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Review on Herbal Toothpaste

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Abstract: *Herbal toothpaste is also one of the products which are available in the market & we can used in our daily life. People are either stick to old brands and keep trying it or buying without knowing the real effect of product. Herbal toothpaste is a paste or gel dentifrice used to clean and maintain the aesthetic and health of teeth. Toothpaste is designed to target specific issues inside the mouth, like whitening teeth, eliminating food debris, prevent from caries & reducing sensitivity. Toothpaste is a part of our daily oral hygiene routine. Many dentists recommend to use herbal toothpaste to treat disorders like sensitivity and chronic gingivitis etc. In recent year dental caries is the most common health problem in the world. Azadirachta Indica also known as neem is being used in India from ancient as a toothbrush in oral hygiene. Herbal toothpaste is containing numerous herbs like Ginger, Amala, Clove, Neem, & Peppermint which have the ability to remove the plaque, freshen our breath and also prevent various gum diseases. Herbal toothpaste gives the significant action like fluorinated chemical toothpaste. Fluorinated toothpaste leads to fluorosis which weaken the bone for this purpose herbal toothpaste is the best choice for adults and children. There are numerous products available in the market as anticaries and antiplaque effect. Toothpaste protects, cleans and polishes teeth. It makes oral hygiene more efficient. Review says that the herbal toothpaste contain herbs also gives same effect like chemical toothpaste*

Keywords: Herbal toothpaste, Oral hygiene, Chronic gingivitis, Neem, Periodontitis, Ginger, Clove, Antiplaque, etc

I. INTRODUCTION

Toothpaste is a paste or gel used to maintain and improve oral health. It is a semi-solid dosage form used to enhance oral hygiene. [1-2] Dental caries is a global oral health problem that has a distinctive variation in world. Dental caries is the most common oral disease that affects a significant portion of the Indian population. The overall prevalence of caries in India is reported to be 54.60%. [3] Dental caries is widely recognized as a microbial infectious disease which results in toothache, heart related problem, migraine & some time leaded to death in severe condition. The main etiology of dental caries is: cariogenic bacteria & fermentable carbohydrates. [3]

Cariogenic microorganisms like ***Streptococcus mutans*** & ***Streptococcus sobrinus*** are the primary causative microorganism for the development of dental caries. Poor oral hygiene is results in plague formation which is responsible for gingivitis disease. [4] The methods used for plaque control are chemical and mechanical. Mechanical method involve cleaning of the teeth by toothbrush & chemical agents with antiplaque or antimicrobial activity into dental products has been proposed as a potential prophylactic method of reducing plaque by limiting the cariogenic bacteria in the oral cavity. [5] Various chemical antimicrobial agents are incorporated into dentifrices include Triclosan, Sodium fluoride, Sodium mono fluorophosphate & Zinc chloride, etc. like chemical antimicrobial agent herbal Miswak & Neem extract also have antimicrobial effect. [6] Fluoride was first added to toothpaste in the 1890. [7] Consumers who wish to avoid the artificial ingredients commonly found in regular toothpaste use herbal toothpaste. Many herbal toothpastes do not contain fluoride or sodium lauryl sulphate. The ingredients found in natural toothpaste Aloe vera, Cinnamon, Clove, & Myrrh have Anti-bacterial activity. [8] In recent times, there has been renewed interest in naturally occurring products. A dozen brands claim or position themselves as natural, chemical-free, made of herbs.

History of Toothpaste:

Ancient Greeks and Romans are known to have used toothpastes, around 500BC India and China used toothpaste. The greeks and romans people used ingredient which included crushed bone & oyster shell as well as powdered charcoal

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and bark to avoid bad breath. Chinese used ginseng, mint and salt as toothpaste in cleaning mouth. Indian used *Azadirachta Indica* sticks as toothbrush. [9] Peabody added Sodium palmitate as salt in 1824 and John harris added chalk such as Calcium carbonate in 1850. In 1850s, developed new toothpaste in a jar called Creme Dentifrices and starts production in 1873 by Colgate. Washington Sheffield in 1892 put paste into collapsible tube. In 1914 one of the most important Fluoride added in toothpaste. In 1980 largely introduced antiplaque agent to control the gingivitis. Enzymes in body has scientific evidence that Glucose oxidase and Amyloglucosidase gives natural antimicrobial activity. [10]

Oral Disease:

Dental caries: [11]

Dental caries is a contagious microbial disorder that ends with degradation of calcified teeth tissue. It is the most common problem in children. Tooth decay occurs due to the plaque form by *streptococcus mutans* bacteria. Plaque is a sticky bacterial film layer on surface of teeth which leads to dental plaque & dental caries. S. mutans bacteria produces acid that damage enamel leads to tooth decay. Symptoms associated in tooth decay are bad breath, bad smell & black tooth surface. Dental caries result in severe pain, & it can be worsened by the heat, cold drinks and evn by sweet foods.

Fig. 1 Dental caries

Chronic gingivitis: [12]

Chronic gingivitis is a gum inflammation of gingival tissue. Formation of plaque on tooth surface is a sticky layer of bacteria which causes the gum inflammation of gingival tissue and leads to gingivitis. The main sign in chronic gingivitis is redness of tissue, swollen, tenderness & bleeding gums. Bleeding occurs when you brush your teeth with great force generally it doesn't cause any pain.

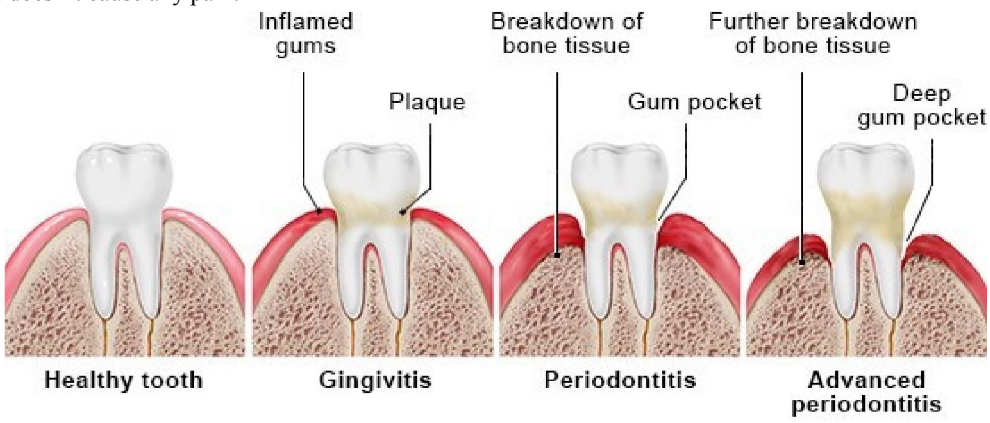

Fig. 2 Chronic gingivitis

eriodontitis: [13]

Periodontal disease is the next step of gingivitis. Periodontitis leads to bleeding gums, sensitive teeth & bad breath. In periodontal disease gums are inflamed due to the bacteria & starts pulling away from neck of tooth that causes gap

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between teeth and gum, which is known as gum pocket. Due to the formation of gum pocket bleeding occurs & can cause teeth to shift position.

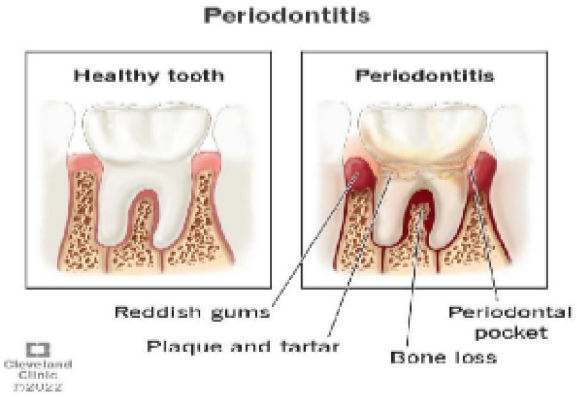

Fig. 3 Periodontitis

Sensitive teeth: [14]
Sensitivity also known as dentin hypersensitivity, & it is due to tooth decay, cracked tooth, gum disease & root infection. Tooth becomes sensitive to hot and cold food & drinks because of tooth decay.

Fig. 4 Sensitivity

Bad breath: [14]
Bad breath is most common dental problem it may be due to dental caries. Poor oral hygiene, infection, intake of medicine & dry mouth is some factors that causes bad breath. Food contain garlic and onion also leads to bad breath.

Fig. 5 Bad breath

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Forms of Dentifrices: [15]

Tooth Powder:

Tooth powder is in the form of microcrystals an alternative to toothpaste. Tooth powder available in form of Fluorinated and Non-fluorinated. Tooth powder contain abrasive agent which is used in combination with a toothbrush to maintain oral hygiene. The primary ingredient in a tooth powder is Abrasive agent, used to remove food debris and gives shine to teeth plaque and food from the teeth. A tooth powder also included antibacterial ingredients like Tea extract, & Mint for cooling sensation and fresh breathing.

Toothpaste:

Toothpastes is used with the toothbrush, for cleaning teeth and freshen breath. Toothpaste contains active ingredient that enhances antiplaque and anticaries activity. It contains some essential oil which helps in breath freshening & cooling. The essential components are abrasives, binder, surfactants, buffers and humectants. It is combination of liquid and solid which gives semisolid form of toothpaste.

Gel Form:

It is gum like sticky toothpaste which contains surfactant, abrasives, humectant and additionally colouring & flavouring agent. Gel form is due to the silica and abrasive agent like calcium carbonate which make it sticky which is helpful and convenient for brushing teeth.

Toothpaste Ingredients: [10]

1. Abrasives:

Abrasives are found in form of crystals, small and smooth particles. Abrasives are hard than dentine used as abrading and polishing agent. These agents help to remove debris on surface of teeth and gives whitening effect.

e. g. Calcium carbonate ($CaCO_3$), Aluminium hydroxide, Silica, Calcium phosphate, etc.

2. Binders:

Binders are used to bind the powder and liquid ingredient and maintain the elasticity of toothpaste. These binders prevent the breakage of phase separation by held the whole component as one mass.

e. g. CMC, Sodium alginate, carrageenan and Xantham gum.

3. Humectant:

Humectant are used to maintain the water contain in toothpaste. They prevent loss of water, and hardening the paste in the tube or when it is exposed to air. They also provide creamy texture.

e. g. Glycerol, Sorbitol, Propylene glycol, PEG etc.

4. Foaming agent:

Also known as surfactant which reduces the surface tension of liquid present in oral cavity to make contact with surface of teeth. They help to remove plaque by penetrating. They produced foam which helps to clean the teeth.

e. g. SLS, Sodium lauryl sarcosinate, Sodium alkyl sulfosuccinate and sucrose fatty acid esters.

5. Flavouring agents: [11]

They help to improve unpleasant smell and taste of the other raw materials and refreshing taste. Flavouring agents are added to toothpaste for pediatrics to increase the acceptance criteria.

e. g. Spearmint, Peppermint, Eucalyptus, Fennel, etc.

6. Sweeteners:

Sweeteners also improve the taste of toothpastes and give them a mild and sweet taste. The most common used sweeteners are Sodium saccharin, Sorbitol, Xylitol and Glycerol. Xylitol is also claimed to provide anti-caries activity.

7. Coloring agents:

Most toothpastes contain colouring agent which give them an attractive appearance. It improves the acceptance of toothpaste.e. g. Titanium dioxide, Chlorophyll, Turmeric, etc.

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Herbs in Dentistry:

MISWAK: [16]

The miswak is "*Salvadora persica"* belongs to family "Salvadorecea". Miswak contain Sulfur has a bactericidal effect and vitamin C has tissue repair property. Silica acts as an abrasive and help in removing stains from tooth. Tannins has astringent effect may help to reduces plaque and gingivitis. Resins form a layer on enamel that protects against dental caries. Salvadorine alkaloid present in miswak has bactericidal effect and stimulate the gingiva. The essential oil present in miswak gives bitter taste helps to stimulates the flow of saliva, which acts as a buffering agent. Saturation of calcium in saliva due to chewing of miswak stick promotes enamel remineralization.

Fig. 6 Miswak

AMALA:

Amla "*Emblica officinalis*" or "*Phyllanthus emblica*" is a medicinal plant commonly known as Indian gooseberry. Amala is belongs to family "*Phyllanthaceae*". Amala is rich source of Vitamin C. presence of tannins and flavonoids provide anti-inflammatory and astringent property. Periodontal diseases are caused by the microbes that destroy the periodontal structure. Amala have Antimicrobial and Anti-ulcerative property which helps to treat periodontal disease. Clinical study says that amala provides anticaries effect by inhibiting the growth of bacteria which are responsible for caries by increasing the pH of saliva.

Fig.7 Amala

NEEM: [17]

"Azadirachta indica" commonly known as Neem or Margosa belongs to family "*Meliaceae"* an evergreen tree having potential medicinal values. Neem is effective against the periodontal disease. Its effective against periodontal pathogens, dental caries and dental plaque. Neem dental care products contains Neem leaf or bark extract. Neem leaf is rich source of antioxidants and helps to boost the immune response in gum and tissues of the mouth. various scientific studies revealed that neem have its antibacterial activity. The antimicrobial effect of neem reported against S. mutans, extract of neem, stick and bark exhibited significant antibacterial activity.

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Fig. 8 Neem

EUCALYPTUS:

Eucalyptus is a genus species of more than 700 species of flowering plants. Eucalyptus comes under the family "*Myrtaceae*". In India eucalyptus also known as Nilgiri. Eucalyptus oil and its major component 1,8-cineole have antimicrobial effects and anti-bacterial effect. Eucalyptus oil helps to reduces dental plaque, gingivitis and bad breath.

Essential oils of Eucalyptus mainly contain sesquiterpenoids, monoterpenoids, phenylpropanoids, etc., containing number of chemical constituents.

Fig. 9 Eucalyptus

PEPPERMINT: [18]

"*Mentha piperita*" is a medically significant aromatic plant which contain volatile oil belongs to family *"Lamiaceae"*. Mint leaves have a characteristics odour and aromatic, pungent taste with cooling sensation. Peppermint leaves have an antiseptic, antibacterial, antiviral, antioxidant, antifungal effect. It is effective against the bacteria streptococcus mutan by acting as antibacterial.

Mint used as flavouring and cooling agent in oral preparation. Compound menthol present in mint plant is help to kill bacteria and prevent gingivitis.

Fig. 10 Mint leaves

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CLOVE: [19]

"Syzygium aromaticum" obtained from dried flower bud which is belongs to family *Myrtaceae.* Clove used as traditional medicine in India and China as a stimulating and warming agent. Clove possess chemical constituent has antioxidant, antifungal, antiviral, antibacterial, anti-inflammatory, analgesic, anesthetic and antiseptic effect therefore clove mostly used in dentistry.

Clove used as preservative in many foods and meat processing due to their antioxidant and antimicrobial properties. Eugenol present in clove penetrate the dental pulp and enter the bloodstream. Clove oil is generally used in treatment of burns, wound and pain reliever in dental care as well as toothache.

Fig. 11 Clove

ALOE VERA: [20]

"Aloe barbadensis miller" belongs to family *"Liliaceae"*. Aloe vera have good antiseptic and anti-inflammatory properties which is used in treatment of gingivitis by reducing the inflammation and pain in gingival tissue. Aloe vera has antiviral properties against herpes infection which helps in treatment of infection.

Aloe vera contain chemical constituent like aloin, emodin, cinnamomic acid etc. which are responsible for antimicrobial effect against the microbes present in oral cavity such *as S. mutans*, & *C. albicans.* Aloe vera gel possesses wound healing and anti-inflammatory property which helps in treatment of gum bleeding. Also used as lubricant in root canal. It is good choice for sensitive teeth because of absent abrasive agent.

Fig. 12 Aloe vera

TURMERIC: [21]

It is obtained from dried rhizomes of *"Curcuma longa"* belonging to the family *"Zingiberaceae"*. Turmeric main chemical constituent curcumin which possesses antioxidant, anti-inflammatory, antidiabetic, anticancer, antibacterial, hepatoprotective, and expectorant properties. Turmeric act as pit & fissure sealant in children to prevent dental caries. Curcumin present in turmeric give colour to the pit and fissure sealant for easy identification.

Curcumin chemical constituent present in turmeric is responsible for antibacterial property which prevent dental caries. Turmeric also acts as staining agent in detection of plaque. Dental plaque is sticky film of bacteria on surface of tooth which may be colourless. Essential oil in curcuma longa act as anticariogenic by inhibiting the growth of streptococcus mutan which helps to prevent plaque and gingivitis.

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Fig. 13 Turmeric

Ginger: [22]

Ginger is obtained from dried rhizomes of the *"Zingiber officinale"* belongs to family *Zingiberaceae.* Ginger has anti-inflammatory, antioxidant and antibacterial property which contribute to oral health.

Ginger act as antifungal agent against the candida albicans in oral candidiasis. In which the candida albicans deposit on mucosal surface of oral cavity and causes the white lesions. Ginger has antipyretic property so they act as analgesic in mouth ulcer and provide the warm sensation. It also promoting the wound healing effect in ulcer.

Methanol and ethyl acetate constituent of ginger shows the antimicrobial activity against the streptococcus mutan bacteria to reduce the dental caries. Ginger also helps to increase the hardness of dentine, remineralization, reduces sensitivity and act as polishing agent.

Fig. 14 Ginger

Liquorice: [23]

It is obtained from dried root of "Glycyrrhiza glabra" a flowering plant belongs to "Fabaceae" family. Liquorice commonly known as Jeshthamadh it is used as sweetener because of its sweet taste and flavouring agent due to aromatic nature. Liquorice has anti-inflammatory, anti-adhesive and antimicrobial properties which is beneficial for oral diseases like dental caries & mouth ulcer.

Glycyrrhizol-A and Glycyrrhizol-B along with isoflavanoids gives antimicrobial activity against the S. mutans to prevent dental caries. Liquorice contains licochalcone-A, Glabridin, and liquiritigenin which act as antifugal agent against candida albicans in oral candidiasis. Licochalcone-A, Glabridin and 18 beta Glycyrrhetinic acid helps in treatment of gingivitis and periodontitis to reduce the inflammation of gingival tissue due to plaque formation.

Fig. 15 Liquorice

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Preparation Method of Toothpaste:

Dry Gum Method: [24]

1. In this method the dry solid compounds of formulation like abrasive agent, binding agent, without surfactant added and mixed together in uniform motion.
2. Agitation mixer is used to with slow rotating speed.
3. Liquid components like humectant and solvent are gradually added to the dry mixture to form uniform mass. Humectant provide the elasticity which maintain the semisolid form of toothpaste.
4. Remaining ingredients like surfactant, coloring agent, and flavouring agent is added to the homogenous mixture of paste. Addition of herb extracts like peppermint, neem, and miswak which is active constituent of toothpaste.

General Method for Evaluation of Toothpaste: [25-26]

1.Physical Examination:

Color: The visually color was checked.

Odour: Odour was found by smelling the product.

Taste: Taste was checked manually by tasting the formulation.

Smoothness: The smoothness was tested by rubbing the paste formulation between the fingers.

2. pH Determination:

A pH paper was used to measure the pH of toothpaste. Herbal toothpaste was diluted with water. One drop of the diluted paste was poured on pH paper, & the color change was compared with the standard strip. pH meter also available for determination of pH of sample dilute the paste in water and determine the pH by using pH meter.

3. Relative Density:

Relative density was determined by weight in gram formulation & sufficient distilled water using RD bottle.

4. Abrasiveness:

Extrude the material onto the butter paper until it is 15 to 20 cm long. Repeat the process to create at least ten collapsible tubes. Fingertip pressure along the length of the object should reveal any sharp or hard-edged abrasive particles. Such particles are not permitted in toothpaste.

5. Determination of Spreadability:

Paste was applied to the ground slide. In research to remove air and create a homogenous paste film between slides, the prepared paste was sandwiched between this glass slide and another for five minutes. The edges of the paste were scraped clean of excess. Better Spreadability was indicates.

Spreadability was determined using the following formula:

$S=M.L/T$

Where, S= Spreadability,

M=Weight in the pan (tied to the upper slide)

L = The length that the glass slide moved.

T=Time in seconds need to separate top slide from bottom slide.

6. Foaming:

By mixing a tiny amount of the formulation with water, the foamability of toothpaste formulations is assessed. Initial cylinder capacity measurement was recorded, followed by a 10-time shake. Foam's final volume was noted.

Power of foaming = V1 – V2

Where, V1: Water and foam volume in mm.

V2: Volume of solution.

7. Moisture content:

Toothpaste weighted in a Porcelain dish and dried it in the oven at $105^{O}C$. It was cooled in a desiccator. The loss of weight is recorded as percentage moisture content and calculated by the given formula.

% Moisture = Original sample weight - Dry sample weight/ Original sample weight.

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8. Stability:

The stability study was performed as per ICH guideline The formulated paste was filled in collapsible tube and stored at different temperature and humidity conditions for the period of three months and studied for appearance, pH and spreadability.

II. CONCLUSION

Teeth are the important part of body and it is essential to maintain the hygiene of teeth to keep mouth fresh from bad breath and prevents the attack of microorganism which causes tooth decay an disturbs the oral hygiene so, Toothpaste is formulations that have been developed and used from ancient years. Herbal toothpaste seems to be powerful similar to non-herbal toothpaste; however, it is no longer extra superior to fluoride toothpaste. We conclude that the herbal toothpaste also having similar properties like chemical toothpaste.

Chemical constituents present in herbs having a active and superior effect on caries, gingivitis and any other oral health. Natural flouring agent present in herbs helps to improve customers compliance and acceptability. Natural sweetening agents present in herbal toothpaste we can used for children oral health. It is a formulation which is more organoleptically accepted by children.

Naturally obtained neem and miswak sticks we also used directly as natural toothbrush which promotes oral hygiene and its antibacterial and antimicrobial property reduces the growth of microorganism which causes caries and leads to bad breath.

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