

## Dentifrice- Fricare your Teeth

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### ABSTRACT

Oral hygiene maintenance is the part and parcel of the overall oral health. The entire treatment phases and maintenance phases rely on the extent of clean oral cavity. We have with chemical and mechanical plaque control measures for maintenance. Dentifrices come handy in our mechanical control for use along with toothbrushes. Dentifrices come in wide ranges with additional therapeutic ingredients added to them. Toothpastes are often used in treatment of halitosis and gingivitis as a delivery system for therapeutic agents such as antimicrobials and ant sensitivity agents.

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### Introduction

Toothpastes are used in oral hygiene practices universally. Dentifrices (toothpastes) have been used since antiquity but recently formulations which deliver active compounds aimed at preventive and/or treating oral diseases have been developed [1]. The selection of the appropriate therapeutic dentifrice is based on diagnosis of disease or condition [2].

The origin of our modern abrasion limits for dentifrices dates back over a century. Researches resulted in development and implementation of methodologies to measure tooth abrasion and broad scale adoption of recommended safety standards [3].

### History and Origin

Around 3000 to 5000 BC, ancient Egyptians first developed a dental cream, which contained powdered ashes from Oxen Hooves, Myrrh, Eggshells and Pumice, primarily with the aim to remove debris from teeth. Persians then added burned shells of snails and oysters along with gypsum, herbs and honey around 1000 BC. Some 1000 years later, Greeks and Romans appear also to be the first to add flavour, most likely to help with bad breath and to make their paste more palatable.

In 18<sup>th</sup> century, use of toothpowders became more common, but they were very harsh to teeth due to abrasives such as brick dust, crushed china, and earthenware and cuttle fish. Still nowadays popular bicarbonate of soda is used as the main ingredient for

most toothpowders. At the end of 18<sup>th</sup> century Borax powder (sodium borate) was added to produce a favourable foaming effect and early 19<sup>th</sup> century to make powders to pastes glycerine was introduced. Use of glycerine also contribute to tooth pastes to become more palatable and prevent it from drying out. Strontium was introduced at the same time, which was believed to strengthen teeth and reduce sensitivity.

A dentist called Peabody become the first person to add soap (salt of fatty acids) to toothpowders in 1824. In addition, John Harris added chalk in 1850s. In 1873 toothpastes was first mass-produced in a jar by “Colgate and Co.” in 1892, Dr. Washington Sheffield of Connecticut was first to put toothpaste into a collapsible tube.

In 1914 one of the most important breakthroughs in the history –the introduction of fluoride took place. British patent “GB3034” (Patented in 1915) describes “improvements in or relating to dentifrices” and there in toothpaste formulations containing sodium fluoride among others. Crest toothpaste introduced by “Procter and Gamble” in USA in 1956, was likely to be the first marketed fluoride toothpaste in world [4].

The journey to today’s dentifrice abrasion standards begin with William Miller. His works showed that abrasives like ground cuttle fish and raw sand cause significant damage to both dentin and enamel. Then Dr Richard Manly who conducted first researches showing brushing techniques cause abrasion in addition to presence of harsh toothpaste abrasives [1].

## General Composition of Dentifrice and Uses

Agents	Functions
Abrasives	Aid in removal of Plaque and debris and polish the enamel after debris removal.
Humectants	Give the toothpaste texture and maintain moisture content.
Surfactants /Detergents	It produce foam and aid in the removal of debris.
Buffering agents	Control pH.
Dyes	Improves appearance.
Flavouring agents	Provide flavour.
Sweeteners	Sweetens the dentifrice.
Preservatives	Preserve the dentifrice.
Water	Form a paste with the ingredients

### Abrasives

Abrasives are used for removal of plaque and debris with polishing purpose. This function is provided by alumina, kaolin, bentonite, calcium pyrophosphate, pumice etc. Along with this alumina can improve tooth gloss, calcium pyrophosphate reduce availability of soluble calcium ions and thereby increase fluoride ion availability and pumice can restore the gleam.

### Surfactants

Surfactants produce foam and thereby decrease the surface tension so that all the ingredients can contact the teeth easily and also it can act as emulsifier of flavouring agent. Sodium lauryl sulphate (SLS) is the most common surfactant used in toothpaste. Other surfactants include Sodium lauryl sarcosinate, amine fluorides, sodium stearyl lactate, sodium stearyl fumarate, etc.

### Humectants

To keep moisture content in toothpaste for prevent it from drying out and maintain the texture is served by humectants. Substance used as humectants are glycerol, sorbitol which can also serve the initial freshness during storage and prevent tooth decay by reducing plaque build-up, peg 8 (polyoxyethylene glycol), xylitol.

### Binding Agents

Binding agents prevent the separation of liquid and solid phases. Carrageenan Binder stabilises and thickens the consistency of toothpaste, Hydroxyethyl Cellulose Binds and stabilizes the ingredients, Sodium alginate reduce bacterial growth and cleans the teeth. Plant extracts such that alginate, guar gum, gum Arabic are also used for this purpose.

### Colouring Agents

Colouring agents that are used to give colour are chlorophyll and titanium dioxide.

### Flavours

Flavouring agent provide pleasant taste to dentifrices and hide the taste of some other ingredients, which have bitter or metallic taste. Clove oil, peppermint, eucalyptus, wintergreen etc. are used as flavouring agents.

### Sweeteners

Saccharine, sorbitol, aspartame, etc. are used to provide sweet taste to the dentifrices.

### Preservatives

Alcohols, Formaldehyde, Benzoic acid, Ethyl parabens are used as preservatives in dentifrices.

### Antiplaque Agent

Stannous Fluoride, Triclosan are used for plaque control in dentifrices [3].

### Classification of Toothpastes

There is an established toothpaste classification based on certain characteristics of the active ingredients. Caries prevention and treatment

To treat early decay two main principles are there:

- Reduce etymological factor- dental plaque and the bacterial biofilm of which is composed.
- Increase amount of remineralizing substance.

These two principles can be achieved by cleaning the teeth with fluoride toothpaste. As per a survey, widespread use of fluoride dentifrices showed significant decrease in caries prevalence in spite of socioeconomic status in Brazil [5]. Toothpastes with 1000-1500 ppm concentration of fluoride is recognized as the most effective fluoride source and in case of children fluoride content limited to 500-550 ppm.

In addition to fluoride, xylitol demonstrates a good anti caries effect, as well as antibacterial impact, a salivary stimulating effect, and direct biochemical effects.

Higher concentration of fluoride 2500-5000 ppm can achieve a caries reduction up to 36%. In vitro studies also show that toothpastes with elevated concentrations have a higher ability to remineralize enamel and dentin better than toothpastes with normal concentrations [6].

### For Periodontal Disease Prevention and Treatment

The cause of gingivitis and periodontitis is bacteria in dental plaque. The prevention of this disease has two main rules.

- Remove plaque regularly thus preventing the growth of bacteria on the biofilm.
- Prevent the growth of bacteria thus inhibiting formation of plaque and tartar.

The first rule is insured by mechanical cleaning of the teeth. But in order to prevent bacterial growth manufacturers add various antiseptic and antibacterial substances like triclosan, chlorhexidine, hydrogen peroxide, baking soda, povidone iodine, zinc citrate, etc. are added to toothpaste.

Toothpastes containing natural plant extracts, essential oils, enzymes and vitamins including Ayurveda provides similar antibacterial effectiveness and use of Topical antioxidants prevent negative effects of immune response on tissues without hindering their effects on microorganisms.

Synthetic antiseptic or antibacterial substances like triclosan, chlorhexidine help to reduce periodontal diseases in several levels. Triclosan decreases the signs of gingivitis by preventing growth of microorganisms and by reducing production of inflammatory cytokine mediators. Triclosan preserves normal flora. The antibacterial quality of chlorhexidine is associated with the prevention of glucose transport in bacterial cells. But chlorhexidine shows some undesirable effects also like pigmentation of teeth and composite restoration, dryness, temporary taste changes, potential allergic reactions, intensified formation tartar [6].

**Ant-calculus Dentifrices:** Dental calculus is ubiquitous in humans. Over 90% of adult have calculus, requiring professional calculus removal and oral hygiene evaluation. Anti-calculus dentifrices vary in their effectiveness depending on their active agents and their concentrations [7]. Supra gingival calculus is mineralized plaque and one approach to its control is the inhibition of its mineralization by crystal growth inhibitor. The most effective anti-calculus dentifrices contain pyrophosphate and copolymer (Polyvinyl ether and Maleic acid) [1].

#### **For Treatment of Sensitive Teeth**

Dental hypersensitivity is generally reported by the patient on experiencing a sharp pain caused by stimuli. Main causes of this condition are loss of cementum, improper brushing habits, etc. Exposed root surfaces due to gingival recession are a major predisposing factor to dental root sensitivity [2].

Two groups of products are used to treat sensitivity; those that interfere with transmission of neural impulses and those that block and occlude the dentinal tubules. Potassium nitrate (5%), potassium chloride (3.75%) and potassium citrate (5.5%) are used interchangeably in many countries since each of these salts provides 2% potassium ion, which acts to block neural transmission. Principle of occluding dentinal tubules involves strontium chloride and Stannous fluoride. stannous fluoride possess the ability to block tubules forming SnF<sub>2</sub> and CaF<sub>2</sub>, and the ability to form protective layer on the tooth surface by creating a reaction of Sn<sup>2+</sup> ion with sodium, calcium, and phosphate compounds and forming Sn-Na hexamataphosphate [1, 6].

#### **Whitening and Bleaching Tooth Paste**

Main purpose of whitening toothpastes is that it provides bleaching effects, therefore in a toothpaste class there are two definite subclasses – whitening toothpaste and bleaching toothpaste

##### **a) Whitening Toothpaste**

By removing stained plaque, teeth will regain their natural whiteness. Plaque can be removed by abrasive substance or by enzyme that stick to protein in the pellicle, thus facilitating the removal of stained plaque.

Whitening toothpaste with abrasive substances: the performance of these toothpastes is based on the size and hardness of the molecule of the added abrasive substances, which are harder than stain molecule. The pressure used in brushing the teeth and hardness, size, shape and concentration of particles affect the cleaning process. The most commonly used abrasive substances are silica dioxide, hydrated silica dioxide, calcium carbonate, calcium phosphate dehydrate, calcium pyrophosphate, alumina dioxide, perlite and sodium bicarbonate.

##### **Whitening Toothpaste with Chemicals**

Surface stains can be reduced by various chemicals added to toothpaste. Most of the stain molecules are included in pellicle, containing protein. Therefore, enzymes such as protease and papain creates a whitening effect. Sodium pyrophosphate, sodium tripolyphosphate and other pyrophosphates can bind with the Enamel, Dentin on tartar and absorb the stain molecules, creating a whitening effect [6].

Charcoal containing Dentifrices: They are increasingly fashionable for tooth brushing in extrinsic stain removal and tooth whitening. Activated charcoal binds to all tooth surface deposits. Holding plaque, bacteria and stained material in the pores of charcoal is then brushed away [8].

#### **b) Bleaching Toothpaste**

Bleaching toothpaste contain most commonly hydrogen peroxide or calcium peroxide. The peroxides touch tooth surface or penetrate the tooth tissue, they break down the stain molecule providing a bleaching effect [6].

#### **Tooth Paste with Specific Purpose**

Some manufactures claim to produce toothpaste to treat specific conditions. Toothpaste containing olive oil betadine and xylitol can stimulate salivary secretion when at rest, thus increasing the basal rate of salivary secretion. In case of xerostomia, the mucous membrane is more sensitive and more vulnerable so one should avoid irritating toothpastes such as those contain strong essential oils and foaming substances, but antioxidants and enzymes such as lacto peroxidase, lysozyme, lactoferrin and glycozyloxidase are advisable. These ensure salivary function [6].

#### **Recent Advances**

##### **Enamelon**

It is formulated with stabilized stannous fluoride and has the remineralizing potential of amorphous calcium phosphate technology. It provides fluoride as well as calcium and phosphate by converting soluble calcium and phosphate to natural hydroxyapatite. Enamelon contain 970-ppm fluoride and yet according to the studies on the product provides more than twice the fluoride uptake into enamel lesions. It prevent caries but also interference with the harmful effect of plaque associated with gingivitis. Based on studies it helped to manage dry mouth as it provide immediate and long-lasting moisturisation and lubrication [9, 10].

##### **Desensitizing Dentifrice**

Bioactive glass called Nova Min is the most recent technology in the desensitizing category. The active ingredient in Nova min is calcium sodium phosphosilicate. Saliva in the mouth reacts with calcium sodium phosphosilicate present in Nova min to form a protective layer of hydroxyapatite on teeth. This layer creates a barrier that prevents tooth sensitivity it decreases hypersensitivity.

##### **Calcium Phosphate Dentifrices**

###### **Tooth Mousse**

It strengthen teeth by binding calcium and phosphate to the tooth surface, plaque and surrounding soft tissue. It contains RECALDENT a special milk desired protein which maintenance saturation of LA levels of mineral. Especially calcium and phosphate at the tooth surface thereby decreasing demineralization and enhances remineralisation of teeth [9].

###### **Clinpro Tooth Crème**

It delivers a unique combination of fluoride, calcium and phosphate. As the dentifrice comes in contact with saliva during brushing the barrier breaks down and makes the calcium, phosphate and fluoride readily available to the tooth. The tooth naturally absorbs these components helping prevent the initiation and further progression of demineralization and allowing remineralisation to occur [9, 11].

###### **Ora MD**

It functions as a dentifrices mouthwash and breath all at once. Ora MD is made from 100% natural almond spearmint and peppermint oils. It is a natural bacteria fighters. It maintain good oral hygiene [9, 12-15].

## Conclusion

Toothpastes are universal oral hygiene practice and it primarily serving the purpose of cleaning tooth surfaces. It is evolution in ingredients give it new purposes to serve like caries prevention, periodontal disease prevention, treatment of sensitive teeth, etc. Its composition include abrasives, binding agents, antimicrobials, and antidrying agents and in addition, colouring and flavouring agents stimulates its action. Each agents constitute different functions and them together dealing its actions. Clinical trials has introduced new advances in the field by which dentifrices with specific functions are evolved and its marketing field grows widely.

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