration should be placed.<sup>[6-9]</sup>

It is recommended to use the sealants compared with both nonuse of sealants and use of Fluoride varnishes in permanent molars with both sound occlusal surfaces and noncavitated occlusal carious lesions in children. The proper ages that are indicated for application of sealant are 3–4 years, 6–7 years, and 11–13 years, for deciduous teeth, first permanent molars,

and second permanent molars and premolars, respectively. Nevertheless, sealant is contraindicated if patient behavior does not permit isolation, there is an open occlusal carious lesion, caries exists on other surfaces of the same tooth, a large occlusal restoration is already present, and if pits and fissures are well coalesced and self-cleansing.<sup>[7]</sup>

### Fluoride therapy

Fluoride is an important and cost-effective caries preventive measure. Fluoride is up-taken by tooth in the preeruptive and posteruptive stages. A distinction is made between F that is ingested systemically and that is applied topically.<sup>[10,11]</sup>

#### *Water fluoridation*

It is the controlled adjustment of a fluoride compound to a public water supply to bring the fluoride ion concentration up to a level that effectively prevents caries. According to the World Health Organization guidelines, the optimal fluoride concentration in drinking water is a range of 0.7–1.2 ppm, depending on the climate.<sup>[8]</sup>

#### *Fluoride toothpaste*

All children should regularly use fluoridated toothpaste to reduce the risk of the development of caries.<sup>[6]</sup> Regarding children under the age of 6 years, if they are at low caries risk, a toothpaste that containing no more than 600 ppm of fluoride should be used.<sup>[12,13,14]</sup> Those with a higher risk of developing caries should use a standard 1000-ppm paste. Regarding children over the age of 6 years should use a standard 1000 ppm or even higher fluoride level paste.<sup>[15]</sup> Children under 7 years old should brush their teeth under their parents' supervision. Parents should be instructed to use just a smear layer of fluoridated toothpaste for children under 2 years old, and a pea-sized for those aged 2–6 years. Children should be instructed to spit out the excess amount of the toothpaste during and after brushing.<sup>[15]</sup>

#### *Fluoride varnish*

It is a professionally applied adherent material and not intended to be as permanent as pit and fissure sealant. The use of fluoride varnish is based on the premise that longer duration and more intimate contact between fluoride ions and enamel leads to a higher fluoride uptake by the enamel. The application of high fluoride concentrations, around 22,000 mg F/L, in a small amount of material, leads to slow release of fluoride into the surrounding environment. This release has been shown to continue for 5–6 months.

Fluoride varnish has been used widely for over three decades both as part of community-based programs and on an individual basis. It is effective in preventing new carious lesions and halting the progression of established ones. It is the treatment of choice for children at high caries risk. F varnishes typically contain 5% sodium fluoride (NaF), which is equivalent to 2.26% F (Duraphat) and an organic fluoride varnish contains 0.1% F (fluor protector) are available. It is applied to teeth by the paint-on technique.<sup>[14]</sup>

### Fluoride mouth rinse

It is not recommended in fluoridated community and for children under 6 years, due to the risk of fluoride ingestion. The two main concentrations available are 0.05% (225 ppm F) NaF, and 0.2% (900 ppm F) NaF For daily and weekly uses, respectively.<sup>[6]</sup>

### Fluoride gel

Many of the problems associated with fluoride solutions were overwhelmed by the introduction of fluoride gels. Gels are produced by the addition of a gelling agent such as methyl or hydroxyethyl cellulose to the fluoride preparation, which increases its viscosity. It was found that fluoride gel effectively may lead to 28% reduction in dental caries. The most commonly used gel is 12,300 ppm of acidulated phosphate fluoride (APF). APF thixotropic gel is available, thixotropic denotes a solution that sets in a gel-like state but is not a true gel on the application of pressure thixotropic gel behaves like a solution. It is not recommended for children under 6 years, due to the risk of Fluoride ingestion. It is applied to teeth by the tray technique.<sup>[6]</sup>

### Fluoride supplements

Fluoride supplements are provided in the form of tablets, lozenges, drops, liquids, and F-vitamin preparations. These supplements usually contain neutral NaF as the active ingredient. All potential fluoride sources should be evaluated and a caries risk assessment should be conducted on every child before prescribing, to reduce the risk of over-dosage and fluorosis. For children at low caries risk, dietary fluoride supplements are not recommended and other sources of fluoride should be considered as a caries preventive measure. Fluoride supplements have some topically effect by elevating salivary and plaque levels of fluoride for some hours. Fluoride drops are placed directly on the tongue or inside the cheeks, and it is used until a child is old enough to swallow. The tablets and lozenges are intended to be chewed or sucked before swallowing. The use of F-vitamin preparations is recommended when the patient requires both fluoride and vitamins. This combined preparation may aid motivation for continued and regular Fluoride ingestion. However, it cannot provide a topical effect to the erupted teeth because it has to be swallowed directly.<sup>[13]</sup>

### Silver diamine fluoride

Silver diamine fluoride (SDF) is used to prevent and arrest caries across the globe, particularly in the developing world. Its potential side effects include staining of carious tooth structure, but in some cases that is acceptable to patients and their parents. SDF has the potential to play an important role in managing dental disease in both primary and permanent dentitions.<sup>[15]</sup>

### Casein phosphopeptide-amorphous calcium phosphate

The anti-cariogenic effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) (Tooth mousse, GC Co., Japan) has been attributed to the multiphosphoryl-containing sequences of casein. CPP can stabilize the level of ACP

in saliva as it acts as reservoir of calcium. It is available in a form of chewing gum, mouthrinses, lozenges, topical cream, dentifrices, sprays, and energy drinks. CPP-ACP prevents caries by remineralizing early carious lesions, and it is a cost-effective method in high-risk population. It has been reported that the use of CPP-ACP tooth-mousse has an advantage over F toothpaste in neutralizing acids in the oral cavity.<sup>[16,17]</sup>

### Probiotics

Probiotics are defined as living microorganisms that are safe for human consumption and considered to provide health benefits when ingested in sufficient quantities. The probiotic properties include the following: Enhancement of the adaptive immune response, treatment of urogenital and respiratory tract infections, prevention or reduction of allergies in infants, and reduction of cancer risk factors in polypectomized and colon cancer.<sup>[10]</sup>

### Ozone

Recently, ozone has been proposed as a preventive mode for caries. Ozone treatment has shown to eliminate bacteria associated with caries; it can also lead to lesion reversal It is delivered to the tooth surface for 10–40 s. The ozone delivery should be followed by remineralization solutions and fluoride rinses. Heal ozone: Carious enamel and dentine are ozone permeable. Ozone deactivated 99% of the bacteria. Acids from bacteria are thus largely neutralized. Reductant fluid neutralizes residual acid and supplies fluorides and minerals. A neutral medium enriched with minerals is now available. Remineralization occurs within 4–12 weeks.<sup>[12]</sup>

### Caries vaccine

Vaccine is defined as a “Suspension of attenuated or killed microorganisms administered for the prevention, amelioration or treatment of infected diseases. The concept of a vaccine can be visualized primarily with the recognition of MS as the key organism in caries development.

### Laser

Laser light can be used in the visible region (blue or red) as a tool for the detection of carious lesions. Techniques developed to date for early caries detection by laser light rely on fluorescence naturally from the tooth material or bacterial by-products. Co<sub>2</sub> laser irradiation increased acid resistance of enamel. Resistance could result from chemical changes such as reduction of the carbonate content of the enamel surface or partial decomposition of the organic matrix. It caused an irregular, rough, and melted enamel surface and increased the bonding strength between the resin and enamel surface.<sup>[11]</sup>

### CONCLUSION

“Prevention is better than cure” so it is imperative that we, as dentists should focus on treating not only those who are ill but also treat those who are more likely to get ill. We have a variety of new agents, which can be used to prevent dental caries, but the application of these agents in clinical trials is still

limited in the developing countries. Moreover, dental caries is a multifactorial and all preventive measures should be evaluated properly in human trials so that they can be introduced at the community level for the prevention of dental caries.

### Financial support and sponsorship

Self-funded.

### Conflicts of interest

There are no conflicts of interest.

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