CONSERVATIVE DENTISTRY

REMINERALISING AGENTS IN DENTISTRY

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TOPIC: Remineralising agents in Dentistry

AIM: To know about the use of various remineralising agents in dentistry for the prevention of dental caries .

BACKGROUND:
Dental caries, also known as tooth decay, cavities, or caries, is a breakdown of teeth due to activities of bacteria. Caries is a highly prevalent multifactorial disease and has been a major public health problem for many centuries. The goal of modern dentistry is to manage non-cavitated caries lesions non-invasively through remineralization in an attempt to prevent disease progression and improve aesthetics, strength, and function.The routine drill and fill technique eliminates bacteria only at the site of restoration and recolonization can occur in remaining part of oral cavity.
Hence this review is to know about various remineralising agents present in dentistry for the prevention of dental caries.

REASON: Dental caries has become one of the most prevalent disease in the tooth occurring from young children to older people. So it's important to know about the use of remineralising agents for the prevention and treatment of dental caries.

INTRODUCTION:
Dental caries is an infectious disease that results in destruction of calcified tissues. Caries is a process which occurs when demineralization exceeds remineralisation. But progression of dental caries is slow process and during early stages non-invasive can convert the lesion to inactive state from an active state. 1
Modern dentistry aims to manage carious lesions non-invasively through remineralization in an attempt to prevent disease, and to improve form, function, strength and esthetics of teeth .2 Early diagnosis of incipient carious lesions has led to a new transaction in preventive dentistry in the form of remineralisation. The ultimate treatment for caries management is use of remineralizing products. Presently fluoride, calcium phosphate-based systems, calcium sodium phosphosilicate etc that help in remineralization are available commercially. Recent investigations have primarily focused on various calcium phosphate based technologies which are designed to supplement and enhance fluoride's ability to restore tooth .3. This article discusses the different types of remineralising agents used in dentistry.

* IDEAL REQUIREMENTS OF REMINERALISING AGENTS:
Should diffuse into the subsurface.

Should not expel excess amount of calcium

Calculus formation is prevented
Should work at acidic PH
Should work at xerostomic patients
Should improve the properties of saliva

INDICATIONS OF REMINERALISING AGENTS IN DENTISTRY:

* An adjunct preventive therapy to reduce caries in high-risk patients
* Reduce dental erosion in patients with gastric reflux or other disorders
* To reduce decalcification in orthodontic patients
* To repair enamel in cases involving white-spot lesions
* Orthodontic decalcification or fluorosis or before and after teeth whitening and to desensitize sensitive teeth.

REMINERALISING AGENTS PRESENT IN DENTISTRY:

There are many remineralising agents in the current field of Dentistry: Those are
Fluorides

Casein Phosphopeptide - Amorphous Calcium Phosphate

Bioactive Glass

Tri-Calcium Phosphate

Xylitol

Ozone

Calcium carbonate carrier – SensiStat

Nano-hydroxyapatite

The trimetaphosphate ion

Dicalcium phosphate dehydrate

FLOURIDES:
Fluorides are the most effective agent in prevention of dental caries. They are supplied in the form of dentifrices or rinses for personal use. They are used in the form of varnishes, solutions, gels and fluoride releasing restorative materials. The mechanism of action of fluorides includes :

* The fluoride ion can exchange with hydroxyl group in the apatite crystal forming fluorapatite .
* The fluoride can enter void spaces on the apatite crystal and provide stability by additional bonds,
* Fluorides can contribute to remineralization of early lesions,
* Fluorides can act as an antimicrobial agent against bacteria and
* Inhibits enzymes essential to bacterial metabolism and growth .(6)
*
* Fluorides are also available in the form of solutions, gels , varnishes and fluoride releasing restorative materials .

Casein Phosphopeptide - Amorphous Calcium Phosphate:

The casein phosphopeptides (CPPs) are produced from the tryptic digest of casein, aggregated with calcium phosphate and purified through ultrafiltration. Casein has the ability to stabilize calcium and phosphate ions by releasing small sequences of peptides (CPPs) through partial enzymic digestion that led to the development of a remineralization technology based on casein phosphopeptide-stabilized amorphous calcium phosphate complexes (CPP-ACP) and casein phosphopeptide-stabilized amorphous calcium fluoride phosphate complexes (CPP-ACFP). [7][8][9]
CPP-ACP is a useful cario-static agent for the control of dental caries. A dentifrice containing CPP-ACP with fluoride will provide remineralization, which is superior to both CPP-ACP alone and to conventional and high fluoride dentifrices. Reynolds and colleagues found a reduction of 15% and 46%, respectively, in 0.1% and 1.0% w/v CPP-ACP. (10)

TRICALCIUM PHOSPHATE:
TCP is a new hybrid material created with a milling technique that fuses beta tricalcium phosphate (í-TCP) and sodium laurylsulfate or fumaric acid. This blending results in a "functionalized" calcium and a "free" phosphate, designed to increase the efficacy of fluoride remineralization. (12)(13)í-TCP is similar to apatite structure and possesses unique calcium environments capable of reactingTCP provides catalytic amounts of calcium to boost fluoride efficacy and may be well designed to coexist with fluoride in a mouthrinse or dentifrice because it will not react before reaching the tooth surface. (14) When TCP finally comes into contact with the tooth surface and is moistened by saliva, the protective barrier breaks down, making the calcium, phosphate and fluoride ions available to the teeth. The fluoride and calcium then react with weakened enamel to provide a seed for enhanced mineral growth relative to fluoride alone.

XYLITOL:
Xylitol is a 5-carbon sugar that the oral micro-flora cannot metabolize.
Xylitol has well-documented anti-cariogenic effects through its inactivation of strep mutans and inhibition of plaque's ability to produce acids and polysaccharides. Plaque becomes less tenacious, less acidic and less able to thicken on teeth in the presence of xylitol. These effects will occur no matter , providing an adequate dose and frequency is reached.
This flow of saliva results in increased buffering capacity in the mouth. This saliva has a high mineral content, which will provide the minerals to remineralize damaged areas of enamel at this higher and alkaline pH.
Xylitol does not simply protect teeth from caries, but creates a situation for remineralization and repair of existing demineralized lesions. (15)
"Xylitol additives working as calcium-ion carriers possibly promoted remineralization in the intermediate and deep layers."

Remineralization becomes all the more remarkable in the presence of xylitol. Xylitol strongly stimulated saliva-induced remineralization in deep layers." (16)

OZONE:
* Ozone is a chemical compound which acts as a powerful oxidizing agent. Ozone acts by attacking thiol groups in cysteine amino acid and destroys the cellular membrane of carious bacteria [17]. Ozone can shift microbial flora from acidogenic micro-organisms to normal commensals allowing the process of remineralization to occur [18]. Presently remineralizing solution consisting of xylitol, fluoride, calcium, phosphate and zinc are approved for treatment of caries. That can be used as 2100 ppm of ozone ± 5% at a flow rate of 615 cc/min for 40 seconds [19]
*
* Calcium carbonate carrier - SensiStat
The SensiStat technology is made of arginine bicarbonate with amino acid complex, and particles of calcium carbonate, an abrasive in toothpaste. The arginine complex is responsible for adhering the calcium carbonate particles to the dentin or enamel surface and allows the calcium carbonate to dissolve and release calcium that is responsible to remineralize the tooth surface. (20).

NANO-HYDROXYAPATITE :
A study was done to determine the effect of nano-hydroxyapatite concentrations on enamel lesions under dynamic pH-cycling conditions. It was concluded that nano-hydroxyapatite was having the potential to remineralize enamel lesions. A concentration of 10% nano-hydroxyapatite is optimal for remineralization of early caries occurring in the enamel .22]

THE TRIMETAPHOSPHATE ION:
The potential mode of action of trimetaphosphate ion (TMP) is likely to involve in adsorption of the agent to the enamel surface, causing a barrier coating that is effective in preventing or retarding reactions of the crystal surface with its fluid environment, and hence reducing demineralization during acid challenge. [23]
the role of sodium TMP as a templating analog of dentin matrix phosphoproteins for inducing intrafibrillarremineralization of apatite nanocrystals within the collagen matrix of incompletely resin infiltrated dentin. [24]

CONCLUSION :
A goal of modern dentistry is the non-invasive management of carious lesions involving remineralization systems to repair the enamel with fluorapatite crystals.
With an understanding of the implementation of these remineralizing agents, we can create a more favorable condition in which remineralization can occur. It is important for dentists to be aware that it takes significant time to establish the bonafides of a new technology.
Prevention of dental caries by remineralization is a concept and philosophy that focuses on the intervention at the earliest possible stage with the long term protection of the patient.

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