

Importance of Oral Hygiene, Herbal Ingredients and their Application in Dentistry

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ABSTRACT: Oral health is very important for well-being but it is highly ignored by many of us, the problem associated with poor oral health are dental caries, periodontal disease, bleeding gum, staining of teeth, toothache, etc. So, to avoid all these problems oral hygiene is very important. Marketed dentifrices contain various chemicals such as preservatives, strong abrasive agent, dyes, etc. in higher concentration that have negative impact in maintaining healthy gum and teeth. So, in this present article we have mentioned herbal ingredients like guava leaf extract, turmeric, rock salt, mustard oil, charcoal, propolis, clove, peppermint, Indian gooseberry, pomegranate which are harmless, carcinogen free natural source with high therapeutic value.

KEYWORDS: prostaglandin E2 (PGE2), interleukin 1 (IL1), interleukin 6 (IL6), TNF- (tumour necrosis factor), nuclear factor kappa (NFK), activated protein 1 (AP1), Herbal toothpaste (HTP), white spot lesions (WSL), Streptococci mutans (*S. mutans*), Streptococcus sanguinis (*S. sanguinis*).

INTRODUCTION:

Microbes have an impact on every aspect of human life. The human oral cavity contains a variety of habitats in which the synergy and interaction of various oral microorganisms benefit the human body by preventing the invasion of unwanted species. An imbalance of microbial flora, on the other hand, plays a role in the development of systemic diseases and oral disorders such as dental caries, periodontal disease and pulp pathosis, as well as being linked to oral carcinoma. Although dental caries is a multifactorial disease, high levels of cariogenic bacteria are a major etiological factor in disease initiation and progression. Streptococcus mutans is the most commonly isolated bacterium

from human dental plaque. Its properties are the result of virulence factors such as aciduricity, acidogenicity and adhesion capacity [1].

Enterococcus faecalis is another example of an oral pathogenic bacterium that has been linked to chronic apical periodontitis in failed endodontic treatments. Staphylococcus aureus is another dentally important bacterium that can appear as an oral coloniser in health and oral diseases. The spread of *S. aureus* has been identified as a significant public health issue, causing severe infections, primarily in children and hospitalised patients [1].

Because of the increased resistance to antibiotics and chemotherapeutics, it is critical to use safe and effective products for the prevention and management of dental diseases. Natural products with herbal, animal or microbial origins have a lot of potential in this field. The rapid increase in the use of herbal remedies is due to their plausibility, availability, beneficial effect, and lack of adverse reactions. Mouthwash and toothpaste could be useful applications for utilising natural extracts as dental remedies. In recent years, there has been a growing interest in using antioxidants in dentistry. Antioxidant treatments inhibit the formation of free radicals or reactive oxygen species, which contribute to the progression of dental disorders [1].

Anatomy of Oral Cavity

Understanding the oral cavity is essential before looking at oral care products. The anatomy of the oral cavity has been thoroughly studied and much information is now available. As a result, this review will only touch on the parts that are pertinent to the subject. The oral mucosa is a moist membrane composed primarily of stratified squamous epithelium that covers a connective tissue proper or Lamina Propria. Based on histology and

function within the oral cavity, the oral mucosa is classified into three types. To begin, the keratinized mucosa that covers the hard palate and gingiva is known as the masticatory mucosa. The abrasive and mechanical forces used during the masticatory process necessitate a stronger more rigid masticatory mucosa. Any damage to the masticatory mucosa raises the risk of infection from foreign bacteria and pathogens in food and other objects that enter the mouth. The lining mucosa, on the other hand, is non-keratinized and covers a much larger percentage of the oral cavity than the other types of mucosa. This non-keratinized mucosa can be further subdivided into tissues such as labial mucosa, which lines the lips and buccal mucosa, which lines the cheeks and the floor of the mouth. The specialised oral mucosa that covers the dorsum of the tongue is the third type of oral mucosa. The tongue's dorsum is a mixture of lining and masticatory mucosa that contains nerve endings for taste perception and sensory reception. These salivary glands secrete a slimy viscoelastic material known as saliva which is mainly composed of water and mucins. This mucus has a variety of roles from helping to create a layer over the gingiva and oral cavity to protect against abrasions and pathogens as well as providing lubrication for masticatory processes. Lingual papillae are small structures located on the surface of the tongue. These structures provide the tongue with a rough texture that aids in food consumption. On the tongue, there are four kinds of lingual papillae: Filiform papillae are small cone-shaped, keratinized papillae that cover the dorsal surface of the tongue and are responsible for the sensation of touch. Fungiform papillae are covered by non-keratinized mucosa and are located at the front of the tongue, containing taste buds and temperature receptors; foliate papillae are short symmetrical vertical folds located on the sides at the back of the tongue, covered by non-keratinised mucosa and containing taste buds; circumvallate papillae are round dome shaped structures at the back of the tongue near the tonsils. the substance to aid swallowing and digestion and to reduce the risk of choking. They also play an important part in speech and communication through facial expressions. Humans are born toothless because mammals nurse their young, providing a selective advantage. Humans have two sets of teeth throughout their lives. The first set, known as deciduous teeth, appears around the age of six months and the second set, known as permanent teeth, appears around the age of twelve. The reason for this is that

the deciduous teeth do not continue to grow and must be replaced by a larger set as the human body grows and develops. The average adult has four types of teeth in their mouth. The incisors are located at the front of the mouth and as the name implies are used for biting/cutting into food during the first bite. Canines are the sharpest teeth in the mouth and are used to tear food. Because of their large surface area and flat biting surface, premolars are effective at tearing and grinding food, converting solid bits of food into an easy-to-digest paste. The crown, neck and root are the three parts of the tooth. A complex network of nerves and blood vessels extends through the jawbone into the pulp chamber located in the centre of the tooth in the root section. The tooth's neck is located in the middle of the roots and crown and is surrounded by gingiva. The enamel-covered top of the tooth visible above the gingiva margin is known as the crown. Enamel is the white, highly mineralized substance that protects the tooth's softer interior. It is the hardest substance in the human body and contains the highest percentage of minerals, but it is vulnerable to acid erosion and bacteria buildup. The enamel layer can be as thick as 2 mm to protect the soft dentin and nerves inside a tooth. Enamel is composed of 96% inorganic materials, the most important of which is calcium hydroxyapatite ($\text{Ca}_5(\text{PO}_4)_3(\text{OH})$) [2]

Oral Diseases

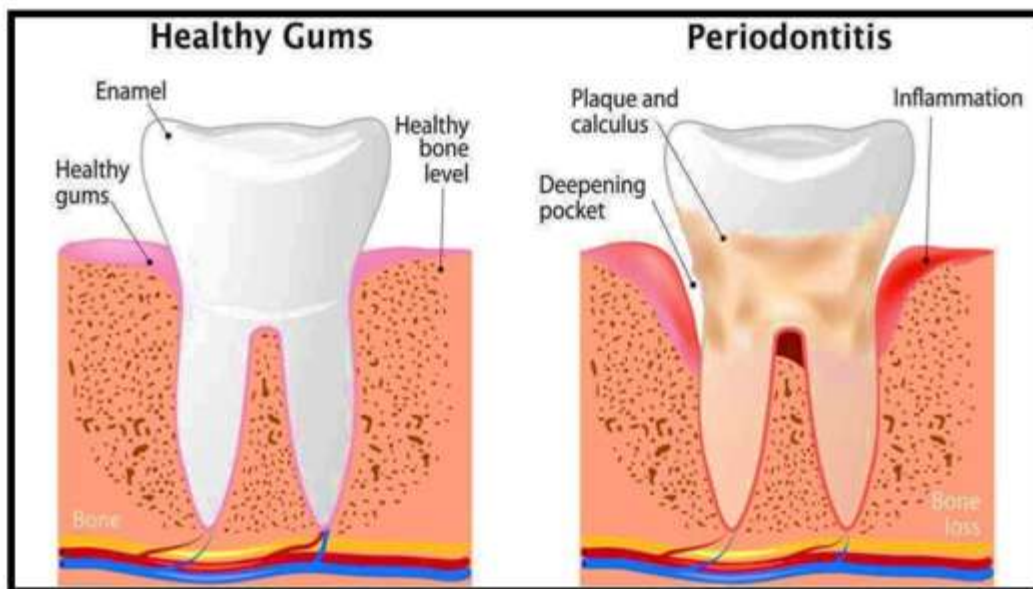
Periodontitis: Periodontal infection is linked to organ systems such as the cardiovascular system, the endocrine system, the reproductive system and the respiratory system. Periodontal infection is a multiphase disease with many stages. Dental plaque is thought to be a major contributor to both dental caries and gingival inflammation. If left untreated, the latter can spread beyond the gingival margin and lead to periodontitis. This may eventually result in tooth loss. Controlling dental plaque relies on mechanical removal via tooth cleaning or the use of chemicals that prevent or reduce bacterial multiplication. One of the most widely used methods of controlling plaque and gingivitis is self-performed mechanical plaque removal. Because most people have difficulty in maintaining adequate levels of plaque control, particularly at interproximal sites, the use of chemicals for plaque control as an adjunct to mechanical plaque control procedures is required. For years, researchers have been looking for chemical agents that could replace patient-dependent mechanical plaque control and thus

reduce or prevent oral disease [3].

Effective plaque removal is essential for maintaining periodontal and oral health. Although self-care efforts to control microbial plaque are important for preventing plaque accumulation, this alone will not suffice. Chemical plaque control is an adjunct therapy that may aid in the removal and prevention of microbial plaque accumulation, potentially decreasing reliance on mechanical oral care behaviours. Various chemical agents have been used in toothpastes and mouth rinses, and a few have been shown to reduce dental plaque formation. Because of increased awareness of indigenous medical practices in various parts of the world, the use of "herbal" medicine has sparked interest and facilitated the growth of complementary and alternative therapies in health care promotion [4].

Periodontal disease is a common but easily avoidable condition. Periodontal disease is a

serious infection caused by poor oral hygiene. Periodontitis is caused by microorganisms in dental plaque. Periodontitis and dental plaque have a direct relationship. According to the Global Burden of Disease study (2016), the 11th most common disease was severe periodontal disease. Periodontal disease is estimated to affect 20% to 50% of the global population. It is one of the most common causes of enamel loss, which can impair mastication, aesthetic and self-confidence. Periodontal diseases accounted for 3.5 million years of incapacity worldwide in 2016. Between 1990 and 2010, there was a 57.3% increase in the global burden of periodontal disease. In 2010, the global loss of productivity due to severe periodontitis was estimated to be US\$54 billion per year. The global prevalence of periodontal disease is expected to rise in the coming years as the world's population ages [4].

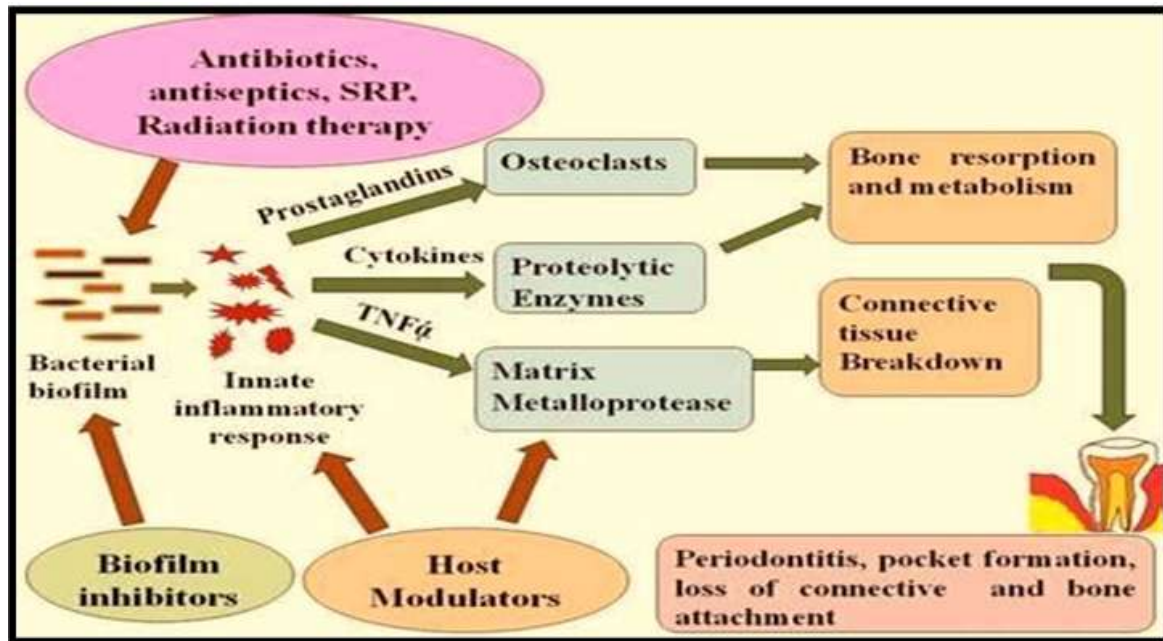


Pathogenesis:

Periodontitis

The MOSFETs used are (IRF3205) which act as current amplifiers and amplify the current from 1 amp to 3 am. Periodontium is a tissue complex that includes blood vessels, nerves, and

fibres. It has the ability to regenerate and remodel throughout its lifespan. Only structural integrity and interaction between its components allow the periodontium to function properly.



The periodontium's main function is to connect the tooth to the bone tissue and to keep the masticatory mucosa of the oral cavity intact. Homeostasis exists between the periodontal host and the microbe. Novel mechanisms underlying the breakdown of periodontal host-microbe homeostasis have been discovered, which can lead to dysbiosis and periodontitis in susceptible hosts. Bacterial lipopolysaccharides stimulate the production of catabolic cytokines and inflammatory mediators, as well as arachidonic acid metabolites (prostaglandin E2 (PGE2), interleukin 1 (IL1), interleukin 6 (IL6), and TNF- (tumour necrosis factor). In turn, these cytokines and inflammatory mediators stimulate the release of tissue-derived enzymes such as matrix metalloproteinases, which degrade the extracellular matrix and bone. Periodontitis pathogenesis is also influenced by reactive oxygen species. Tissue oxidative stress can directly cause tissue damage. In periodontitis, oxidative stress is a major cause of hyperinflammation. It stimulates nuclear transcription factors, which can be nuclear factor kappa (NFK) receptor activators and activated protein 1 (AP1), which can also induce gene transcription for key pro-inflammatory mediators and osteoclast genesis stimulation. Taking all of this into account, it is possible to conclude that periodontitis has a multifactorial aetiology. The intact epithelial barrier of the gingival sulcular and junctional epithelium typically prevents bacterial invasion of periodontal tissue. The microbial

biofilm that colonises the enamel surface produces a large amount of metabolites (fatty acids, peptides, and lipopolysaccharides) that can diffuse through the junctional epithelium. Microbes may damage periodontal structural factors by releasing proteolytic and noxious waste products. This results in the loss of tissue bones and, eventually, the tooth[5] A wide variety of toothpastes are commercially available and natural products have recently gained popularity. A number of controlled clinical trials have shown that brushing your teeth with herbal dentifrices reduces supragingival plaque and gingivitis. As a result, many of these agents have found their way into toothpastes and mouth rinses. Meswak is a scientifically formulated herbal toothpaste that contains a pure extract of the Miswak plant, "Salvatore Persica," which has been used for centuries. Several studies have recently reported antibacterial effects of Miswak (chewing sticks) on cariogenic bacteria and periodontal pathogens, as well as inhibiting dental plaque formation [3] Several chemical agents have been found to reduce dental plaque formation in toothpastes and mouth rinses. The use of "herbal" medicine has sparked interest and facilitated the growth of complementary and alternative therapies in health care promotion as a result of increased awareness of indigenous medical practises in various parts of the world. Herbal ingredients have long been used in oral care products, particularly in South Asian countries. The most commonly used herbal ingredients in oral care products (such as

toothpaste and mouthwash) are sanguinarine, propolis, *Azadirachta indica* (neem), charcoal, clove and miswak. Natural products such as neem twigs, charcoal powder and others have been used as part of regular oral hygiene practise in rural South Asian countries for centuries. Through in vitro, in vivo and animal studies, many herbal or plant extracts have been promoted as having anti-inflammatory, antipyretic, analgesic, antibacterial, antiviral, anticarcinogenic and antioxidant activities. Several oral care product manufacturers and multinational corporations have incorporated herbal ingredients into their products as a result of these observations. Manufacturers of these products claim that they use a variety of herbal ingredients that mimic the benefits of traditional toothpastes, such as the ability to fight plaque, freshen breath and prevent gum disease. Consumers desire to "go natural" has fuelled an increase in demand for such products, with many reportedly choosing them because they are not tested on animals, have no side effects, use no animal products, are vegan friendly, contain no added artificial colours or flavours and are culturally appropriate. Herbal products outnumber fluoride-based toothpastes in some areas. Clinical trials compared herbal and conventional oral care products for the reduction of dental plaque or gingivitis. Despite the large number of trials carried out, the results are contradictory and inconclusive. In some countries, dental associations have approved some of these products. Existing reviews are primarily narrative in nature or focus on a single herbal ingredient (e.g., Aloe vera) in mouth rinse or toothpaste. There is no single, comprehensive systematic review that has synthesised the current evidence for assessing the effectiveness of herbal oral care products such as herbal toothpaste (HTP) and herbal mouth rinse in reducing dental plaque and gingivitis (HMR) [4]

Tooth Decay

Tooth decay (also known as dental caries or cavities) is a progressive, multifactorial disease in which the surface structure of a tooth deteriorates over time. This is due to the irreversible solubilisation of hydroxyapatite by the acids produced by bacteria during their metabolic processes. This is exacerbated by increased sugary food and drink consumption, as well as continued poor oral hygiene. Although tooth decay is less common than in previous decades due to improved global oral hygiene and the incorporation of fluoride compounds into most toothpaste formulations, our changing diets, habits, and

longer life expectancies mean that dental caries persist. Dental caries do not develop overnight because the process of demineralizing and breaking down the enamel surface occurs over the course of a person's lifetime. There are no symptoms of tooth decay in the early stages, except for white spot lesions (WSL) visible on the enamel surface. These localised WSLs occur as a result of subsurface enamel demineralization on the teeth's smooth surfaces. These lesions develop as a result of prolonged exposure to plaque that has accumulated on the surface and has not been disturbed for extended periods of time. When exposed to the acids produced by plaque bacteria, the enamel surface becomes demineralized and decalcified. Tooth enamel demineralization occurs at pH 5-6. The critical pH is the pH at which the saliva and plaque fluid are not saturated with phosphate and calcium, allowing hydroxyapatite to dissolve in the enamel. However, WSL are caused by more than just demineralization. Fluorosis from excessive fluoride consumption as teeth develop, enamel hypoplasia (a lack of enamel on a tooth). Lesions can also form as a result of hypomineralization (softening and discoloration of the enamel) and hypomaturation (part of the medical condition Amelogenesis imperfecta, which causes abnormal enamel formations). The spots appear a different shade of white than the rest of the tooth surface due to decalcification and the newly formed porous enamel surface, causing localised light to scatter differently due to the difference in the refractive index of enamel ($RI = 1.62$) compared to the lesion. Because this is a very early stage of tooth decay, topical fluoride treatments and fluoride toothpastes can be used to remineralize the enamel. The enamel begins to deteriorate in the second stage as a result of ongoing demineralization. This enamel decay increases the likelihood of the tooth's surface breaking, resulting in irreversible damage. As the enamel layer is breached, dentin hypersensitivity develops. If the enamel decay is not stopped and demineralization of the enamel continues, the tooth may break and dentin decay will begin. When a person reaches this stage, their pain level increases and their sensitivity to stimuli increases. When enough phosphate and calcium minerals are lost, the enamel collapses and a dental cavity forms. The cavity is dark brown/black in colour and grows in size as the tooth is left untreated and exposed to acid and bacteria. A dental filling or root canal surgery will be required to relieve the pain and discomfort while preserving the tooth's integrity and preventing further damage. If the cavity is not

treated, the pulp in the centre of the tooth can become infected by bacteria in the oral cavity, resulting in pulpitis. Microorganisms that reach the dentin cause an inflammatory response, which if left untreated can result in persistent recurrence, resulting in permanent loss of normal tissue and reducing the ability of the cells and tissue to repair themselves. Bacterial colonisation of the root canals causes blood vessels and nerves to die, and exudate to form. If the bacteria are not removed/killed, complications such as septicaemia, cardiovascular disease, shock, infections into

surrounding bones and tissue that can lead to brain abscesses, and even death can occur. Tooth loss is the final stage of decay. The tooth has suffered enough damage that it must be extracted. With a regular cleaning routine, tooth decay is easily controlled. Using specific oral care products and visiting the dentist on a regular basis are critical to preventing damage, discoloration, and disease in the oral cavity and treating any issues before they become problems. Teeth, due to their strong composition and high strength, will outlast their owners if properly maintained [2]



Bacteria and Plaque formation

The oral cavity is inhabited by a diverse bacterial flora. over 700 different bacterial species or phylotypes have been discovered living within the oral cavity, forming a bacterial biofilm that coats all surfaces present. The majority of the microorganisms in this oral biofilm protect the body from external stimuli. This, however, is not always effective, and an imbalance in the microbial flora or invasion by a foreign body can occur, leading to diseases and infections. Although the majority of the bacteria present pose no risk to the surrounding mucosal surfaces or the mineral-rich teeth, some species have been linked to systemic diseases such as aspiration pneumonia, cardiovascular disease, certain types of cancers, and oral diseases such as oral thrush, dental caries, and gingivitis. Continued research in this area has revealed that the bacteria in our mouth play a much larger role in maintaining

our overall health and well-being, with the effects of foreign bacteria affecting the entire body rather than just the oral cavity. Because the focus of this review is on herbal oral care products such as toothpastes and mouthwashes, the details of how oral bacteria colonise the tooth's surface and how the acid they produce damages the enamel surface of teeth will be the main focus of this section. Streptococci mutans (*S. mutans*) is the most common bacteria associated with dental caries, and it is present in everyone's oral cavity from birth. Dental caries is caused by a number of processes, not just bacteria. Food debris and mechanical damage also contribute to cavities, but acids produced by bacteria are the most common causes of dental plaque and dental caries. Dental plaque, a soft sticky film that forms on the tooth surface, particularly near the gum line, is created in a number of steps. The first step is the attachment

of bacteria to the acquired pellicles. When salivary glycoproteins, lipids, mucin, exoproducts (any exocellular product) and phosphoproteins form on the cleaned enamel surface immediately after cleaning, an acellular layer is formed. In stage 2, *Streptococcus sanguinis* (*S. sanguinis*) forms weak, reversible van der Waals bonds, providing the bacteria with an initial foothold to colonise the tooth surface. If the bacteria are not removed, they can anchor themselves to the hydroxyapatite surface via pili (hair-like appendages found on the surface of certain types of bacteria). In Stage 3, organisms that were unable to attach to the pellicle initially begin to irreversibly adhere to the first layer of bacteria on the tooth's surface via adhesion-receptor interactions. The bonded bacteria begin to replicate, forming microcolonies. The early colonisers are now well established in stage 4. As a

result, as more oxygen is consumed by the ever-increasing number of bacteria present, the colony of bacteria now known as dental plaque becomes increasingly complex. The high demand for oxygen results in the formation of anaerobic zones. The continued maturation of the bacteria eventually leads to a decrease in the rate at which cell division occurs as the demand for food required for growth outpaces the supply and space on the oral surface becomes limited. Eventually, a pseudo steady-state climax community emerges. In the final stage, enzymes or mechanical forces can reverse the bonds that hold these microorganisms to the tooth, allowing the microorganisms to spread throughout the oral cavity and restart the cycle by colonising new surfaces, as these biofilms can form on any surface inside the oral cavity [2].



Role of herbs in dental disease

One disease that affects people everywhere is dental disease. The standard of living that goes beyond the purposes of the craniofacial complex and is related to dental health is essential to overall well-being. Herbal medicine with medical properties has been used for an extended period to prevent and treat various diseases of dental diseases. In dentistry, herbal remedies have been used as sedatives, analgesics, anti-inflammatories, and antibiotics as well as endodontic irrigants[6]. Compared to chemical drugs, herbal remedies are less toxic and more affordable [7]. Neem bark is said to have natural antibacterial properties that make it useful in

dentistry for treating gingival issues and maintaining oral health. Neem twigs are used as a dental cleaner, a toothache reliever, and an oral deodorant[8].

Herbal remedies are helpful in preventing oral thrush, tooth decay, gum disease, mouth ulcers, swollen tonsils, and hairy tongue[9]. Neem, eucalyptus, Tulsi, clove, and Punica are a combination that has good antibacterial activity against dental pathogens[10]. In dental implantology, *Malus Domestica* (apple) and *Cissusquadrangularis* (velvet grape) and *Carthamus tinctorius* (safflower) are frequently used as titanium implant coatings, and in periodontal regeneration, *Cissusquadrangularis* and safflower

are advised as periodontal fillers [11].

The heartwood of Cutch tree (*Acacia Chundra* Willd.), Malabar nut leaf (*Adhatoda vasica* Nees.), Spanish cherry bark (*Mimusops selengi* L.), Black pepper (*Piper nigrum* L.), Pongam oil tree root (*Pongamia pinnata* (L.) Pirerre), Aleppo oak galls (*Quercus infectoria* Olivier.), Clove (*Syzygium aromaticum* L.), Myrobalan fruit (*Terminalia schebula* Retz.), and Ginger (*Zingiber officinale* Roscoe) are used traditionally in Ayurveda for oral care. According to the literature, a number of plants and plant parts have beneficial properties like anti-inflammatory, antioxidant, antibacterial, astringent, and other properties. Dental diseases can be treated using these characteristics. Herbs or phytotherapy materials frequently contain multiple bioactive components with multiple targets during intakes and therapy, in contrast to plant-derived drugs, which frequently consist of one natural compound combined with other chemicals.

4. Herbal Ingredients to treat Dental Diseases

Turmeric [12]

Turmeric is a perennial plant with orange, oblong tubers 2 or 3 inches long and one inch in diameter, pointed or tapering at one end. When dried, it turns into a yellow powder with a bitter, slightly acrid, yet sweet flavour. It is similar to ginger. Turmeric, known as *Curcuma longa*, is a member of the ginger family, Zingiberaceae. The Latin name is derived from the Persian word *kirkum*, which means saffron, in reference to the rhizome's vibrant yellow-orange colour. It is native to Southeast Asia but has long been used and cultivated in India. Turmeric is extremely beneficial to the digestive system and the liver. It is regarded as a bitter digestive and a carminative in both Ayurvedic and traditional Chinese medicine. Unani practitioners use it to expel phlegm or kapha, opening up the blood vessels and improving blood circulation. It can be mixed into foods, such as rice and bean dishes, to improve digestion and reduce gas and bloating. It acts as a cholagogue, increasing bile production in the liver and encouraging bile excretion through the gallbladder. This helps the body to digest fats better. Turmeric is not used directly in Western cuisine, but it is found in a variety of spice blends and sauces, and it is also used to give mustard paste a bright yellow colour.



Chemical Composition of Turmeric [13]

Curcumin (Diferuloyl Methane), Desmethoxycurcumin, Bisdemethoxycurcumin, Volatile oil, Curcuminoid, Essential Oil (ar-turmerone, α -turmerone and β -turmerone were the biologically active constituents in the essential oil), Terpenoids, Flavonoids,

Therapeutic Activities of Turmeric [13]

Turmeric has antimicrobial, anti-inflammatory, anticancer and antioxidative properties.

Mechanism of Action of Turmeric Antibacterial action is due to its component ability to break

bacterial cell membrane, resulting in cell lysis.

Mustard Oil [14-21]

Natural compounds are gaining popularity these days. Mustard oil act as natural alternative to the modern medical system to cure the illness that occurs in the biological system. A natural oil typically obtained by distillation and having the characteristic odour of the plant or other source from which it is extracted. EO is thought to be a naturally produced medication for the majority of illnesses that occur in the biological system. Mustard oil is a popular oil known for its nutritional value and various therapeutic properties, which make it a viable alternative to synthetic drugs in the treatment of many infectious diseases. Mustard oils are classified as Lipids, a type of biomolecule. Triglyceride is a fundamental functional unit in mustard oil that is derived from 3 units of FA and 1 unit of glycerol. These, on the other hand, have polymeric structures with monomers, dimers, and trimers derived from free FAs, sterol, phospholipids, tocopherol, pigments, and lipoprotein moieties. The type and proportion of triacylglycerol FAs have a large impact on both the physical and chemical properties of these oils. Mustard oil is derived from the seeds of the mustard plant (*Brassica Campestri* L). It has a distinctively pungent flavour and aroma. It has a high concentration of selenium and magnesium. It

contains approximately 70% monounsaturated fatty acids, 42% of which are erucic acid. It is a high-antioxidant, highly unsaturated oil. Because of its low saturated fatty acid content (8%), mustard oil is regarded as one of the healthiest edible oils. It is used for frying and cooking.

Chemical composition of mustard oil

Mustard oil is a combination of beneficial FAs such as linoleic and linolenic acids. Mustard oil contains 92% Allyl isothiocyanate (AITC). Mustard seeds are rich in phytoalexins (sinalenin, sinalbins A and B), sterols and steryl esters (primarily sitosterol and campesterol), and flavonoids (apigenin, chalcone). Glucosinolates produce the pungency, which is then hydrolyzed to flavor-active isothiocyanates (ITCs) by the enzyme myrosinase (thioglucoside glucohydrolase). Glucosinolates are secondary metabolites that contain sulphur and are completely safe. Many of the therapeutic properties of mustard oil are due to the antibacterial, antifungal, and anticarcinogenic properties of glucosinolate. Mustard oil is high in omega-3 and omega-6 fatty acids, as well as monounsaturated and polyunsaturated lipids, in addition to FAs such as oleic, linoleic, and erucic acids. The active ingredient AITC, a Glucosinolate hydrolysis product (GHP) and a non-phenolic volatile compound make up the majority of mustard oil.



Mechanism of Action of Mustard Oil

Mustard oil's antibacterial action is most likely due to its components ability to break bacterial cell membranes, resulting in cell lysis. Mustard is high in flavonoid and carotenoid antioxidants such as carotenes, zeaxanthins and lutein, as well as vitamins A, C and K. These components combine to make it high in antioxidants. Furthermore, Vitamin E is a powerful fat-soluble antioxidant that protects mucus membranes from harmful oxygen-free radicals. Glucosinolate, on the other hand, is a major antioxidant in mustard oil that has medicinal properties for reducing bacterial and fungal effects.

Therapeutic benefits of mustard oil

1. Antimicrobial and antibacterial properties
2. Cardio-Protective properties
3. Anticancer properties
4. Antioxidant properties
5. Anti-inflammatory properties

Guava Leaf Extract [22]

Psidium guajava (Guava) is an evergreen tree in the Myrtaceae family that grows in tropical and subtropical climates, preferentially in dry climates. It is thought to have originated in Mexico or Central America and because of its health benefits, it is widely grown in countries such as Brazil, Bangladesh, China, Indonesia, India, Nigeria, Mexico, Pakistan, Thailand, and the Philippines. It is commercially grown in almost all Indian states. The total estimated area under guava crop production in 2016-2017 was 2,61,700 hectares (ha), with a total production of 36,48,200 million tonnes (MT). Guava, like *Mangifera indica* and *Azadirachta indica*, is regarded as a multipurpose medicinal tree due to the numerous medicinal properties found in its leaf, roots, bark and fruit. Extract from guava leaves has pharmacological activity due to the presence of active compounds that treat dysentery, diarrhoea, fatulence, gastrointestinal problems, and regulate blood glucose levels.



Mechanism of Action of Guava Leaf Extract

Guava leaf extract antibacterial action is due to its component ability to break bacterial cell wall, resulting in cell lysis.

Chemical Composition of Guava Leaf Extract [23-24]

Tannins, Triterpenes, Flavonoids, Essential oil, Fixed oil, Saponin, Carotenoids, Lectins, Vitamins (A & C), Alkaloids, Glycosides, Kaempferol, Mallic acid, Gallic acid, Chlorophyll and reducing sugars of these, flavonoids is known for its antibacterial effect along with Quercetin which is responsible for antioxidant effect.

Therapeutic Benefits of Guava Leaf Extract

1. Antibacterial Properties
2. Anti-inflammatory Properties
3. Antimicrobial properties
4. Anticancer Properties

Rock Salt (Sendha Namak) [25]

Saindhava lavana, or rock salt, is thought to be the best of all salts. Herbal remedies practitioners recommend it for daily use. Its properties, applications, and therapeutic properties differ significantly from regular salt. There is a distinction among rock salt and the common salt that we eat. Sendha namak is the purest form of rock salt currently offered in small quantities in India. As a result, it is more costlier than commercial salt. Rock salt, as opposed to iodized commercial salt, is more granular with large

chunky crystals, has a less salty taste, and is not chemically produced. It can be used as a healthy alternative for table salt because it is high in micronutrients and does not cause health problems such as high blood pressure, body puffiness, or eye puffiness. It is primarily to use for seasoning and preserving foods. Other than consumption, The nutritional value of rock salt is so significant that it has numerous effects on various parts of the human body. As previously stated, rock salt is the purest form of salt that is free of environmental contaminants and chemical components. It contains 84 of the 92 trace minerals required by the body, including calcium, iron, zinc, potassium, magnesium, copper and so on. As a result, it is available in drug stores and pharmacies as a powder, pill supplement, or even as a liquid extract in health beverages.



Chemical Composition of Rock Salt

Sodium chloride is the main component, accounting for up to 98% of the total. It is rich in minerals and elements. It also has Iodine, Lithium, Magnesium, Phosphorus, Potassium, Chromium, Manganese, Iron, Zinc, Strontium and other trace elements.

Therapeutic Benefits of Rock Salt

Rock salt can be used as a teeth whitener or mouth freshener. Gargling with rock salt provides relief against sore throat.

Mechanism of Action of Rock Salt

Rock salt being alkaline raises the pH of saliva and acts as a bacteriostatic agent that is it inhibits bacterial growth in mouth.

Charcoal

Cosmetic dentistry has grown in popularity around the world. Bleaching is a method for achieving high aesthetic results that is both effective and nontoxic. But even though teeth whitening is generally safe, some side effects may occur after whitening procedures. The much more common side effect is tooth sensitivity, which

occurs in 15-78% of patients following treatment. Another effect of bleaching that may increase the susceptibility to extrinsic discoloration after bleaching is increased enamel surface roughness. Other side effects include temporary gingival irritation, increased glass ionomer solubility and lessened bonding strength of bonded restorations to tooth structure. The abrasiveness of dentifrices could increase resin composite surface roughness, resulting in compromised restoration aesthetics. Abrasive constituents in dentifrices and toothbrush bristles may cause damage to the tooth surface and the composite's outer surface. According to some studies, bleaching can partially remove discoloration in resin composites. As a result, introducing a brand-new bleaching agent made from natural products with similar aesthetic results and minimal negative effects would be advantageous. to bleach the teeth or remove extrinsic resin composite stains. Because of its capacity to absorb pigments, chromophores and stains, charcoal-containing compounds have recently gained popularity for teeth whitening. Charcoal-

containing products are becoming increasingly popular, and social media advertising may help them spread across multiple regions. Using charcoal- containing compounds for cleaning or cosmetic purposes is an ancient practice in various parts of the world. The abrasive potency of charcoal-containing products is affected by particle size and distribution as well as the production process. Several charcoal- based dentifrices have been discovered to be highly abrasive, making them more efficient at removing extrinsic stains and surface deposits [26]. Products containing charcoal are constantly being introduced to the market, advertising various advantageous properties, such as a whitening effect and detoxification. In order to produce charcoal, carbon- based materials like bamboo, wood, or coconut husk and shell must first be stripped of water and other volatile substances [27]. Charcoal is primarily composed of black carbon and ash residue hydrocarbons obtained by removing water and other volatile constituents from substances of animal and vegetation origin.



It is typically generated by a method known as slow pyrolysis, during which the wood or other material is slowly pyrolyzed. Other substances are heated in the absence of oxygen. Charcoal, also known as "Black magic," has been produced and used for a long time. It is a very lightweight black carbon and ash residue hydrocarbon manufactured by removing water and other volatile constituents from animal and vegetation-derived substances. It

is typically created through a process known as slow pyrolysis, in which wood or even other materials are heated in the absence of oxygen. The charred material, as well as the temperature at which it is charred, establish the product's properties.

Uses of Charcoal in Dentifrices

1. Remove Stains & Whitens teeth

2. Removes acidic plaque [28].
3. Gives fresh breath
4. Aiding in good dental health
5. Tooth Whitening
6. Charcoal has the ability to kill microbes and absorb gases causing malodor.
7. Remineralizes teeth [29].
8. Protects teeth from infection [30].

Mechanism of Action of Charcoal containing Dentifrices

The activated charcoal in toothpaste works by combining mild abrasion with the absorption of extrinsic tooth surface stain. Because the charcoal in such products does not adhere to the tooth surface, it is easily washed away. Because of its absorbent characteristics, it can only bind with surface stains such as coffee and tea [31], [32]. As a result, these products are an effective way to remove extrinsic stains, or discoloration of the tooth's outside surface caused by substances such as coffee, wine, berries, and other staining foods [33].

Propolis

Propolis is one substance that has been utilised in medicine since ancient times. Honey bees (*Apis mellifera*) generate propolis, or "bee glue," a resinous material made from various plant components, including leaves, buds, cuts in tree

bark, and fissures.

Propolis serves as a protective coating for beehives (34). Propolis is a brownish resinous material that bees mostly gather from plants and utilise to strengthen their hives and maintain a sterile environment. Due to the presence of flavonoids, phenolics, and other aromatic components, it has strong antibacterial, antioxidant, and anti-inflammatory properties (35)

Therapeutic Actions

Antibacterial,
Anti-inflammatory properties and Antioxidant activity (34, 36)

Chemical composition of Propolis

Flavonoids, including chrysenes, galangin, pinocembrin and pinobanksin, phenolic acids, including molecules such as caffeic acid, p-coumaric acid and ferulic acid, and also caffeic acid esters, such as phenylethyl and 1,1-dimethylallyl ester (36-38) of which Flavanones, flavones, phenolic acids and their esters present in poplar-type propolis determine its antibacterial and anti-inflammatory properties, as well as antioxidant activity (37)

Therapeutic Benefits of Propolis

Oral cavity hygiene in cleft lip/palate patients and gingivitis prevention (39)



Clove

Spices like clove are made from the dried flower buds of the clove tree. The dried flower buds, leaves, and stem of the clove tree, together with clove oil, have all been used to create dental remedies.

Chemical Composition

Clove spices produce three essential oils like clove bud oil, clove stem oil and clove leaf oil. Clove oil's main constituents include eugenol, β -caryophyllene, eugenol cetate and in lesser amounts, benzyl alcohol, chavicol, acetyl salicylate and α -caryophyllene.

Mechanism of Action of Clove

Zinc oxide/ eugenol main ingredient, eugenol (2- methoxy-4-(2-propenyl) phenol), has a powerful sedative and obtundent impact on teeth that are already sensitive. Eugenol reduced

bacterial growth at 1000 parts per million, and at a high concentration of 2000 parts per million, which was high in comparison to ampicillin. *P. aeruginosa* was completely suppressed. As a positive control, 1mg/ml-1 was used. Eugenol has been found to have antibacterial action against a number of pathogens, including *E. coli*, *B. cereus*, *Helicobacter pylori*, *S. aureus*, *S. epidermidis*, *Streptococcus pneumoniae*, and *S. pyogenes*. Eugenol (0.5%) was also highlighted for its antibacterial action, which was more than 90% effective against two *P. aeruginosa* infections. When contrasting the antibacterial efficacy of carvacrol, thymol, and eugenol in relation to cinnamaldehyde, Eugenol showed the lowest antibacterial activity (MIC value: 1600mg/l -1), whereas their mixtures had synergistic interactions that led to MIC values of 400, 100, and 100mg/l -1 being reported, respectively.



Therapeutic Benefits of Clove

According to research done in 2012 by Marya and co-authors, clove volatile oil prevents apple juice- induced decalcification and encourages remineralization (40). Clove oil is frequently used to treat toothaches. The effects of zinc oxide and eugenol compounds on dental erosion and

demineralization of dental hard tissues are reduced.

Peppermint

Mentha piperta, also known as peppermint, is a popular herb that is grown throughout North America and Europe. Since ancient times, peppermint oil has been used for

many different things, including the treatment of headaches, the common cold, neuralgia, etc. (41). 0.1–1.0% volatile oil is produced by peppermint leaves, and the main components are menthol (29–48%) and menthone (20–31%) (42). *M. piperita* L. is used to create oral dentifrices because it can improve general breath freshness and prevent bad breath.(41). To get rid of dental plaque, mouthwashes made with mentha are utilized. its aqueous extract has been used to treat oral mucosal irritation and to prevent the onset and progression of oral dysplastic lesions.(43).

Therapeutic Benefits

inhibits plaque build-up, minimizes salivary *S.* mutant count, enhances salivary buffer capacity, and Flavoring agent (44).

Chemical Composition and Therapeutic Actions

Peppermint is a medicinal plant that is also known as *Mentha piperita* from the family of Lamiaceae. Menthol is the main component of peppermint. It has been reported to have antibacterial activity against streptococcus mutants (45)



Mechanism of Action:

Peppermint oil and various extracts of *Mentha piperita* have substantial antibacterial action against some Gram-positive and Gram-negative bacteria strains, as well as the capacity to influence bacterium adhesion and retention in dental biofilm. It possesses anti-microbial and anti-oxidant activity (45).

Lemongrass

Lemongrass (*Cymbopogon citratus*) is a perennial herb in the Poaceae family of grasses (47). It originated in Southwest Asia and currently grows

naturally all throughout the world, particularly in tropical and savannah areas (48). In almost all continents, lemongrass has been used extensively as a traditional medicine by making "tea" or an infusion from fresh or dried leaves. It covers a wide range of indications, from mild ailments like flu, fever, coughing, headaches and wounds to more serious illnesses including rheumatoid arthritis, bladder trouble, diabetes, and malaria (49). With its anti-bacterial, anti-fungal, antioxidant, anti-proliferative, anti-viral, and anti-inflammatory qualities, lemon grass oil can be used to treat a variety of human ailments. The extract can be used

to treat a variety of dental problems as a mouthwash, tooth paste, or medicine (50).

Chemical Composition:

Citronella, myrcene, limonene, linalool, citronellal, geranyl acetate, neral, geraniol, and neral. Lemon grass oil is also known as citronella oil. This grass' oil has a distinct lemon aroma due to its high citral concentration, which makes it stand out (63).

Therapeutic Actions



In 2022, Marwa Aly Elchaghaby and co-authors have been stated that Lemongrass inhibited the growth of three bacterial strains examined, namely *S. aureus*, *E. faecalis*, and *S. mutans*. It also has an antioxidant activity (54).

Therapeutic Benefits

Lemongrass oil can be used in the management of Periodontist. It shows activities like anti-plaque activity, anti-bacterial activity, anti-candida activity (52).

Indian gooseberry

Emblica officinalis also known as amla, *Phyllanthus emblica*, Native to India, the plant grows in South East Asia, China, Malaysia, Pakistan, Uzbekistan, Sri Lanka, and other tropical and subtropical climates (51). It is a key herb used for medicinal purposes in Ayurveda. It has been extensively utilized scientifically in the Ayurvedic medical system. *E. officinalis* is recognized to have anti-inflammatory and wound-healing effects through boosting collagen formation during cutaneous wound healing, according to numerous current studies. These characteristics are essential for the recovery of damaged tooth pulp (52).

Chemical Composition:

According to reports, Indian gooseberry contains tannins, flavonoids, gallic acid, polyphenols, emblicol, minerals, and vitamin C (55).

Mechanism of action of Indian Gooseberry

P. emblica comprises antioxidant-rich hydrolyzable tannins and vitamin C. Punigloconin, Pendunculagin, Embicanin A, Embicanin B, and are types of tannins that safeguard the body from oxidised free radicals. The gingiva is protected against oral micropathogens by the antioxidant property. The tannins have been proven to have antibacterial action by deactivating the microbial enzymes and adhesions. They have an anti-infective action by promoting host-mediated tumour activity and phagocytic cell activity (56). Quinones shows the antimicrobial property by inactivating the proteins by the provision of free radicals (57).

Therapeutic Actions and benefits

Both anti-ulcerative and antibacterial activities are present. It is used to cure of periodontal diseases and mouth ulcers (58).

Punica granatum (Pomegranate)

Chemical constituents

phenol, flavonoids, proanthocyanidin, Tannins, ellagitannins, Polyphenols, anthocyanins

Mechanism of Action of Punica Granatum

It has been proposed that pomegranate components' antioxidant activity is related to their phenolic constituents [59]. These compounds are well-known for their ability to scavenge free radicals and prevent lipid oxidation [60]. However, there are some disagreements about which compounds are more important in performing this activity. The antioxidant activity is caused by punicalagin, with anthocyanins playing only a minor role [61]. The mechanism underlying the polyphenolic compounds' redox reactions is what gives them their anti-oxidant properties. Reductones, which work by donating an atom of hydrogen to break the free radical chain, is hence linked to reducing characteristics. By interacting with a few particular precursors, these reductones also inhibit the generation of peroxide [62]. This will happen as a result of the extract's capacity to stop germs from adhering to tooth surfaces and from hindering the production of chemicals by species of Streptococcus that cause dental caries. In order to prevent gingivitis [73], it is believed that polyphenolic flavonoids lower the level of oxidative

stress in the oral cavity, provide direct antioxidant activity, anti-inflammatory and antibacterial properties, and completely remove plaque from the tooth's surface. Punica granatum extract also has anti-inflammatory characteristics that can help calm inflamed tissues or ulcers, and it attacks the fundamental molecular reasons of tooth decay with excellent vigour and aggression [64]. Bacterial lipopolysaccharides promote the production of inflammatory mediators and catabolic cytokines, such as prostaglandin E2, interleukin-1, interleukin-6, and tumor necrosis factor (TNF). The extracellular matrix and bone are destroyed by the matrix metalloproteinases, tissue-derived enzymes that are stimulated by these cytokines and inflammatory mediators.[65]

Uses

1. It shows antibacterial activity.
2. Components of pomegranates may improve dental health, lowering the risk of gingivitis, among other benefits.
3. Pomegranate could produce an anti-gingivitis effect as the flavonoids possess direct antioxidant properties
4. Pomegranate reduced the ability of plaque-forming microorganisms to stick to tooth surfaces.
5. It is very useful in bleeding gums due to scurvy



Neem

Azadirachta indica tree belongs to the Meliaceae family.

Chemical constituents

Genin, Sodium Nimbin, Salannin, Nimbin, Azadirachtin, Nimbidiol, Quercetin, Nimbidin, fiber, carbohydrates, 10 amino acid proteins, calcium, carotenoids, fluoride.

Mechanism of Action of Neem

Neem is a potent anti-inflammatory agent due to its ability to regulate proinflammatory enzyme activities [66]. Nimbidin, isolated from seed

oil, has the ability to suppress the macrophage and neutrophil functions. It also inhibits nitric oxide (NO) and prostaglandin E2 (PGE2) production in macrophages following in vitro exposure [67]. Antioxidants deactivate free radicals before they attack targets in biological cells and play a role in the activation of enzymatic antioxidants such as control damage caused by free radicals/ reactive oxygen species [68]. Neem has free radical scavenging properties due to a high concentration of antioxidants such as Azadirachtin and nimbolide [69]. A tumour suppressor gene, is important in inhibiting abnormal cell proliferation and thus preventing cancer progression [70].



Therapeutic uses

1. It has anti-inflammatory properties.
2. Free radical scavenging activity.
3. It has antibacterial properties.

Garlic

Garlic (*Allium sativum* L.), a member of the Liliaceae family, is used to improve dental health and promote oral hygiene.

Chemical constituents of Garlic

Alliin, methiin, S-allylcysteine

Mechanism of Action of Garlic
Bioactive compounds derived from GE inhibit the transcription of several cytokine genes involved in proinflammatory responses, including tumor

necrosis factor- (TNF-), interleukin-1beta (IL-1), IL-6, monocyte chemoattractant protein-1 (MCP-1), and IL-12.[71] In one in vitro study, AGE increased the production of IL-10 while decreasing the production of IL-12, which in turn decreased the production of the proinflammatory cytokines TNF-, IL-6, and IL-2 by T cells, acting as negative feedback in the signalling of proinflammatory response.[72] Garlic and its related bioactive compounds have stimulatory and inhibitory effects on whole blood cultures of monocytes and lymphocyte proliferation, which controls the production of proinflammatory cytokines such as TNF- and IL-10. In human preadipocytes treated

with macrophagic factors, the bioactive compound 1,2- vinylldithiin from garlic reduces IL-6 and MCP-1, -2 secretion. Both molecules are linked to

metabolic complications of obesity and inflammation [73].



Uses

1. It is more effective against *Candida Albicans*, which is prevalent in the oral cavity [74].
2. It shows inhibitory effect of garlic against periodontal pathogens.
3. It is active against both *P. gingivitis* and *A. actinomycetemcomitans*, as well as *P. gingivitis* proteases [75].
4. Garlic has a beneficial effect in the treatment of oral cancer [75].
5. Garlic has an antibacterial effect on dental plaque.
6. The paste of the bulb is applied to the gums and cavities of infected teeth

Aloe Vera Chemical Constituents

Aloe emodin, Aloetic acid, Anthranol, Isobarbaloin, Emodin, Ester of cinnamic acid.

Mechanism of action of Aloe Vera Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone, interact with the growth factor receptor on the fibroblast, stimulating its activity and proliferation for oral application [76]. Aloe gel has wound-healing properties that include maintaining the wound's moisture, promoting epithelial cell migration, accelerating collagen maturation and reducing inflammatory reaction. A high-molecular-weight polypeptide component of

the gel showed evidence of healing excisional lesions [74]. While Davis et al. found that Aloe vera gel accelerated wound healing, Yagi et al. discovered that Aloe vera gel includes a glycoprotein with cell proliferation-promoting activity. via boosting blood flow (angiogenesis), which led to an increase in oxygenation. Angiogenesis, which is a component of tissue regeneration, involves the development of new blood capillaries. A glycoprotein found in aloe vera gel has the ability to promote cell proliferation, and aloe vera gel has been shown to accelerate angiogenesis, which improves wound healing. as a result, oxygenation Angiogenesis, which is a component of tissue regeneration, involves the development of new blood capillaries [75]. The periodontal ligament (PDL) cells' viability could be maintained by aloe vera gel [76]. Aloe vera is a potent antibacterial and has demonstrated its antibacterial properties, which could account for the low plaque index (PI) seen in these subjects. against *Streptococcus faecalis*, *Streptococcus pyogenes*, and *Candida albicans*. Aloe emodin, aloetic acid, aloin, and other natural anthraquinones present in *A. vera* are thought to have antimicrobial properties. Among them are anthracene, anthranol, barbaloin, chrysophanic acid, ethereal oil, ester of cinnamic acid, isobarbaloin, and resistannol. These anthraquinones, along with the gel fraction,

have analgesic, antibacterial, antifungal, and antiviral properties in relatively low concentrations; however, at very high concentrations, they may be

toxic. Early periodontitis can be successfully treated with *A. vera*, and the treatments were effective. [77]



Uses

1. When applied at maximum dosage, aloe vera greatly decreased accumulated plaque.
2. It is very beneficial for the treatment of periodontitis and gingivitis.
3. Due to its calming and healing qualities, as well

as its ability to minimise swelling and soft tissue oedema, aloe vera significantly lowers the incidences of gingival bleeding. Hence, it aids in restoring the health of gums.

4. Periodontal health improves with subgingival aloe vera gel treatment.

Marketed Herbal Toothpastes:

Sr no.	Name	Ingredients
1	Himalaya Complete Care Toothpaste	Pomegranate, Neem, Indian Gum Arabic Tree's twigs, Triphala, Bishop's Weed, False Black Pepper, Five-Leaved Chaste Tree
2	Dabur Meswak Toothpaste	Calcium Carbonate, Sorbitol, Water, Silica, Sodium Lauryl Sulphate, Flavour, Meswak Extract, Cellulose Gum, Carrageenan, Sodium Silicate, PVM/MA Copolymer, Sodium Saccharin, Zinc Gluconate, Sodium Benzoate, Benzyl Alcohol, CI 77891, P-Thymol.

3	Neem Toothpaste - CompleteCare	Neem Extract, Mint Flavour, CalciumCarbonate.
4	Dabur Herbal Complete Care Toothpaste	Sorbitol, Aqua, Silica, Peg-32, Sodium LaurylSulfate, Aroma(Flavour),Sodium Carboxymethyl Cellulose, Sodium Benzoate, Benzyl Alcohol, Trisodium Phosphate, SodiumSaccharin, Ws-3, NigellaSativa(Black Seed) Oil, Melaleuca Alternifolia(Tea Tree)Leaf Oil, CI 77891, CI 77499
5	Colgate Herbal OralCare Toothpaste	Eucalyptus,tea tree oil,chamomille
6	Patanjali Dant Kanti	Laung (Syzygium aromaticum) Tomar (Zanthoxylum armatum) Akarkara (Anacyclus pyrethrum) Babool (Vachellia nilotica) Triphla(Terminalia chebula,Terminalia
		bellirica, Emblica officinalis) Khadir (Senegalia catechu) Divya Dhara Neem (Azadirachta indica) Vajradanti (Barleria prionitis) Meswak
7	Sri TattvaSudanta Herbal Gel Toothpaste	Charcoal
8	Colgate Active Salt Lemon Toothpaste	Calcium Carbonate, Sorbitol, Sodium Lauryl Sulphate, Silica, Titanium Dioxide, Titanium Dioxide, Sodium Silicate, Flavour Carrageenan, Sodium Monofluorophosphate, Sodium Bicarbonate, Benzyl Alcohol, Sodium Saccharin, Triclosan, In Aqueous Base
9	Colgate Active Salt Neem	Calcium Carbonate, Sorbitol, Sodium Lauryl Sulphate, Silica, Titanium

	Toothpaste	Dioxide, Titanium Dioxide, Sodium Silicate, Flavour Carrageenan, Sodium Monofluorophosphate, Sodium Bicarbonate, Benzyl Alcohol, Sodium Saccharin, Triclosan, In Aqueous Base
10	Colgate Swarna Vedshakti Ayurvedic Toothpaste	Calcium Carbonate, Sorbitol, Sodium Lauryl Sulphate, Silica, Titanium Dioxide, Titanium Dioxide, Sodium Silicate, Flavour Carrageenan, Sodium Monofluorophosphate, Sodium Bicarbonate, Benzyl Alcohol, Sodium Saccharin, Triclosan, In Aqueous Base.
11	Lever AyushAnti Cavity Clove Oil Toothpaste	Clove Oil, DasanakanthiChooranam, Babool
12	Lever AyushFreshness Gel NaturalAyurvedic CardamomToothpaste	Cardamom and ArimedasThaila
13	Lever Ayush Whitening Rock Natural Ayurvedic Salt Toothpaste	Rock Salt and ArimedasThailam

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