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Dentifrices: An overview from past to present

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Abstract

The health of the teeth and gums are maintained by cleaning of teeth regularly. Plaque is the main etiological factor for causing tooth decay, bad breath and gingival/periodontal diseases leading to tooth loss^[1], so we need an agent which removes plaque. From the ancient days agents either in the form of powder, paste, or gel are in practice. This article mainly concentrates on evolution of tooth paste from past to present.

Keywords: Dentifrices, gingival, periodontal

Introduction

The history of dentifrices is a striking example of the persistent changes and preparations containing harmful substances known by the medical professionals^[2]. Damocrates, a Greek physician, considered cleanliness as the indispensable condition for avoiding disease of the teeth and gums. In any case the covering or removal of unwholesome breath was undoubtedly an important objective, as practically all formulas included one or more flavouring agents. Humans have been using tooth pastes for several centuries which involved some primitive materials like ashes made from ox hooves, myrrh, burnt egg shells and pumice which were mixed with water.

Evolution of dentifrices

By 1900, a paste made of hydrogen peroxide and baking soda was recommended for use with toothbrushes. Pre-mixed toothpastes were first marketed in the 19th century, but did not surpass the popularity of tooth-powder until World War I^[3,4].

First lead/tin alloy tubes were used in 1914, the most prolific component fluoride was introduced in the same year. During World War 2 there is a shortage of lead/tin — and this led to the development of plastic tubes^[3,4].

During the first third of the 20th century the relative importance of the various types of dentifrices has undergone considerable changes. Liquids or solutions have been sharply differentiated into those intended to whiten the teeth and into the antiseptic mouth washes. The first class of tooth pastes have shown that many of these contain the mineral acids like hydrochloric and sulphuric acids that are distinctly harmful to the teeth. Less objectionable are those which contain the organic or so-called fruit acids. Mouth washes containing various antiseptic ingredients have been extensively advertised and sold but it is now recognized that only extremely active disinfectants can be expected to have any action on the oral bacteria under the conditions of use. These preparations are popular for the purpose of improving the bad breath and removing the bad taste. The modern toothpaste or cream, welcomed on account of its convenience, palatability and stability, rapidly became a best seller. The first preparations of this type contained the more severe abrasives that contain tricalcium phosphate, other abrasives which have been considered are magnesium phosphate, calcium fluoride, barium sulphate, silica, calcium and magnesium sulphates, etc. These and many others have been investigated and the majority abandoned for various reasons as they were not suitable for continued use.

Fluoride toothpaste became the standard during the late 1950's and 1960's. And from the 1980's to the present day have seen all kinds of additions — gels, whitening agents, toothpaste for sensitive teeth and so on. Tanagra, containing calcium fluoride as the active ingredient, was sold by Karl F. Toellner Company, of Bremen, Germany, based upon the early work of chemist

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Albert Deninger ^[5]. An analogous invention by Roy Cross, of Kansas City, Missouri, was initially criticized by the American Dental Association (ADA) in 1937. Fluoride toothpastes developed in the 1950s received the ADA's approval. To develop the first ADA-approved fluoride toothpaste, Procter & Gamble started a research program in the early 1940s. In 1950, Procter & Gamble developed a joint research project team headed by Dr. Joseph Muhler at Indiana University to study new toothpaste with fluoride. In 1955, Procter & Gamble's Crest launched its first clinically proven fluoride-containing toothpaste. On August 1, 1960, the ADA reported that "Crest has been shown to be an effective anticavity (decay preventative) dentifrice that can be of significant value when used in a conscientiously applied program of oral hygiene and regular professional care." In 2006 Bio Repair appeared in Europe with the first toothpaste containing synthetic hydroxyl apatite as an alternative to fluoride for the remineralization and reparation of tooth enamel. The "biomimetic hydroxyl apatite" is intended to protect the teeth by creating a new layer of synthetic enamel around the tooth instead of hardening the existing layer with fluoride that chemically changes it

into fluorapatite ^[6]. The most recent advances in toothpastes have included the development of whitening toothpastes, and toothpaste containing Triclosan which provides extra protection against caries, gum disease, plaque, calculus and bad breath. The new BioMinF toothpaste ingredient provides a new tooth repair technology which will bring relief to the millions of adults and children around the world who are prone to tooth decay and sensitivity. Toothpastes containing BioMinF are able to slowly release calcium, phosphate and fluoride ions over an 8-12 hour timeframe to form fluorapatite mineral to rebuild, strengthen and protect tooth structure. The slow release of fluoride has been identified to be particularly beneficial in prevention of tooth decay. Toothpastes today typically contain fluoride, colouring agents, flavouring agents, sweeteners as well as ingredients that make the toothpaste a smooth paste, foam and stay moist. Individual toothpastes also may contain special ingredients, such as triclosan in Colgate Total. Toothpaste in tubes is used throughout the world and has been a very successful invention.

Year	Dentifrice Used	Properties
3000- 5000 BC (Ancient Egyptians)	Dental cream which comprised of powdered ashes from oxen hooves, myrrh, egg shells, pumice, and water	Terrible taste with minimal level of tooth cleaning.
Around 5000 BC (Greece & Rome)	Tooth powder with abrasives like crushed bones and oyster shells.	More cleaning power with bad taste
500 BC (China & India)	Tooth powder and paste as well.	Flavouring agents like ginseng, herbal mints and salt were added to enhance the taste.
Until 1800's	Crude powder or pastes were used	--
1824	A dentist named Peabody added soap to toothpaste.	Added cleanliness. Soap was later replaced by sodium lauryl sulfate to create a smooth paste.
1868	New and improved form of tooth powder. the tooth tablet	This was supplied in the form of a cake from which one tablet at a time, sufficient for one brushing, could be broken.
End of 19 th century	Tooth soaps were introduced	Tooth soaps, made by adding about one-third by volume of powdered soap to an ordinary tooth powder.
1873	Colgate started commercial mass production which was sold in a jar.	These pastes still used fairly abrasive ingredients, which definitely scrapes away the bad stuff.
1892	Tooth paste in a collapsible tube by Dr. Washington Sheffield	Similar to today's version tooth paste.
1914	Fluoride is added to the tooth paste.	Decreased dental cavities.
1950	Fluoride tooth paste was approved by ADA.	--
1975	Herbal tooth paste such as Tom's became available.	Alternative to cleaning teeth without fluoride. These toothpastes include ingredients like peppermint oil, myrrh and plant extracts.
1987	Edible tooth paste was invented.	Invented by NASA so astronauts could brush their teeth without spitting into a zero-gravity abyss.
1989	Rembrandt invented first whitening tooth paste.	--
2006	First tooth paste containing hydroxyl apatite as an alternative to fluoride.	Creates a new layer of synthetic enamel around the tooth.

Dentifrice ^[7] commonly contains the following ingredients

- 1. Abrasives:** These are added to clean the teeth and to remove the stains. The cleaning power of abrasive depends on the type and amount of abrasive particles, surface it contacts, dilution by saliva and brushing pressure. Commonly used abrasives are silica or hydrated silica, hydrated aluminium oxides, calcium carbonate, brushite and gibbsite.
- 2. Water:** It acts as a solvent and dissolves ingredients allowing them to be mixed.
- 3. Humectants:** These act as moisturizing agents and protect dentifrice from drying up during storage. Commonly used humectants are glycerine, sorbitol, propylene glycol and paraffin oil ^[8].
- 4. Detergent /surfactant:** They act as surface active

- substances and decrease surface tension, there by emulsify and remove debris with their foaming action, sodium lauryl sulphate, sodium lauryl sarcoside are some of the commonly used detergents.
- 5. Thickening agent/Binding agent:** These are hydrophilic colloids which disperse or swell in the presence of water and are used to stabilise dentifrice formulations by preventing the separation of solid and liquid phases. Eg: natural gums (Arabic, karaya and tragacanth), the seaweed colloids (alginates), synthetic celluloses (carboxy methyl cellulose).
- 6. Flavouring agent:** Various natural and artificial flavouring agents such as mint, pepper mint, spear mint and winter green and sweeteners such as saccharine, acesulfame K, aspartame and xylitol have been added to

improve the taste.

7. **Therapeutic agent:** These are active components added to the dentifrice to reduce caries, inhibit tartar formation, help in desensitization and have an antimicrobial and anti-inflammatory action. Eg: Fluoride, triclosan, strontium chloride etc.
8. Colouring agent and preservatives

Classification of tooth pastes^[9, 10]

There is an established toothpaste classification based on certain characteristics of the active ingredients.

1. **For caries prevention and treatment:** Toothpaste used as a local fluoride source has the best ability to inhibit the development of caries (19-27% reduction of caries), providing remineralization of enamel.
2. **For periodontal disease prevention and treatment:** The first rule is insured by a mechanical cleaning of the teeth, but in order to prevent bacterial growth, manufacturers add various antiseptic and antibacterial substances to toothpaste – triclosan, chlorhexidine, hydrogen peroxide, baking soda, Povidone Iodine, zinc citrate and others. Pyrophosphates^[11], zinc citrate and zinc chloride are used to remove the tartar formed on the teeth. They stabilize the amount of calcium in saliva and interfere with the crystalline structure of calculus.
3. **For treatment of sensitive teeth:** Analgesic toothpastes, tooth pastes containing potassium saline maintain a high K⁺ extracellular level, thus preventing re-polarization of the nerve cell membrane and inhibiting the transmission of impulses without causing changes in the pulp.
4. **Whitening and bleaching toothpastes:** Whitening toothpastes by removing stained plaque, teeth will regain their natural whiteness. Plaque can be removed by abrasive substances or by enzymes that stick to proteins in the pellicle, thus facilitating the removal of stained plaque.
5. **Bleaching toothpastes:** Also bleaching toothpastes contain chemicals, most commonly – hydrogen peroxide or calcium peroxide (Calprox). When peroxides touch the tooth surface or penetrate the tooth tissue, they break down the stain molecule, providing a bleaching effect.
6. **Toothpastes with a specific purpose:** Some manufacturers claim to produce toothpastes to treat specific conditions, and such products do not belong to classification groups mentioned previously. The example of toothpastes claim to solve specific problems, are antiviral products. It has been proven that lariphan can mobilize the body's natural immune responses, providing antiviral and immunomodulatory activity. This also inhibits the penetration and growth of pathogenic bacteria.

Herbal toothpastes were introduced to avoid the artificial ingredients commonly found in regular toothpastes. Many herbal toothpastes do not contain fluoride or sodium lauryl sulfate. The ingredients found in natural toothpastes vary widely but often include baking soda, aloe, eucalyptus oil, myrrh, plant extract (strawberry extract), and essential oils. Eg: Meswak, Dabur red, Patanjali dantkanti, Himalaya complete care etc.

Tooth pastes have been specially formulated for kids to make brushing fun. These pastes are safe and mild for children and have clinically proven enamel and cavity protection. They are available in gentle fruit flavours so that the children can enjoy brushing.

Future of dentrifices^[12]

Nanotechnology^[13] dentifrice, there will be the use of nano robots that will interact with the human body to clean the teeth. These devices would also identify food particles, plaque, or tartar, and lift them from teeth to be rinsed away. Solar toothbrush¹⁴ of the future may replace dentifrice. According to the manufacturers, the solar toothbrush will remove plaque even if dentifrice is not used; meaning that if the innovation ever catches on, it could shake up the oral care industry.

The £10 dentifrice that can 'rebuild' teeth: Unilever has unveiled new dentifrice (Regenerate) and it claims can regenerate 82per cent of tooth enamel after just three days of use. The company claims this has the effect of restoring teeth to their original whiteness while making them much stronger, which means they are less likely to develop cavities. The technology requires the use of a 'Boosting Serum' treatment, which is applied using two custom-fit mouth trays. The two key ingredients in the dentifrice are calcium silicate and sodium phosphate

In Ireland researchers of Athlone Institute of Technology (AIT) have found that growth of harmful bacteria can be inhibited effectively by coconut oil and thus can prevent tooth decay and oral infections. Hence Coconut might make the perfect dentifrice of the future.

Conclusion

As Dr. Grater said "A clean mouth will lead to clean body." One cannot be healthy without oral health, oral health and general health should not be interpreted as separate entities. Scientists have long seen a link between healthy teeth and gums and oral cavity without plaque can prevent the risk of systemic diseases, hence dentrifices also plays a major role in this aspect.

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