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A REVIEW ARTICLE ON HERBAL DENTAL TOOTHPASTE BY USING NEEM STEM EXTRACT

Ms. Aishwarya. B. Indure[1], Mr. Avinash. G. Wagh[2], Ms. Ashwini. R. Shelke[3]
Dr. Swati. Rawat[4], Dr.Sunil S. Jaybhaye[5]

[1]Student of Bachelor of Pharmacy, Faculty of Pharmacy, Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad.
[2]Department of Pharmaceutics, Faculty of Pharmaceutics, Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad.
[3]Department of communication skills, Faculty of Pharmacy, Dr.Babasaheb Ambedkar Technological University, Lonere, Raigad.
[4]Principal of Instinte of Pharmacy, Badnapur, Dr. Bahasaheb Ambedkar Technological Universin, Lonere, Raigad.
[5]Department of Quality assurance, Faculty of Institute of Pharmacy, Badnapur, Dr.Babasaheb Ambedkar Technological University:Lonere,Raigad.

ABSTRACT

Since many centuries, Ayurveda regarded neem (Azadirachta indica Family: Meliaceae) as a cure for many ail-ments, predominantly due to its superb antimicrobial activity. It has been a practice since time immemorial to use tender twigs of neem as dentifrice. Looking as these facts the possibility of developing an authentic dentifrice from neem extract and formulations were formulated and evaluated for their antimicrobial activity and some formulations were found to have significant antimicrobial activity.The main objective of this review article is to compile the available information related to herbal toothpaste like its introduction, different formulations and different parameters on which these herbal toothpastes can be evaluated. This information can be used by many researcher who wants to make research in this area.These herbal toothpastes can be evaluated by different tests like Physical Examination, Relative density, Abrasiveness, Determination of spreadability, pH determination, Homogeneity, Foaming,Stability, Determination of moisture and volatile matter, Moisture content, Foaming character, Organoleptic evaluation, pH, Fragrance test, Shape retention, Storage stability, Total flavonoid content estimation of Tooth paste Formulation, Stability study (Storage stability), Antimicrobial activity of toothpaste etc.

KEYWORDS: *Herbal toothpaste,Antimicrobial activity, Azadirachta Indica,Neem stem,Formulation.*

INTRODUCTION

The neem has been antibacterial activity it has been evaluated from the ancient times. It has been use for the various activities like as astringent, antiseptic, insecticidal, anti ulcer and for cleaning the teeth in pyorrhea and other dental disease[1].The chewing neem sticks have been widely used in the Indian subcontinent, the Middle East and Africa since ancient time period. Dental caries is steadily increasing in the underdeveloped and developing country[2]. The aim to formulate herbal paste was compare efficacy with other marketed preparations[3].Toothpaste are most common preventive means in oral healt care.Many commercially available dentifrices claim to have anti microbial properties but little research has been conducted to investigate these claims.Therefore this study was conducted to evaluate efficacy of different toothpaste formulations in reducing oral microbial load [4].

Types-

1.Herbal.

2.Non-herbal.

MATERIALS AND METHODS

Collection of tender stem:Tender stem of Azadirachta indica were collected from Shirner village Tq.Ambad,Dist..Jalna.The stems were dried in vacuum oven at 35°C to get coarse powder and fine preparation of paste. Fine neem powder (FNP) was obtained by sifting through muslin cloth.[5]

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Preparation of Extracts

- The tender stem (100 grams) was extracted by two methods.
- Method I: The tender stem (100 grams) was extracted by two methods.
- Method I: Continuous hot extraction (Soxhelate extractor)10with absolute alcohol at 50°C designated as SNE. Method II: Percolation in conical percolator by standard percolation method using water, ethyl alcohol, benzene, petroleum ether and isopropyl alcohol as a solvent11 and designated by PNE.[6]
- These extracts were dried by evaporation in vacuum oven.
- After evaporation, the dried extracts were evaluated for antimicrobial activity.

Formulation of Neem Toothpaste

Toothpaste

A toothpaste or dentifrice is a substance used with a toothbrush for the purpose of cleaning the accessible surfaces of the teeth.

Purpose of Toothpaste

1. Polishing.
2. Cleaning..
3. Removal of stains.
4. Reduce incidence of tooth decay. 5.Reduction of oral malodors.

General toothpaste Formulation Composition Contains

1. Abrasive, Detergents, Water.
2. Humectants, Thickening Agents.
3. Sweeteners,Preservative, flavours.
4. Corrosion Inhibitors.
5. Colorance, Bleaches.
6. Anticaries.
7. Anticalculus Agents.
8. Desensitizing Agents.
9. Antimicrobials /Antiplaque/ Antigengivitis Agents.

Drug Profile

Neem Stem is taken as Active Pharmaceutical Ingredient.

- Kingdom-Plantae.
- Subkingdom-tracheobionta.
- Division-magnoliophyta.
- Subdivision-spermatophyta.
- Order-sapindles.
- Superorder-retinae.
- Class-eudicot.
- Genus-azadirachta.
- Species-A.Indica.
- Family-mahogany.
- Subfamily-meliodeae.
- Tribe-Meliceae.

ADVANTAGES

1. NaturaL ingredients, Reduced chemicals,
2. Antibacterial properties,
3. Fresh breath.
4. Gum health.
5. Sensitive teeth.
6. Environmentally friendly,
7. No artificial sweeteners,

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8. Whitening and stain removal.

DISADVANTAGES

1. Lack of fluoride.
2. Lack of regulation.
3. Allergic reactions.
4. Abrasive nature.
5. Limited availability.

AZADIRACHTA INDICA

Azadirachta Indica has antifungal and antibacterial properties which help eliminate dandruff and strengths your hair. Application of neem oil or extract on the affected area can help reduce pain and discomfort. Hence it is widely used for treating arthritis. Neem is an excellent exfoliant.



Figure.1-Azadirachta Indica

Botanical Description of Neem.

Neem tree belongs to the family Meliaceae which is found in abundance in tropical and semitropical regions like India, Bangladesh, Pakistan, and Nepal. It is a fast-growing tree with 20–23 m tall and trunk is straight and has a diameter around 4-5 ft. The leaves are compound, imparipinnate, with each comprising 5–15 leaflets. Its fruits are green drupes which turn golden yellow on ripening in the months of June–August. Taxonomic position of *Azadirachta indica* (neem).

Pharmacological Activities of Azadiracta Indica ,neem is diseases management through the modulation of various activities.

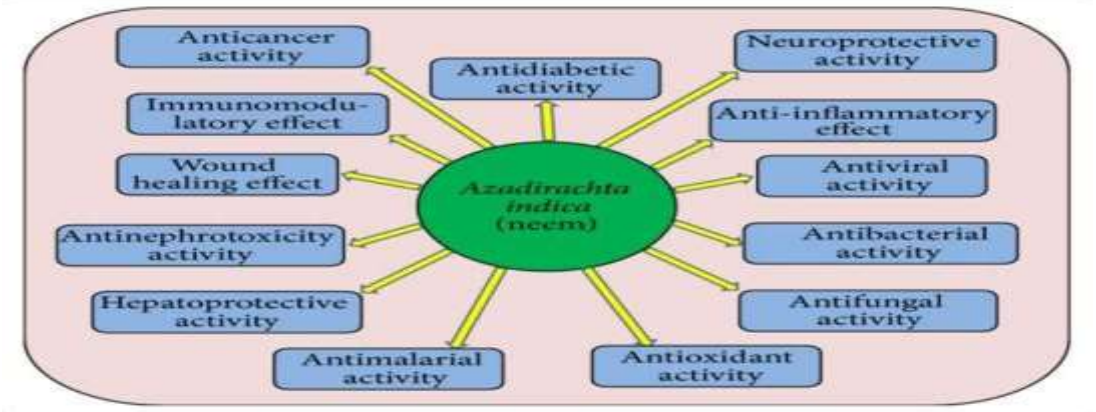


Figure.2- Pharmacological activities of Neem.

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Scientific classification	
Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Rosids
Order:	Sapindales
Family:	Meliaceae
Genus:	*Azadirachta*
Species:	***A. indica***

Figure.3-Scientific Classification

Clove

Syzygium aromaticum is a spice made from the dried, unopened flower buds of the clove tree. It's native to Indonesia and has been used for centuries in traditional medicine, cooking, and oral care.



Figure.4-Clove.

Synonyms: Lavanga, Devakusuma.
Biological Sources: Clove is obtained from the dried flower buds of the tree syzygium aromaticum.
Family: Myrtaceae.
Chemical Constituents

1. Eugenol: The principal compound (70-90%) responsible for clove's aroma and many of its therapeutic properties, such as analgesic, anti-inflammatory, and antimicrobial effects.
2. Eugenyl acetate: Contributes to the aroma and flavor.
3. Caryophyllene: A sesquiterpene that also contributes to the spicy aroma and has anti-inflammatory properties.

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4. Tannins: Including gallotannic acid, which has astringent properties.
5. Flavonoids: Such as kaempferol, rhamnetin, and eugenin, which contribute to its antioxidant activity.

Uses

1. Reduces inflammation and associated symptoms.
2. Commonly used in mulled wine, chai, and other spiced drinks
3. Used to flavor meats, curries, marinades, and baked goods.

Pharmacological Activities

1. Analgesic: Eugenol has analgesic and anti-inflammatory properties, effective against toothache, headache, and muscle pain.
2. Antimicrobial: Clove oil exhibits antibacterial, antifungal, and antiviral properties, effective against various microorganisms.
3. Anti-inflammatory: Eugenol inhibits inflammatory pathways, reducing inflammation and pain.
4. Antioxidant: Clove oil has antioxidant properties, protecting against oxidative stress and cell damage.
5. Anticancer: Eugenol has been shown to inhibit cancer cell growth and induce apoptosis (cell death).
6. Antidiabetic: Clove oil may help regulate blood sugar levels and improve insulin sensitivity.
7. Cardiovascular: Eugenol may help lower cholesterol levels and prevent blood clotting.
8. Gastroprotective: Clove oil may help protect against gastric ulcers and inflammation.
9. Neuroprotective: Eugenol may help prevent or slow neurodegenerative diseases like Alzheimer's and Parkinson's.

Cinnamon

Cinnamomum Verum is a spice made from the inner bark of the cinnamon tree, native to Sri Lanka. It's a popular ingredient in cooking, baking, and traditional medicine.



Figure.5-Cinnamon

Synonyms: Cinnamon Tavk, Dalchini.

Biological Sources: Cinnamon is obtained from the inner bark of trees from the genus Cinnamomum..The two most commonly used species are: Cinnamomum verum, Cinnamomum cassia.

Family: Lauraceae.

Chemical Constituents

1. Cinnamaldehyde: This is the main component of cinnamon oil, contributing to its distinctive aroma and many of its health benefits.
2. Eugenol: Found in Ceylon cinnamon, it has antiseptic and anesthetic properties.

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3. Coumarin: Present in higher amounts in cassia cinnamon, this compound has anticoagulant properties but can be toxic in large quantities.
4. Tannins: These contribute to the astringent properties of cinnamon.
5. Polyphenols: Including proanthocyanidins, which have strong antioxidant properties.
6. Terpenoids: Such as linalool and beta-caryophyllene, contributing to the spice's aroma and potential therapeutic effects.

Uses

1. Helps in reducing oxidative stress.
2. May reduce inflammation and pain.
3. May reduce risk factors like high cholesterol and blood pressure.
4. Helps in alleviating digestive issues such as indigestion, bloating, and gas.

Pharmacological Activities

1. Antioxidant: Neutralizes free radicals, protecting against oxidative stress and cell damage.
2. Anti-inflammatory: Inhibits inflammatory pathways, reducing inflammation and pain.
3. Antimicrobial: Exhibits antibacterial, antifungal, and antiviral properties, effective against various microorganisms.
4. Antidiabetic: Improves insulin sensitivity, reduces glucose levels, and enhances glucose uptake in cells.
5. Cardiovascular: Lowers cholesterol, triglycerides, and blood pressure, reducing cardiovascular risk.
6. Neuroprotective: May help prevent or slow neurodegenerative diseases like Alzheimer's, Parkinson's, and multiple sclerosis.
7. Anti-cancer: Inhibits cancer cell growth, induces apoptosis (cell death), and prevents tumor formation.
8. Analgesic: Relieves pain by inhibiting pain pathways and reducing inflammation.
9. Anti-allergic: Inhibits allergic reactions, reducing histamine release and inflammation.

Honey

Honey is antimicrobial and antibacterial properties make it a popular ingredient in natural toothpastes.



Figure.6-Honey

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Benefits of Honey in Toothpaste

1. Antimicrobial properties: Honey inhibits growth of bacteria, viruses, and fungi, reducing plaque, bad breath, and gum inflammation.
2. Antibacterial properties: Honey's acidity (pH 3.5-4.5) creates an environment unfavorable to bacterial growth, reducing tooth decay and gum disease.
3. Anti-inflammatory properties: Honey's antioxidants and polyphenols reduce inflammation, alleviating gum sensitivity and swelling.
4. Natural sweetener: Honey replaces refined sugars, making toothpaste more appealing to children and those with dietary restrictions.
5. Moisturizing properties: Honey's humectant properties help retain moisture, soothing dry mouth and lips.

Types of Honey Used in Toothpaste

1. Manuka honey: Known for its unique antibacterial properties (UMF rating).
2. Raw honey: Unfiltered, unpasteurized honey retains its natural enzymes and nutrients.
3. Organic honey: Free from pesticides, herbicides, and synthetic additives.

Xanthan Gum

Xanthan gum is a popular food additive and ingredient in various industries.



Figure.7-Xanthan Gum.

Xanthan gum is a polysaccharide (complex carbohydrate) derived from the bacterium Xanthomonas campestris. It's produced through fermentation and purified for use in various applications.

Properties and Benefits

1. Thickening agent: Xanthan gum is an effective thickener, stabilizer, and emulsifier.
2. Viscosity control: Regulates fluid viscosity, improving texture and flow.
3. Stability: Enhances stability in emulsions, suspensions, and foams.
4. Temperature tolerance: Remains effective across a wide temperature range.
5. pH tolerance: Stable in acidic and alkaline environments.
6. Non-toxic: Generally recognized as safe (GRAS) for human consumption.

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Uses

1. Food industry: Salad dressings, sauces, beverages, dairy products, baked foods.
2. Cosmetics: Toothpaste, mouthwash, skincare products, hair care.
3. Pharmaceuticals: Tablet coatings, capsules, ointments.
4. Oil and gas: Drilling fluids, well stimulation.
5. Textiles: Dyeing, printing, finishing.

Titanium Dioxide

Titanium Dioxide is a versatile, widely used in toothpaste.



Figure.8-Titanium Dioxide

Properties

1. White pigment.
2. High refractive index.
3. Opacity and brightness.
4. Chemical inertness.
5. UV resistance.

Uses

1. Paints and coatings: Pigment for white paint, varnishes, and coatings.
2 .Plastics: Adds whiteness, opacity, and UV resistance.
3. Cosmetics: Pigment in sunscreen, skincare, and makeup products.
4. Food: Food coloring (E171) in confectionery, baked goods, and beverages.
5. Pharmaceuticals: Coatings for tablets, capsules, and pharmaceutical products.
6. Paper: Pigment for paper coatings and fillers.
7. Ceramics: Used in ceramic glazes and enamels.

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Pottasium Nitrate

Potassium Nitrate (KNO3) is a common ingredient in toothpastes, particularly those designed for sensitive teeth.



Figure.9-Pottasium Nitrate

Uses

1. Desensitizing agent: Potassium nitrate helps alleviate tooth sensitivity by blocking the dentinal tubules (tiny channels) in the teeth, reducing the flow of fluids and sensations to the nerves.
2. Pain relief: It has analgesic and anti-inflammatory properties, providing temporary relief from toothache pain.
3. Antibacterial properties: Potassium nitrate has been shown to inhibit the growth of certain bacteria, which can contribute to tooth decay, gum disease, and bad breath.

Types of toothpastes containing potassium nitrate:

1.Sensitivity toothpastes: Toothpastes specifically designed for sensitive teeth, such as Sensodyne.

2. Desensitizing toothpastes: Toothpastes that aim to reduce tooth sensitivity, often containing potassium nitrate as the active ingredient.

3. Anti-plaque toothpastes: Some toothpastes that target plaque and gingivitis may also contain potassium nitrate.

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- **Sorbitol**



Figure.10-Sorbitol

Sorbitol is a sugar substitute derived from corn syrup, widely used in food, pharmaceuticals.

Properties

1. Sweetness: 60% as sweet as sugar
2. Solubility: Highly soluble in water
3. Viscosity: Thickening agent
4. Humectancy: Retains moisture

Uses

1. Food industry: Sugar substitute in sugar-free products (gum, candy, baked goods)
2. Pharmaceuticals: Excipient in tablets, capsules, syrups
3. Cosmetics: Moisturizer in skincare, haircare products
4. Toothpaste: Humectant, sweetener

Health Benefits

1. Low-calorie sweetener: Suitable for diabetes management.
2. Oral health: Prevents tooth decay, reduces plaque.
3. Digestive aid: Relieves constipation, diarrhea.
4. Skin health: Hydrates, soothes skin irritations.

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Sodium Bicarbonate

Sodium Bicarbonate (NaHCO3), also known as baking soda it is a versatile compound with various applications**.**



Figure.11-Sodium Bicarbonate

Properties

1. pH level: 8.3 (alkaline)
2. Solubility: Highly soluble in water
3. Chemical formula: NaHCO3

Uses

1. Baking:Leavening agent in baked goods (cakes, cookies, bread)
2. Cooking: Tenderizer for meat, vegetables, and beans
3. Personal care:Toothpaste, mouthwash, shampoo, and skincare products
4. Medicine:Antacid, anti-inflammatory, and laxative properties
5. Cleaning:Natural cleaner, odor absorber, and scrubbing agent
6. Industrial: Paper manufacturing, textile industry, and water treatment

Health Benefits

1. Digestive aid: Relieves heartburn, indigestion, and bloating
2. Oral health: Neutralizes acid, whitens teeth, and freshens breath
3. Skin care:Soothes sunburn, acne, and itchiness
4. Muscle relief:Reduces muscle cramps, spasms, and soreness
5. Immune system: Supports immune function and reduces inflammation

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Methyl Paraben

Methyl Paraben is a widely used preservative in personal care products, pharmaceuticals, and food.



Figure.12-Methyl Paraben

Properties

1. Chemical formula: C8H8O3.
2. Solubility: Soluble in water, ethanol, and propylene glycol.
3. pH level: 4.5-5.5.

Uses

1. Personal care products: Cosmetics, skincare, haircare, and oral care.
2. Pharmaceuticals: Preservative in creams, ointments, and injectables.
3. Food: Preservative in baked goods, beverages, and dairy products.
4. Medical devices: Preservative in medical instruments and equipment.

Benefits

1. Antimicrobial properties: Effective against bacteria, yeast, and mold.
2. Preservative: Extends product shelf life.
3. Stability: Enhances product stability and texture.

Sodium Lauryl Sulfate

Sodium Lauryl Sulfate is a widely used surfactant in personal care products.



Figure.13-SLS

Properties

1. Chemical formula: C12H25SO4Na
2. Solubility: Soluble in water, ethanol, and propylene glycol
3. pH level: 5.5-7.5

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Uses

1. Personal care products: Shampoos, soaps, toothpastes, mouthwashes, and body washes
2. Pharmaceuticals: Emulsifier, wetting agent, and solubilizer
3. Industrial applications: Textile industry, paper manufacturing, and oil drilling

- **Benefits**

1. Foaming agent: Creates rich, creamy lather
2. Emulsifier: Mixes oil and water-based ingredients
3. Surfactant: Reduces surface tension, improving product spreadability
4. Cleansing agent: Effective at removing dirt, oil, and grime

- **Types of Toothpaste**

1. Anti cariës-clove.
2. Plaque&prevention-Neem stem.
3. Tooth whitening-Alum, Titanium dioxide, clove.
4. Sensitivity-Potassium nitrate,Potassium citrate.
5. Tartar control-Aloevera.
6. Fresh breath-Alum.cinnamon.menthol.
7. Sweetning agent-Honey, Sod.saccharine.
8. Thickening agent-Xanthan gum.
9. Foaming agent-SLS, Baking Soda.
10. Humectant-Sorbitol, Propylene glycol.
11. Ph-Sod. Bicarbonate.
12. Preservative-Methyl paraben,Ethyl paraben.
13. Solvent-Water.

Formulation

1. Polishing Agents / Abrasive Agents: The abrasives or the polishing agents are used to polish the teeth and remove food debris adhered to the surface of the teeth. They are used in concentration of about 20 - 50% of the total formulation.[11]
2. Foaming Agents / Surfactants: They are also known as wetting agents. The mechanism of cleansing action is by reducing the surface tension at the interface of the adhered material and enamel of the teeth.[12]
3. Humectants: Humectants are used in order to prevent the rapid drying of dentifrices. They prevent excessive moisture loss from the product. They may additionally impart plasticity to the final product.[13]
   The concentration of the humectant used in the formulation may vary from 20% to 40% (13).
   Ceiling/ Binding Agents: The binding agents are used in order to hold the solid and the liquid components together to form a smooth paste and maintain its property, particularly during storage.[14] They prevent bleeding from the paste and also add up to the body and viscosity of the final formulation .[14]
4. Flavouring Agents: Flavouring agents may comprise the most proprietary and most crucial part of the formulation essential to meet the consumer preferences. They are generally a mixture of edible volatile oils consisting of spearmint and peppermint oil as major components [12].
5. Preservatives: Preservatives are used in the formulation in order to maintain the properties of the product throughout the storage period and to improve the shelf-life of the product. Generally, a mixture of 5% methyl paraben and 0.02% propyl paraben is the most effective and commonly used combination preservatives.[14]

Preparation of Toothpaste

1.Dry Gum Method

In this method, all the solid components of the formulation like abrasive agent, binding agent etc., except the surfactants are mixed together in a dry mixer.
The mixer may be an agitation mixer which consists of slow rotating blades.
The liquid components such as the humectants and water are gradually added to the dry mix.
The mixing process is carried out till a smooth paste is formed.
The remaining ingredients like the surfactants and the flavouring agents are added to the homogenous paste under vacuum (12,15),

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2.Wet Cum Method

In this method, all the liquid components are mixed together to form a liquid phase. The binding agent is then mixed with the liquid phase with uniform stirring in order form mucilage.

The solid ingredients excluding the surfactants are then gradually added to the mucilage with uniform mixing in an agitation mixer, in order to form a homogenous paste.

The remaining ingredients i.e., the surfactants, the flavoring agents, coloring agents are added under vacuum the homogeneous paste. [16,17]

DISCUSSION

The aim of study was to formulate herbal base product was compare the efficacy with conventionally marketed formulated toothpaste and evaluated the various parameter like colour, spredability, foamability, extrudability and anti-bacterial activity. However, there is approach to provide the formulation for commercial production of herbal dental product with environmental friendly attributes. Toothpastes have evolved immensely since their earliest forms, when they served primarily as a toothbrush aid to attempt to make the teeth less yellow and freshen the mouth. Toothpaste was made long ago. The most important ingredient in toothpaste is fluoride.

CONCLUSION

In order to achieve the multi-claim products required for the dental care category, it is necessary for the formulator to use a variety of different ingredients. This places a number of demands on the development process. Innovations in the areas of pharmaceutical technology have contributed to the formulation of the products having superior efficacy as well as other attributes that may contribute to clinical response and patient acceptability. Improved clinical efficacy and tolerability, along with conditioning signals, should encourage patient compliance with oral hygiene further complementing professional efforts directed at disease prevention. Neglected Oral problems can lead to permanent loss of tooth and some leads to cancer and severe disorders to avoid this is different oral cosmeceuticals were used like toothpastes, mouth rinse etc.along with this points below have to be followed regularly:Brushing thoroughly twice a day and flossing daily II. Eating a balanced diet and limiting snacks between meals.Using dental products that contain fluoride, including toothpaste.Rinsing with a fluoride mouth rinse.Making sure that your children under 12 drink fluoridated water or take a fluoride supplement they live in a non-fluoridated area.By following this oral hygiene is maintained and problems can be minimized.

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