

AYURVEDA IN DENTISTRY

BY

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Publication

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DEDICATION

I can never thank you enough for the never-ending love, support and
patience,
my family

Mr Gururaj Kulkarni
Mrs Savitri Kulkarni
Mrs Mayuri Varagiri
Mr Girish Varagiri
Miss Shatakshi Varagiri

And dear friend
Dr Abbin John

PREFACE

Traditional Medicine is defined by the World Health Organisation (WHO, 1978a) as the sum total of knowledge or practices whether explicable or inexplicable, used in diagnosing, preventing or eliminating a physical, mental or social disease which may rely exclusively on past experience or observations handed down from generation to generation, verbally or in writing. It also comprises therapeutic practices that have been in existence for hundreds of years before the development of modern scientific medicine and are still in use today without any documented evidence of adverse effects.

There has been a change in thinking globally, with a growing tendency to "GO NATURAL". The World Health Organization estimates that 4 billion people (80% of the World's population) use traditional medicines for some aspect of primary healthcare. This change is because the plant-based therapeutics are natural products, non-narcotic, easily bio-degradable, pose minimum environmental hazards, have less adverse effects, and are easily available and affordable.

Traditional medicine has its roots, grounded deep in India and is being used here since times immemorial. Ayurvedic medicine (Ayurveda = the science of life) is a system of Hindu traditional medicine native to the Indian subcontinent and a form of alternative medicine.

Ayurveda is a Sanskrit word derived from two roots: The word "Ayu" means all aspects of life from birth to death. The word "Veda" means knowledge or learning. Hence Ayurveda indicates the science by which life in its totality is understood. Ayurvedic medicine also treats specific physical and mental health problems. A chief aim of ayurvedic practices is to cleanse the body of substances that can cause disease, thus helping to re-establish harmony and balance.

Ayurvedic treatment consists of salubrious use of drugs, diets and certain practices. Currently, Ayurveda is widely practiced in the Hindustan peninsula (India and the neighbouring countries) and in recent years, has attracted much attention in economically developed countries such as those in Europe and in the United States and Japan. There are approximately 1250 Indian medicinal plants that are used in formulating beneficial measures according to ayurvedic or other ethnicity. This 5000-year-old system of medicine recommends treatments with specific herbs

and minerals to cure various diseases. The botanicals in the ayurvedic material medica have been proven to be safe and effective, through several hundred to several thousand years of use. The exploration of botanicals used in traditional medicine, may lead to the development of novel preventive or therapeutic strategies for oral health. As most of the oral diseases are due to bacterial infections and it has been well-documented that medicinal plants confer considerable anti-bacterial activity against various microorganisms including bacteria responsible for dental caries.

Ayurveda stresses the use of plant-based medicines and treatments. These medicines are not only used for the treatment of systemic diseases, but the natural phytochemicals in them offer an effective alternative to antibiotics and represent a promising approach in the prevention and therapeutic strategies for oral infections too. Ayurveda has mentioned various procedures for maintaining oral hygiene and gingival health such as stem, bark root of neem are used as tonic, antiseptic, astringent and antibacterial. It can be used as mouthwash and neem twigs are used as toothbrush. The natural products derived from medicinal plants such neem, tulsi, amla, dhatura, nimbu etc. have proven to be abundant source of biologically active compounds, many of which have become the basis for the development of new lead chemicals for pharmaceuticals due to a rapid increase in the rate of infections, antibiotic resistance in microorganisms and due to side effects of synthetic antibiotics, such as alteration of microflora and have undesirable side-effects such as vomiting, diarrhoea and tooth staining.

Despite the advances in various field of medicine, oral infections and dental caries are still considered a serious public health problem and inflict a major burden to health care services around the world and especially in developing countries. So, there is an urgent need to address the knowledge and importance about traditional methods used for routine oral practices and herbal remedies for various dental diseases.

Hence, the search for alternative products continues and natural phytochemicals isolated from plants used in traditional medicine are considered as good alternatives to synthetic chemicals as medicinal plants though produce slow recovery but their therapeutic effect is miraculous.

Dr Kulkarni Shriram G
Dr Ankita Gupta

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1

PHARMACOLOGICAL APPLICATIONS OF PLANTS AND NATURAL PRODUCTS

Dr Kulkarni Shriram G

Plants and natural products from time immemorial used for their pharmacological applications viz., antiulcerogenic, wound healing, anti-inflammatory, antimicrobial, antioxidant properties etc. Here is a list of few of these.

- 1) **PLANTS WITH ANTIULCEROGENIC PROPERTY:** Drugs which are commonly used as antiulcerogenic agent for peptic ulcer are as follows: *Ocimum sanctum*, *Allophylus serratus*, *Desmodium gagicum*, *Azadirachta indica*, *Hemidesmus indicus*, *Asparagus racemosus* and *Musa sapientum*.
- 2) **PLANTS WITH ANTIMICROBIAL PROPERTY:** Aloe (*Aloe barbadensis*, *Aloe vera*), Apple (*Malus sylvestris*, *Ashwagandha* (*Withania somniferum*), Bael tree (*Aegle marmelos*), Basil (*Ocimum basilicum*), Betel pepper (*Piper betel*), Black pepper (*Piper nigrum*), Buttercup (*Ranunculus bulbosus*), Cashew (*Anacardium pulsatilla*), Castor bean (*Ricinus communis*), Ceylon cinnamon (*Cinnamomum verum*), Chilli peppers, paprika (*Capsicum annum*,) Clove (*Syzygium aromaticum*), Coriander, (*Coriandrum sativum*), Eucalyptus (*Eucalyptus globules*), Garlic (*Allium sativum*), Peppermint (*Mentha piperita*), Poppy (*Papaver somniferum*), Potato (*Solanum tuberosum*) are few of the many Indian plants species which contain specific or general antimicrobial activities.
- 3) **PLANTS WITH ANTIOXIDANT PROPERTY:** Spinach, pepper, black tea, broccoli, green tea, carrot, potato tomato, blackberry, grape, olive, pineapple, strawberry, orange to name a few known to have potent antioxidant activity.
- 4) **PLANTS WITH ANALGESIC PROPERTY:** Plants with claimed analgesic activity are as follows: *Anicillo* (*Piper*) species, *Arnica* (*Arnica Montana*), *Betle* (*Piper betle*), *Capsicum* (*Capsicum annum*), *Chille* (*Capsicum annum*), *Clove* (*Eugenia caryophyllus*), *Coca* (*Erythroxylum coca*), *Feverview* (*Tanacetum parthenium*), *Ginger*

■ *Ayurveda In Dentistry*

(Zingiber officinale), Marijuana (Cannabis sativa), Menthol (Mentha piperata), Myrrh (Commiphora myrrha), Peppermint (Mentha piperita), Poppy (Papaver somniferum), Tobacco (Nicotiana tabacum), Willow bark (Salix alba), Wintergreen (Gaultheria procumbens).

- 5) PLANTS WITH ANTI-INFLAMMATORY PROPERTY:** Underneath is a list of few drugs used for their anti-inflammatory properties: Aloe (Aloe vera), Anesthesia (Ottonia frutescens), Angelica (Angelica archangelica), Anisillo (Piper auritum), Piperaceae Anisillo (Piper marginatum), Arnica (Arnica Montana), Calendula (Calendula officinalis), Camptotheca (Camptotheca acuminata), Celery seeds (Apium graveolens), Chamomile (Anthemis nobilis), Chickweed (Stellaria media), Chicle (Manilkara sapota), Chilcuague (Heliopsis longipes), Chilmecatli (Heliopsis longipes), Chinchillia (Anicillo) (Tagetes minuta), Dandelion (Taraxacum officinale), Garlic (Allium sativum), Ginger (Zingiber officinale), Gotu kola (Centella asiatica).

2 ALEOVERA

Dr Kulkarni Shriram G, Dr Shivakumar KM

The Aloe vera plant has been known and used for centuries for its health, beauty, medicinal and skin care properties. The name Aloe vera derives from the Arabic word “Alloeh” meaning “shining bitter substance,” while “vera” in Latin means “true.” The Egyptians called Aloe “the plant of immortality.” Today, the Aloe vera plant has been used for various purposes in dermatology.

HISTORY:

Aloe vera has been used for medicinal purposes in several cultures for millennia: Greece, Egypt, India, Mexico, Japan and China. Egyptian queens Nefertiti and Cleopatra used it as part of their regular beauty regimes. Alexander the Great, and Christopher Columbus used it to treat soldiers' wounds. The first reference to Aloe vera in English was a translation by John Goodyew in A.D. 1655 of Dioscorides' Medical treatise De Materia Medica. By the early 1800s, Aloe vera was in use as a laxative in the United States, but in the mid-1930s, a turning point occurred when it was successfully used to treat chronic and severe radiation dermatitis.

ANATOMY: The plant has triangular, fleshy leaves with serrated edges, yellow tubular flowers and fruits that contain numerous seeds. Each leaf is composed of three layers:

- 1) An inner clear gel that contains 99% water and rest is made of amino acids and vitamins.
- 2) The middle layer of latex which is the bitter yellow sap and contains anthraquinones.
- 3) The outer thick layer of 15–20 cells called as rind which has protective function and synthesizes carbohydrates and proteins.



FIGURE: 1 ALOE-VERA PLANT AND LEAF

BOTANICAL CLASSIFICATION OF ALOE VERA:

Kingdom: Plantae
 Clade: Angiosperms
 Order: Asparagales
 Family: Xanthorrhoeaceae
 Subfamily: Asphodeloideae
 Genus: Aloe
 Species: A.vera

TABLE: 1 CHEMICAL COMPOSITION AND PROPERTIES OF ALOE VERA

CONSTITUENTS	NUMBER AND IDENTIFICATION	PROPERTIES AND ACTIVITY
Amino acids	Provides 20 of the 22 required aminoacids and 7 of the 8 essential ones.	Basic building blocks of proteins in bodyand muscle tissues.
Enzymes	Anthranol, barbaloin, chrysophanic acid, smodin, ethereal oil, ester cinnamonic acid, isobarbaloin, resistannol	Antifungal & antiviral activity but toxic at high concentrations
Hormones	Auxins and gibberellins	Wound healing and anti-inflammatory.
Minerals	Calcium, chromium, copper, iron, manganese, potassium, sodium and zinc.	Essential for good health
Saponins	Glycosides	Cleansing & antiseptic
Sugars	Monosaccharides: Glucose and Fructose	Anti-viral, immune modulating activity of acemannan

ACTIONS OF ALOE VERA GEL:

- 1) HEALING PROPERTIES:** Countless studies have demonstrated the healing powers of aloe vera gel. Glucomannan, a mannose-rich polysaccharide and gibberellin, a growth hormone, interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe vera application.¹⁸⁻¹⁹ Yagi et al. reported that Aloe vera gel contains a glycoprotein with cell proliferating-promoting activity, while Davis et al. noted that Aloe vera gel improved wound healing by increasing blood supply (angiogenesis), which increased oxygenation as a result.
- 2) PROTECTIVE EFFECTS:** Aloe vera gel has been reported to have a protective effect against radiation damage to the skin.²¹ On skin exposed to UV and gamma radiation, following the administration of aloe vera gel, an antioxidant protein, metallothionein, is generated in the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin.
- 3) ANTI-INFLAMMATORY ACTION:** Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production from arachidonic acid.¹⁹ Recently, the novel anti-inflammatory compound called C-glucosyl chromone was isolated from gel extracts.²² In addition, peptidase bradykinase was isolated from Aloe and shown to break down the bradykinin, an inflammatory substance that induces pain.
- 4) ANTIBACTERIAL PROPERTY:** *Streptococcus pyogenes* and *Streptococcus faecalis* are two microorganisms that have been inhibited by aloe vera gel.¹⁸ Aloe vera gel reportedly was bactericidal against *Pseudomonas aeruginosa* while acemannan prevented it from adhering to human lung epithelial cells in a monolayer culture.
- 5) ANTIFUNGAL PROPERTY:** A processed aloe vera gel preparation reportedly inhibited the growth of *Candida albicans*.¹⁸ The purified Aloe protein has been found to exhibit potent antifungal activity against *Candida parapsilosis*, *Candida krusei* and *Candida albicans*.
- 6) MOISTURIZING AND ANTI-AGING EFFECT:** It was proposed that the Aloe vera gel formulations with higher concentrations (0.25% w/w and 0.5% w/w) improved skin hydration possibly by means of a humectant mechanism. Aloe stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled.

ALOE VERA IN DENTISTRY:

- **ALOE VERA IN GINGIVAL AND PERIODONTAL DISEASE-** Aloe Vera greatly reduces the instances of gum bleeding due to its soothing & healing properties, reduces swelling and soft tissue edema. Sub gingival administration of Aloe vera gel results in improvement of periodontal condition & can be used as a local drug delivery system in periodontal pockets.
- **ALOE VERA IN CARIES-** Mohammad Mehdi Fani found that, Aloe vera gel exerted strong bactericidal activity against both cariogenic and periodontopathic bacteria. Undiluted Aloe vera gel produced significant growth inhibition zones against all of the oral bacteria tested.
- **AS DENTURE ADHESIVES-** It is Sticky & viscous nature of gel. It strengthens gums, soothes & alleviates gum irritation like gum sores (ulcer). It has adequate adhesive strength to wet and dry conditions. Names of denture adhesives are Fittydent, Bioforce denture adhesive, Protefix adhesive, Secure denture adhesive.
- **ALOE VERA IN RECURRENT APTHOUS STOMATITIS-** Aloe vera oral gel is not only effective in decreasing the recurrent apthous stomatitis patient's pain score and wound size but also decreases the apthous wound healing period. US Food and Drug Administration has also found a derivative of Aloe vera an effective treatment alternative in treating oral ulcers.
- **ORAL LICHEN PLANUS-** Aloe Vera has also been used to treat lichen planus. The topical application of Aloe Vera, three times a day relieves the pain and severity of the oral lesions, and the oral quality of life of the patients is improved.
- **ALOE VERA IN ENDODONTICS-** Aloe-vera has proved to be a good obturative material for primary teeth. Retention of microorganisms within the dentinal tubules is thought to be a source of persistent endodontic infection. In persistent cases of root canal infection and in failed root canal treatments main organism identified is *E. Faecalis*. Aloe vera gel has been found to be effective in decontaminating GP cones within one minute.
- **ALOE VERA AS A MOUTHWASH-** Mouthwash prevents radiation-induced mucositis by its wound healing and anti-inflammatory mechanism. Aloe vera mouthwash may not only prevent radiation-induced mucositis by its wound healing and anti-inflammatory mechanism, but also may reduce oral candidiasis of patients undergoing head and neck radiotherapy due to its antifungal and

immunomodulatory properties. It is recommended that 1-3 tablespoon of aloe vera juice be used as a mouthwash, then swallowed, three times daily.

- **ALOE IN CANKER & COLD SORES-** Aloe-vera accelerates healing & reduces pain associated with canker sores. It does not have a bad taste or sting when applied.

CONTRAINDICATIONS: In some cases contact dermatitis and hypersensitivity reactions after topical applications of Aloe vera gel have been noted. Hence it is contraindicated in cases of known allergy to plants in the Liliaceae family. Aloe vera gel for systemic application is not recommended in combination with antidiabetic, diuretic, or laxative drugs; sevoflurane; or digoxin. Combined use of Aloe vera and furosemide may increase the risk of potassium depletion. It decreases the blood sugar levels and, thus, may interact with oral hypoglycaemic drugs and insulin.

SIDE EFFECTS:

TOPICAL: It may cause redness, burning, stinging sensation and rarely generalized dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as aloin and barbaloin. It is preferred to apply it to a small area first to test for possible allergic reaction.

ORAL: Abdominal cramps, diarrhoea, red urine, hepatitis, dependency or worsening of constipation. Prolonged use has been reported to increase the risk of colorectal cancer. Laxative effect may cause electrolyte imbalances (low potassium levels).

CONCLUSION:

Aloe Vera may find a promising role in various branches of dentistry in future. Proper diagnosis, knowledge of the traditional medicine and implementation of that knowledge to the treatment plan are important in ensuring success with this dental therapeutic agent. Standardization and quality assurance of aloe vera products plays a key area which needs to be focused. Further, controlled studies are also required in future to prove the effectiveness of aloe vera under various conditions. Also, the potential long term side effects of Aloe vera need to be studied and evaluated.

3

NEEM

Dr Ankita Gupta, Dr Smitha B Kulkarni



FIGURE: 2 NEEM LEAVES

Azadirachta indica, popularly known as Indian Neem, Margosa tree or Indian lilac, is well known in India and its neighboring countries for more than 2000 years as one of the most versatile medicinal plants having a wide spectrum of biological activity.

Neem is called 'arista' in Sanskrit a word that means 'perfect, complete and imperishable' The Sanskrit name 'nimba' comes from the term 'nimbatī swasthyamdadati' which means 'to give good health'. It is commonly called 'Indian lilac' or 'Margosa' and belongs to the family Meliaceae. The Persian name of neem is 'Azad- Darakth- E- Hind' which means 'Free tree of India'. Neem is considered to be a part of India's genetic diversity.

All parts of the neem tree- leaves, flowers, seeds, fruits, roots and bark have been used traditionally for the treatment of inflammation, infections, fever, skin diseases and dental disorders. The medicinal utilities have been described especially for neem leaf. Neem leaf and its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, antihyper-glycaemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, antioxidant, antimutagenic and anticarcinogenic properties.

Owing to its versatile characteristics neem is rightly called the 'Village pharmacy' or 'Doctor tree' or 'Wonder tree of India' or 'The bitter gem'. National Research Council (NRC), Washington, USA considers the neem, "One of the most promising of all plants and the fact is that it may eventually benefit every person on this planet. Probably no other plant yields as many strange and varied products or has as many exploitable by-products.

Neem finds immense use in a number of products ranging from cosmetics to agriculture and from pharmaceuticals to Ayurveda. Although literature search reveals that Neem tree has multiple potential uses in dentistry, its application is limited in routine dental practice.

BOTANICAL CLASSIFICATION OF NEEM:

Neem is a member of the Mahogany family.

Taxonomic position of neem:

Order- Rurales

Suborder – Rutinae

Family – Meliaceae

Subfamily – Melioideae

Tribe – Melieae

Genus – Azadirachta

Species – indica

TABLE: 2 SOME BIO-ACTIVE COMPOUNDS FROM NEEM

NEEM COMPOUND	SOURCE	BIOLOGICAL ACTIVITY
Nimbidin	Seed oil	Anti-inflammatory, anti-pyretic, hypoglycemic, antifungal, Antibacterial
Nimbolide	Seed oil	Antibacterial, Antimalarial
Gedunin	Seed oil	Antifungal Antimalarial
Azadirachtin	Seed	Antimalarial
Mahmoodin	Seed oil	Antibacterial
Margolone, and isomargolonone	Bark	Antibacterial
Cyclic trisulphide cyclic tetrasulphide	Leaf	Antifungal
Polysaccharides		Anti-inflammatory
NB-II peptidoglycan	Bark	Immune-modulatory

USES:

Neem is well-known for its durable wood. In addition, the non-wood products of neem like flowers, fruits, seeds (oil, cake), leaves, bark and gum also find various uses³⁶. The most useful and valuable product of the tree are the seeds which yield 40% of a deep yellow oil, the well-known 'Margosa oil'

USES OF NEEM IN DENTISTRY:

- 1) ANTIBACTERIAL EFFICIENCY OF NEEM EXTRACT ON MICRO ORGANISMS CAUSING DENTAL CARIES:** The most common oral disease, dental caries is related to dental plaque and seem to occur when the normal balance between the microorganisms and the host is disturbed. Neem extract produced the maximum zone of inhibition on *Streptococcus mutans* at 50% concentration.
- 2) NEEM EXTRACT AS A POTENT ROOT CANAL IRRIGANT:** Several in vitro studies have shown that Neem leaf extract is a viable medicament against *C. albicans*, *E. faecalis* and even their mixed state. However, preclinical and clinical trials are needed to evaluate biocompatibility and safety before Neem can conclusively be recommended as an intracanal irrigating solution, but in vitro observation of Neem effectiveness appears promising.
- 3) EFFICIENCY OF NEEM EXTRACT IN THE TREATMENT OF CHRONIC GINGIVITIS AND PERIODONTAL DISEASES:** The most effective method of prevention and maintenance of periodontal diseases is mechanical oral hygiene combined with proper professional maintenance. However in reality the degree of motivation and dexterity required for an optimal oral hygiene level may be beyond the ability of the majority of the patients. From this perspective, the utilization of antimicrobial mouth rinses has been considered as a useful adjunct to oral hygiene.
- 4) USAGE OF NEEM EXTRACT IN ORAL CARE INDUSTRY:** Neem bark is used as an active ingredient in a number of tooth pastes and tooth powders because of its antibacterial properties. Its usage are proven to be beneficial for tooth and gums health.

SIDE EFFECTS: Traditional ayurvedic practitioners recommend against the use of neem if the person suffers from obvious wasting or fatigue. Infants have suffered complex sequelae and even death as a cause of internal use of neem and thus should be avoided in children. It is not recommended for pregnant or nursing women to use neem. Those who

have impaired liver or kidney function should also take great caution. Excess doses of seed or seed supplements may be toxic.

CONCLUSION: As the global scenario is now changing towards the use of nontoxic plant products having traditional medicinal use, development of modern drugs from neem should be emphasized for the control of various diseases. Once the Neem tree extracts become the mainstay for the management of various oral diseases, it can be truly regarded as “aristha”, which means “reliever of sickness” in Sanskrit.

4 HONEY

Dr Ankita Gupta

INTRODUCTION:

Honey is defined as a sweet liquid substance produced by bees from the nectar gathered from flowers and stores them for food. The color and flavor are determined by the flowers used. It was the early man's source of sugar.

APITHERAPY, or “bee therapy” (from the Latin word „apis” which means bee) is the medicinal use of products made by honeybees. In ancient times, honey was considered the food of gods and the symbol of wealth and happiness. Honey was used to treat the infected wounds as long ago as 2000 years before the bacteria were discovered to be the cause of infection.



FIGURE: 3 HONEY

HISTORICAL REVIEW:

Honey is the most ancient wound dressing known, mentioned by the Greek philosopher Aristotles and it has continued to be used throughout the ages. Dioscordis (c 50 AD) wrote of honey being 'good for sunburn' and 'for all rotten and hollow ulcers'

The use of honey has been documented in several religious texts including the Veda (a book of Hindu scriptures) and the Bible. 4000- year-old tablets even record the use of honey in ancient sumeria. Honey was important to the ancient Egyptians as well. Hippocrates, who lived between 460-367 BC, said that “honey cleans sores and ulcers of the lips, heals carbuncles and running sores. However, honey continued to be used in folk medicine and as a last resort for patients not responding to modern treatment. In the 1989 issue of the Journal of Royal Society Medicine an editorial expressed that “the time has come for conventional medicine to lift the blinds off this “traditional remedy” (honey) and to give it due recognition” (Molan, 1999). With the recent rise in popularity of alternative medicines, apitherapy is beginning to be re-acknowledged.

COMPOSITION OF HONEY:

The carbohydrates comprise the major portion of honey. It contains a number of enzymes and free amino acids, of which the most abundant is proline. It also contains trace amounts of vitamin B, minerals and antioxidants like flavonoids and Vit C.

TABLE:3 COMPOSITION OF HONEY

COMPOSITION	PERCENTAGE
Water	22.0
Carbohydrates	79.7
Protein	0.2
Ester extract	0.0
Ash	0.1
Fiber	0.0

TYPES:

Honey is available in four forms: comb, extracted, chunk and creamed.

COMB HONEY (HONEYCOMB): Is section of the waxen comb filled with honey just as the bees stored it naturally.

EXTRACTED HONEY (LIQUID): It is the honey which is separated from the comb. It is prepared by cutting off the wax cappings and whirling the comb in a honey extractor, where centrifugal force moves the honey out of the cells. This type is most readily available and used.

CHUNK HONEY: Consist of a chunk of honey filled in a jar with liquid honey.

CREAMED HONEY (GRANULATED): Is extracted honey whipped into a semisolid state similar to the consistency of butter. It is very easy to spread on toast or rolls.

PROPERTIES OF HONEY:

1) ANTIBACTERIAL PROPERTY:

The antibacterial property of honey was first recognized in 1892 by van Ketel. The MIC (minimum inhibitory concentration) of the honey was found to range from 1.8% to 10.8% (v/v), indicating that the honeys had sufficient antibacterial potency to stop bacterial growth if diluted at least nine times. Important factors which influence the antibacterial effectiveness of honey are as follows:

- 1. Its Hygroscopic Properties:** This effect is based on high osmotic properties so it can extract water from bacterial cells and cause them to die. Honey, like other saturated sugar syrups and sugar pastes, has an osmolarity sufficient to inhibit microbial growth. However, it has been shown that wounds infected with *Staphylococcus aureus* are quickly rendered sterile by honey.
- 2. Its Acidic Ph:** Honey is characteristically quite acidic, its pH being between 3.2 and 4.5, which is low enough to be inhibitory to many animal pathogens. The optimum pH for growth of these species normally falls between 7.2 and 7.4.
- 3. Hydrogen Peroxide:** The major antibacterial activity in honey has been found to be due to hydrogen peroxide produced enzymatically in the honey.
- 4. Phytochemical Factors:** It has enzymes and tissue nutrition minerals and vitamins that help repair tissue directly. Several chemicals with antibacterial activity have been identified in honey by various researchers: pinocembrin, terpenes, benzyl alcohol, 3,5-dimethoxy-4-hydroxybenzoic acid (syringic acid), methyl 3,5-dimethoxy-4-hydroxybenzoate (methyl syringate), 3,4,5-trimethoxybenzoic acid, 2-hydroxy-3- phenylpropionic acid, 2-hydroxybenzoic acid and 1,4-dihydroxybenzene.
- 5. Increased Lymphocyte And Phagocytic Activity:** Recent research shows that the proliferation of peripheral blood B-lymphocytes and T-lymphocytes in cell culture is stimulated by honey at concentrations

as low as 0.1%; and phagocytes are activated by honey at concentrations as low as 0.1%.

CLINICAL SIGNIFICANCE IN DENTISTRY:

- 1) **ORAL INFECTIONS:** There has been one report published of honey being used in oral surgery, describing a small clinical trial of placing of honey in the socket before closure of the wound after surgical removal of impacted third molars. This study showed less pain, less incidence of postoperative complications and less swelling in the honey- treated group than in the untreated group.
2. **MOUTH ULCERS:** A similar rapid alleviation of pain was observed when the gelled honey was used in a case of erosion of the gum and jaw bone due to infection following surgery with bone grafting to repair damage to the jaw from traumatic injury that had been non-responsive to any conventional treatment for more than six months. The optimal technology of spray is prepared, and concentration of ethanol as extragent 70% and 15% of honey is determined; and the preparation is called propomel.
3. **PERIODONTAL DISEASES:** Honey having an anti- inflammatory activity raises the possibility of it being useful as a therapeutic agent for periodontitis; the anti- inflammatory activity would block the direct cause of the erosion of the connective tissues and bone. Furthermore, its activating effects on leukocytes could be beneficial, as some periodontitis is due to immune cell hypo-function allowing pathogens to grow unchecked and cause direct tissue damage.

It has also been proposed that antioxidants be used to protect the periodontal tissues from the damaging free radicals formed in the inflammatory response. Honey contains a substantial level of antioxidants (Frankel, Robinson, and Berenbaum 1998), and has an anti-inflammatory action that has been clearly demonstrated to be direct and not secondary to the clearance of infection (Molan 2001a).

Recent studies by Gribel and Pashinskii indicated that honey possessed moderate antitumor and pronounced anti-metastatic effects in five different strains of rat and mouse tumors. Furthermore, honey potentiated the antitumor activity of chemotherapeutic drugs such as 5-fluorouracil and cyclophosphamide.
4. **STOMATITIS FOLLOWING RADIOTHERAPY:** The anti-inflammatory action and stimulating effect on tissue repair of honey could possibly be of benefit for the relief of oral conditions resulting from radiotherapy and chemotherapy of cancer. Publications on the use of

honey on thermal burns to the skin report that honey reduces inflammation.

5. **ANTI-HALITOSIS:** Candy made with honey may also be useful for prevention of halitosis, as honey has been observed to give rapid removal of malodour from infected wounds. It would not be just the antibacterial action of honey involved, as bacteria would use the glucose in honey in preference to amino acids, and thus would produce lactic acid instead of bad-smelling amines and sulphur compounds.
6. **ANTICARIOGENIC:** It was found that the minimum inhibitory concentrations of honey for *Strept mitis*, *Strept sobrinus* and *Lactobacillus caseii* were 7%, 7.5–8.5% and 8–12% respectively. The production of acid by these bacteria was also inhibited.

CHALLENGES AHEAD OF HONEY THERAPY:

Although many researches have reported the benefits of honey, some disadvantages have also been found. Honey is frequently (typically) contaminated by yeasts (*Saccharomyces*, *Schizosaccharomyces* and *Torula* strains), by fungi (*Penicillium* and *Mucor* strains). Upon dilution of the honey to a less hyperosmotic condition typically > 19% water (v/v), such as occurs either after oral ingestion or topical application, these microbial contaminants can serve as opportunistic pathogens in susceptible people.

CONCLUSION:

The curative properties of honey bees and their products have been seen with an eye of speculation since ancient times. It is well established that honey inhibits a broad spectrum of bacterial species.

5 TURMERIC

Dr Shivakumar KM, Dr Kulkarni Shriram G

INTRODUCTION:

Turmeric is an ancient spice derived from the rhizome of *Curcuma longa*, a perennial plant belonging to the Zingiberaceae (ginger) family which has short stem with large oblong leaves, and bears ovate, pyriform or oblong rhizomes, which are often branched and brownish yellow in colour. It is popularly called *halidi* in India and named as *curry spice* by British. The Latin name is derived from the Persian word, *kirkum*, which means saffron, in reference to the rhizomes' vibrant yellow-orange color.



FIGURE: 4 TURMERIC

Use of turmeric dates back nearly 4000 years to the Vedic culture in India. It is extremely used in Ayurveda, Unani and Siddha medicine as home remedy for various diseases (conditions) including biliary disorders, anorexia, cough, diabetic wounds, hepatic disorders, rheumatism and sinusitis. As part of the ancient Indian medical system, Ayurveda, a poultice of turmeric paste is used to treat common eye infections, and to dress wound, treat bites, burns, acne and various skin diseases. Research has revealed that curcumin has surprisingly wide range of beneficial properties, including anti-inflammatory, antioxidant, chemopreventive and chemotherapeutic activity.

ANATOMY: Turmeric is a perennial plant with orange, oblong tubers 2 or 3 inches in length and one inch in diameter, pointed or tapering at one end. When dried, it is made into a yellow powder with a bitter, slightly acrid, yet sweet taste. It is similar to ginger.

Its plant is 3 feet in height and has lance-shaped leaves and spikes of yellow flowers that grow in a fleshy rhizome or in underground stem. An orange pulp contained inside the rhizome constitutes the source of turmeric medicinal powder.

COMPOSITION:

Chemical composition of turmeric includes protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrate (69.4%) and moisture (23.1%). The essential oil (5-8%) obtained by steam distillation of rhizomes has α -phellenderane (1%), saebeeine (0.6%), Cineol (1%), borneol (0.5%), zingiberene (25%) and sesquiterpenes (53%)

Components of turmeric are named curcuminoids, which include mainly curcumin (diferuloyl methane), demethoxycurcumin, and bisdemethoxycurcumin. The active constituents of turmeric are the flavonoid curcumin (diferuloylmethane) and various volatile oils including tumerone, atlantone, and zingiberone. Other constituents include sugars, proteins, and resins. The best-researched active constituent is curcumin, which comprises 0.3-5.4% of raw turmeric. Curcumin has been used extensively in ayurvedic medicine for centuries, as it is nontoxic and has a variety of therapeutic properties including antioxidant, analgesic, anti-inflammatory, antiseptic activity, and anticarcinogenic activity.

THERAPEUTIC APPLICATION OF TURMERIC IN DENTISTRY:

- 1) RELIEF FROM DENTAL PROBLEMS:** Following ways of improving relief from dental problems by using turmeric have been reported in literature
- Rinsing the mouth with turmeric water (boil 5 g of turmeric powder, two cloves, and two dried leaves of guava in 200 g water) gives instant relief.
 - Massaging the aching teeth with roasted, ground turmeric eliminates pain and swelling.
 - Applying a paste made from 1 tsp of turmeric with $\frac{1}{2}$ tsp of salt and $\frac{1}{2}$ tsp of mustard oil provides relief from gingivitis and periodontitis. Rub the teeth and gums with this paste twice daily.

- 2) **PIT AND FISSURE SEALANT:** It has been found that tinted pit and fissure sealant is useful for applying to tooth surfaces for the prevention or reduction of dental caries. This sealant can be produced from a composition comprising a polymerizable resin system containing acrylic monomer and at least one colorant selected from the group consisting of Annatto extract, turmeric extract, and β -Carotene.
- 3) **CURCUMIN AS A TREATMENT MODALITY IN RECURRENT APHTHOUS STOMATITIS:** Recurrent Aphthous Stomatitis (RAS) is an inflammatory condition of unknown etiology affecting the oral mucosa. Approximately 20% of the population suffer from RAS sometime in their lives. Reports have shown that in patients who used conventional antiseptic gel, the lesion healed only after the period of time as in previous attacks. The 10 patients who used curcumin oil reported that ulcers started healing earlier than in previous attacks; there was also early reduction in pain. A follow up for one year has shown no recurrence in these patients
- 4) **ROLE OF CURCUMIN AS A SUBGINGIVAL IRRIGANT:** Curcumin 1% as subgingival irrigant resulted in significant reduction in bleeding on probing and redness, when compared with chlorhexidine and saline group as an adjunctive therapy in periodontitis patients. Curcumin, by virtue of its anti-inflammatory property, reduces inflammatory mediators and causes shrinkage by reducing inflammatory oedema and vascular engorgement of connective tissues.
- 5) **LOCAL DRUG DELIVERY SYSTEM:** In a study conducted by Behal et al., 30 subjects with chronic localized or generalized periodontitis with pocket depth of 5-7 mm were enrolled in a split-mouth study design. Control sites received Scaling and Root Planing [SRP] alone, while experimental sites received SRP plus 2% whole turmeric gel. Both groups demonstrated statistically significant reduction in plaque index, gingival index, sulcus bleeding index, probing pocket depth, and gain in relative attachment loss. There was a significant reduction in the trypsin-like enzyme activity of "red complex" microorganisms. Greater reduction was observed in all parameters in the experimental group in comparison to those in the control group. Thus, the local drug delivery system containing 2% whole turmeric gel can be used as an adjunct to scaling and root planning.
- 6) **ORAL LICHEN PLANUS:** Oral lichen planus presents a white plaques, erythema, erosions or blisters affecting predominantly buccal mucosa, tongue and gingivae, although other sites are occasionally

involved. According to Chainani-wu et. al, curcuminoids at doses of 6000mg/dl in 3 divided doses were well tolerated and may prove efficacious in controlling signs and symptoms of oral lichen planus.

- 7) ORAL SUBMUCOUS FIBROSIS:** Oral submucous fibrosis (OSMF) is a premalignant condition mainly associated with the practice of chewing betel quid containing areca nut prevalent in South Asian population.

As a chemopreventive agent curcumin has been demonstrated to exert its effect through anti-inflammatory and antioxidant properties. Also, scavenging effect of curcumin on superoxide radicals, hydroxyl radicals and lipid peroxidation has been demonstrated. Furthermore, curcumin has been found to have fibrolytic action which could be attributed to inhibition of lipid peroxidation, checking cellular proliferation and inhibition of collagen synthesis.

Hastak et. al⁸⁰ studied the effect of turmeric oil (600 mg), alcoholic extracts of turmeric (3g), and turmeric oleoresin (600mg) on cytogenetic damage in patients suffering from oral submucous fibrosis after daily intake for 3 months. They concluded that turmeric oil and turmeric oleoresin both act synergistically in vivo to offer protection against DNA damage. Thus curcumin holds a promising future in the treatment of oral submucous fibrosis.

8) ANTIOXIDANT PROPERTY:

Antioxidants are the first line of defense against free radical damage and are critical for maintaining optimum health and well being.

San Miguel et. al⁸¹ investigated specific polyphenols and turmeric derivative antioxidants in combination that counteracted the effects of stressors such as hydrogen peroxide, ethanol and nicotine on cultured oral fibroblast proliferation and reactive oxygen species production. They found that turmeric derivative antioxidant combinations protected the oral fibroblast from the detrimental effects of hydrogen peroxide, nicotine and ethanol by decreasing total oxygen species and increasing cell viability and DNA synthesis.

- 9) ANTI CARIOGENIC PROPERTIES:** Lee et. al evaluated the inhibitory effects of an essential oil isolated from *Curcuma longa* on the cariogenic properties of *Streptococcus mutans* (*S. mutans*), which is an important

bacterium in dental plaque and dental caries formation. The results demonstrated that *C. longa* essential oil inhibited the growth and acid production of *S. mutans* at concentration from 0.5 to 4 mg/ml. It was thus suggested that curcuma longa may inhibit the cariogenic properties of *S. mutans*.

10) ANTICANCER PROPERTIES: Curcumin has been found to possess anticancer activities because of its effect on a variety of biological pathways involved in mutagenesis, oncogene expression, cell cycle regulation, apoptosis, tumorigenesis, and metastasis. It potentiates the effect of chemotherapy and acts as an enhancer of radiotherapy. Also, it is found to arrest carcinomatous cells in the G2/M phase of cell cycle, in which cells are more susceptible to cytotoxic effects of radiotherapy.

Kim et. al demonstrated that curcumin has anticancer activity against oral squamous cell carcinoma. Induction of autophagy, marked by autophagic vacuole formation, was detected by acridine orange staining and monodansylcadaverine (MDC) dye after exposure to curcumin. Based on these findings it was suggested that curcumin may potentially contribute to oral cancer treatment.

11) SURGICAL WOUND HEALING: Habibollah et al. performed a study to compare the effects of curcuma longa-ghee formulation and hyaluronic acid on gingival wound healing following surgery in beagle dogs. The results suggested a positive potential therapeutic effect on surgical wound healing, particularly improvement of periodontal treatment consequences after surgery.

SAFETY ASPECTS: Turmeric is cost effective, known to offer health benefits has been considered to be pharmacologically safe. Although human consumption of curcumin as a dietary spice ranges upto 100mg/day, it has been indicated that human can tolerate a dose of curcumin upto 12g/day without any toxic side effects.

POTENTIAL FOR ADVERSE INTERACTIONS: NSAIDs additively interact with turmeric in certain aspects of their pharmacology, and concomitant therapy with these substances may lead to clotting disorders and enhanced risk of bleeding.

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ADVERSE EFFECTS: Generally considered safe, but may cause gastric irritation, stomach upset, nausea, diarrhoea, allergic skin reaction, and antithrombosis activity interfering with blood-clot formation.

FUTURE CHALLENGES: One of the major concerns with developing curcumin for clinical efficacy is its low oral bioavailability that can be attributed to its poor absorption, high rate of metabolism in the intestines, and rapid elimination.

CONCLUSION:

Turmeric is considered a safe, nontoxic, and effective alternative for many conventional drugs due to its distinguished therapeutic properties and multiple effects on various systems of the body. As the number of research studies on therapeutic effects of curcumin keeps on increasing across the globe, it appears that turmeric (*curcuma longa*) truly holds a promising future in therapeutic applications including dentistry.

6

GREEN TEA

Dr Ankita Gupta



FIGURE: 5 GREEN TEA

INTRODUCTION: Green tea is a leading beverage in the far-east for thousands of years. It is one of the most popular beverages consumed worldwide.

Drinking green tea, a suggestive of health beverage, is common for more than 2000 years. Over the time, green tea popularity dropped as compared with black tea. Now days, 80% of the global consumption of tea is black tea; moreover, it is the most popular beverage in Europe and North America. In the last couple of years there is growing interest in green tea in the western world due to scientific findings that show the health potentials of the beverage. Green tea, *Camellia Sinensis* from the family of *Thea Cease* is mostly cultivated in coasts of Caspian sea in North of Iran.

TYPES: Tea prepared from *Camellia sinensis* is of three types: nonfermented green tea that is panfried or steamed and dried to inactivate its enzymes, fermented black tea and semifermented oolong tea. Green tea with active chemical ingredients possesses diverse pharmacological properties which are linked to lower incidence of some pathological conditions including oral cancer, dental caries, stroke, cardiovascular diseases and obesity.

COMPOSITION: Green tea has a unique composition, which includes proteins (15-20% of dry weight), maximum part of it are enzymes.

Carbohydrates (5-7% of dry weight) such as: cellulose, pectin, glucose, fructose and sucrose and lipid components: linoleic and linolenic acids and sterols such as stigmasterol. Besides macronutrients, green tea also includes vitamins (B, C, E), Xanthic bases such as caffeine (27mg/240ml tea infusion) and theophylline; pigments such as chlorophyll and carotenoids; volatile components such as aldehydes and alcohols, minerals and trace elements such as Ca, Mg, Cr, Mn, Fe, Cu, Zn, Mo, Se, Na, P, Co, Sr, Ni, K, F, and Al.

The main polyphenols in green tea are catechins (flavan-3-ols). The four main catechins are: epigallocatechins 3 gallate (EGCG) that constitutes about 59% of total catechins, epigallocatechin (EGC) about 19%, epicatechin 3 gallate (ECG) about 13.6% and epicatechin (EC) about 6.4%.

Similarly to fruits and vegetables, green tea also constitutes an important source of antioxidants. Polyphenols have additional mechanisms in which they reduce oxidation level besides direct role as antioxidants. The polyphenol contents of green tea have been reported to inhibit varieties of pathogenic bacterial growth such as Helico-bacter pylori, methicillin resistant S. aureus, S. mutans, Streptococcus sobrinus and V. cholera. Green tea polyphenols were also found effective against human immunodeficiency virus, hepatitis, and influenza viruses.

GREEN TEA AND ORAL HEALTH:

1) EFFECT ON DENTAL CARIES: Oral pathologies such as dental caries, periodontal diseases and tooth loss can greatly influence human health. Amongst those, dental caries is caused as a result of infectious diseases caused by numerous reasons related to nutrition and bacterial infections. There are reports that tea consumption may decrease dental caries in humans and laboratory animals.

Magalhaes et al. found that mouth rinsing with green tea extract (0.61%) protected from erosion and abrasion of the tooth dentine similarly to mouth rinsing with fluoride extract (250ppm) or chlorhexidine extract (0.06% as found in oral hygiene products).

Zhang et al. showed that tea extract reduced α -amylase activity in human saliva. Therefore, tea consumption is likely to be an anti-cariogenic agent which lessens the cariogenic potential of starch containing foods like crackers and cakes. It might lead to less maltose release that causes mineral depletion from tooth enamel.

- 2) ANTIVIRAL PROPERTIES OF TEA:** Green tea is known for its antiviral properties which are based on the polyphenols ability to act as antioxidants and prevent binding and penetration of virus to cells. Furthermore, there is evidence indicating that green tea is able to interfere the mechanism of Human immunodeficiency virus type 1 (HIV-1), Herpes simplex virus (HSV-1), Epstein Barr virus, adenoviruses and more.
- 3) ABOLITION OF HALITOSIS:** Halitosis is one of the disturbing problems that is caused as a consequence of dental caries. Lodhia et al. found that green tea powder succeeded to abate the creation of those sulphur compounds and consequently halitosis for an hour. Zeng et al. demonstrated that green tea extract (especially under basic conditions) was able to remove the odorant sulphurs.
- 4) PROTECTION FROM ORAL OXIDATIVE STRESS AND CIGARETTE SMOKE INDUCED INFLAMMATION:** Green tea catechins are known for their antioxidant properties. Maruyama et al. have shown green tea catechins' effect in reduction of gingival oxidative stress. Green tea and its catechins have the ability to scavenge NO. Nicotine is the major compounds of cigarettes and known as the cause of gingivitis and periodontitis.
- 5) ORAL MALIGNANCY PREVENTION AND REGRESSION:** Many of the studies reported that green tea extracts or EGCG protected against chemical carcinogens in several organs such as intestine, lung, liver, prostate, breast and mouth.

ADVERSE EFFECTS: Green tea is safe for most of the people when used in moderate quantities. The most adverse effects of green tea administered orally are gastrointestinal upset and central nervous system stimulation from the caffeine content of the tea. There are several case reports of hepatotoxicity linked to GTE products in pill or beverage form, however, the mechanism of this symptom is not known. Allergic reactions have been reported with topical green tea ointment, which may cause cervical and vaginal inflammation, irritation and vulvar burning.

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CONCLUSION: In this, we have presented various studies supporting green tea's role in maintaining oral health, yet there are no conclusive benefits to human, as only one large scale epidemiological study was performed. Surely, more epidemiological studies are required.

7 MISWAK

Dr Smitha B Kulkarni, Dr Ankita Gupta

INTRODUCTION:

Good oral health has a major influence on one's general quality of life and well-being. The maintenance of oral health can be achieved mainly by mechanical and chemical means. The use of a toothbrush in combination with dentrifices is the most common method of cleaning teeth. The traditional toothbrush or chewing stick called "Miswak" has had been used widely by different civilizations for centuries. It was initially used by Babylonians around 7000 years ago followed by Greek and Roman empires. Chewing sticks were also used by Jewish, Egyptian as well as by old Japanese-communities. Chewing sticks are known by different names in different cultures: "arak" or "miswak" in Arabic, "koyoji" in Japanese, "qesam" in Hebrew, "qisa" in Aramaic, and "mastic" in Latin.

Chewing sticks may play a role in the promotion of oral hygiene, and further evaluation of their effectiveness is warranted, as stated in the 2000 World Health Organization (WHO) Consensus Report on Oral Hygiene.

There are around 173 different types of trees, which can be used as chewing sticks, belonging to the families Acacia, Fabaceae, Terminalia, Combretaceae, Lasianthera, Icacinaceae, Gouania, and Rhamnaceae. The most popular chewing stick or fibrous rolled sponges include *Salvadora persica*.



FIGURE: 06 MISWAK STICK FOR CLEANING OF TEETH

SALVADORA PERSICA:

A widely used Miswak stick, so called *S. persica* or Arak tree is often known by the name of tooth brushing tree in European countries or tooth pick tree in Middle East. It belongs to the species of *Salvadora* from the family of *Salvadoraceae*.

It is a small upright shrub, which is 3 m in height and 30 cm in diameter. It has white branches, aromatic roots, as well as warm and pungent taste. Its fruits are small size and round shape. The roots, twigs, and stems of this plant have been used for oral hygiene and small *S. persica* sticks have been used as toothpicks.

The stick is held by one hand in a pen-like grip and the brush-end is used with an up-and-down or rolling motion. When the brushy edge is shred after being frequently used, the stick gets ineffective and it is then cut and further chewed to form a fresh edge. In this way, it can be used for few more weeks.

CHEMICAL COMPOSITION:

Chemical analysis of *S. persica* “miswak” has demonstrated the presence of b-sitosterol and m-anisic acid; chlorides, salvadourea and gypsum; organic compounds, such as pyrrolidine, pyrrole, and piperidine derivatives, glycosides, such as salvadoside and salvadoraside. The roots and bark of the *S. persica* tree are composed of 27% ash; a high ratio of alkaloids, such as salvadorine and trimethylamine; chlorides and fluorides; moderate concentrations of silica, sulfur, and vitamin C; and small quantities of tannins, saponins, flavonoids, and sterols.

S. persica miswak contains nearly 1.0 lg/g of total fluoride and was found to release significant amounts of calcium and phosphorus into water. Repeated chewing of *S. persica* miswak was found to release fresh sap, which may have an anticariogenic effect.

Other components of *S. persica* also have beneficial effects on oral health. Silica acts as an abrasive and was found to help in removing stains from tooth surfaces. The astringent effect of tannins may help to reduce clinically detectable gingivitis. Salvadorine, an alkaloid present in *S. persica* miswak, may exert a bactericidal effect and stimulate the gingiva.

INFLUENCE OF MISWAK ON ORAL HEALTH:

- 1) **ANTIMICROBIAL EFFECTS:** An in vitro study showed that the aqueous extract of *S. persica* miswak had an inhibitory effect on the growth of *Candida albicans* that may be attributed to its high sulfate content. Allafi and Ababneh (1995) investigated the derivatives of *S. persica* miswak using three different laboratory methods, and demonstrated strong antimicrobial effects on the growth of *Streptococcus* sp. and *Staphylococcus aureus*.
- 2) **ANTICARIOGENIC EFFECTS:** Many epidemiological studies revealed that *S. persica* miswak had strong anti-decay effects. In a dental health survey conducted in Sudan, Emslie (1966) reported a lower caries prevalence among miswak users than among toothbrush users. The pungent taste and chewing effects of miswak may increase saliva secretion in the mouth, thereby increasing its buffering capacity.
- 3) **EFFECTS ON DENTAL PLAQUE, GINGIVAL HEALTH AND PERIODONTAL STATUS:** Many reports have revealed that *S. persica* miswak effectively reduced gingivitis and dental plaque. Moustafa et al. (1987) reported 75% plaque reduction after the use of *S. persica* miswak for 8 days. A study conducted among two groups of students in Kenya reported that no additional method was required to remove dental plaque in the group that used toothpaste in combination with chewing sticks.
The combined effect of mechanical cleansing and enhanced salivation achieved with the proper use of *S. persica* miswak was found to be more efficient than toothbrushes in removing dental plaque.
- 4) **ORAL HYGIENE:** The value of *S. persica* miswak is due primarily to its mechanical cleaning action. Gazi et al. (1990) reported significantly lower plaque scores following the proper use of miswak as an oral hygiene aid in comparison with the use of conventional toothbrushes.

DISADVANTAGES OF CHEWING STICKS: Although *S. persica* miswak is considered to be an essential aid in maintaining oral hygiene, certain disadvantages are associated with its use. Its bristles lie in the long axis of the stick, whereas those of a toothbrush are placed perpendicular to the handle. Thus, it is difficult to reach the lingual surfaces of the dentition with a miswak. Another disadvantage is related to the habitual use of miswak for a prolonged period. Khoory (1983) reported that chewing-stick users may excessively scrub the anterior teeth, which are located in the

area of primary concern, while ignoring the posterior teeth. Other studies have considered the use of miswak to be one of the possible etiological factors in gingival recession.

CONCLUSION:

The use of *S. persica* miswak as an oral hygiene aid is effective. Descriptive and experimental studies have provided considerable evidence that the *S. persica* plant and its extracts exert beneficial effects on the oral tissues and help to maintain good oral hygiene. The use of *S. persica* miswak alone or in combination with conventional toothbrushes, when performed judiciously, will result in superior oral health and hygiene. The World Health Organization has recommended and encouraged the use of these sticks as an effective and alternative tool for oral hygiene. This recommendation is also consistent with the principles of the Primary Health Care Approach that focus on prevention, community participation, and the use of appropriate technology. Thus, *S. persica* miswak may be recommended for regular use, given its favorable effects on oral health, low cost, ready availability, and simplicity of use.

8 LICORICE

Dr Kulkarni Shriram G

Licorice, the name given to the roots and stolons of *Glycyrrhiza* species, has been used since ancient times as a traditional herbal remedy. The genus name *Glycyrrhiza* is derived from the ancient Greek words *glycos* (meaning sweet) and *rhiza* (meaning root). It has been traditionally known and used as medicine in Ayurveda for rejuvenation. It is called '*mulethi*' in Hindi. *Glycyrrhiza glabra* L. and *Glycyrrhiza uralensis* Fisch. (Fam. Leguminosae) roots are the commonest sources of licorice used in cosmetics, foods, tobacco, and in both traditional and herbal medicine.



FIGURE: 07 LICORICE

In India, it is used as a tonic, diuretic, demulcent, expectorant, emenagogue laxative and laxative. It is also used: (1) For allaying coughs and catarrhal infections, (2) in irritable conditions of mucous membrane of urinary organs. More specifically, the pharmacological activities of licorice and their effects in the treatment for different human diseases such as cancer, atherosclerosis, gastric ulcers, hepatitis, bacterial infections, and immunodeficiency. The Food and Drug Administration (FDA) also lists liquorice as GRAS (generally regarded as safe) when used as food flavouring and sweetening agent.

HISTORY:

A papyrus dating back from the time of Roman Empire and Assyrian tablets describes the therapeutic value of liquorice, and the root has also been mentioned in the first Chinese herbal, Hippocrates, Theophrastus, and Pliny all referred to liquorice. Theophrastus (372-287 BC) wrote “Liquorice has the property of quenching the thirst if held in the mouth. The root contains a special sweetness which is safe for diabetics” The roots became popular chewing sticks in Italy, Spain, West Indies, and other places where the plant grows. The Greeks learned about the sweet roots from the Scythians. Later, it became Glycyrrhiza (glyks meaning “sweet” and rhiza means “root”). It was widely cultivated in Italy in fifteenth century, and also found its way into northern Europe. The Dominican Black Friars introduced licorice into England, where lycorys extract was later sold as lozenges called “pomfrey cakes”.

BOTANICAL CLASSIFICATION:

Kingdom: Plantae

Order: Fabales

Family: Fabaceae

Subfamily: Faboideae

Tribe: Galegeae

Genus: Glycyrrhiza

Species: *G. glabra*

DESCRIPTION OF THE PLANT, PHYTOCHEMICAL COMPOSITION:

While the genus *Glycyrrhiza* includes about 30 species (Nomura et al, 2002), the classic main botanical sources of *Radix Glycyrrhizae*, or licorice root, are *G. glabra* L. and *G. uralensis* Fisch. (Shen et al, 2007). *Glycyrrhiza glabra* is native to Mediterranean countries and certain regions of Asia.

It is herbaceous perennial, growing to 1 m in height, with pinnate leaves about 7–15 cm (3–6 in) long, with 9–17 leaflets. The flowers are 0.8–1.2 cm (1/3 to 1/2 in) long, purple to pale whitish blue, produced in a loose inflorescence. The fruit is an oblong pod, 2–3 cm (1 inch) long, containing several seeds. The roots are stoloniferous. The licorice shrub has an extensive root system composed of a taproot and numerous stolons. The taproot, which has been harvested for medicinal uses as far back as 6000 years, is soft and fibrous and has a bright yellow interior. The stolons, which can reach 8 m in length, together with the taproot are the source of commercial licorice.

Seven constituents, with antioxidant capacity were isolated from *Glycyrrhiza glabra*. The isolated compounds were identified as the isoflavans Hispaglabridin A (1), Hispaglabridin B (4), Glabridin (3), and 4'-O-Methylglabridin (2), the two chalcones, isoprenylchalcone derivative (5) and Isoliquiritigenin (6), and the isoflavone, Formononetin (7). Among these compounds, Glabridin constituted the major amount in the crude extract (11.6%, w/w) as detected by high-performance liquid chromatography (HPLC) analysis. So, this suggest that constituents 1-6 are very potent antioxidants toward LDL oxidation with Glabridin being the most abundant and potent antioxidant.

TABLE: 4 MAJOR CLASSES OF PHYTOCHEMICALS FOUND IN LICORICE ROOT (RADIX GLYCYRRHIZAE) AND THEIR POTENTIAL BENEFICIAL EFFECTS IN ORAL DISEASES

CLASS	EXAMPLE	POTENTIAL BENEFICIAL EFFECTS
Aurones	Licoagroaurone	None reported
Benzofurans	Licocoumarone	None reported
Chalcones	Isoliquiritigenin	None reported
Coumarins	Glycyrol	None reported
Flavonoids	Glabrol	None reported
	Liquiritigenin	Candidiasis(Lee et al, 2009)
	Glabridin	Candidiasis (Fatima et al, 2009) Messier and Grenier, 2011), periodontal disease (Choi, 2005)
Isoflavonoids	Licoricidin	Periodontal disease (La et al, 2011)
	Licorisoflavan A	Periodontal disease (La et al, 2011)
	Glycyrrhizol A	Dental caries (He et al, 2006; Hu et al, 2011)
Pterocarpenes	Glycyrrhizic acid	Dental caries (Edgar, 1978)
	18b-Glycyrrhetic acid	Candidiasis (Pellati et al, 2009), periodontal disease (Sasaki et al, 2010)
Stilbenes	Gancaonin G	Dental caries (He et al, 2006)

ACTIVE INGREDIENT: The active chemical ingredients imparting the unique liquorice taste are glycyrrhizin acid and its glucoside, glycyrrhizin (C₄₂H₆₂O₁₆). These molecules are regarded as nearly synonymous, are powerful organoleptic flavorants, and impart characteristic liquorice taste and aroma to mixtures in small concentrations.

PROPERTIES, PHYSIOLOGY AND PHARMACOLOGY: Glycyrrhizin is 50 times sweeter than sucrose. It retains, when sapid, a singular liquorice flavour. The liquorice sweetness has a slower onset than sugar and lingers. Unlike artificial sweeteners like aspartame, saccharine, and cyclamates, it contains no sulfur molecule and retains its sweetness when heated. Consequently, antibiotics affecting gut flora, adversely affects absorption of liquorice. Liquorice boosts cellular formation of endogenous interferon, and has a positive long-term healing effect on Hepatitis-C-infected patients.

USE OF LICORICE IN DENTISTRY:

DENTAL CARIES AND LICORICE: Over the past 30 years, dental caries has declined in high socioeconomic populations but has increased in low income and fragile elderly populations. Although mutans streptococci (*Streptococcus mutans* and *Streptococcus sobrinus*) are the primary etiologic agents of dental caries, *Lactobacillus* spp., and *Actinomyces* spp. are also known to contribute to tooth decay (Takahashi and Nyvad, 2008, 2011). While the anti-cariogenic properties of licorice have been suggested for over 30 years, few studies on this aspect have been published.

PERIODONTAL DISEASES AND LICORICE: Licorice can first act on periodonto-pathogens that represent the first etiological factor of the disease.

Bodet et al (2008) showed that human macrophages pretreated with a licorice extract prior to being stimulated with *A. actinomycetemcomitans* or *P. gingivalis* lipopolysaccharide (LPS) secrete significantly less proinflammatory cytokines (IL-1b, IL-6, IL-8, and TNF-a), indicating that the extract has an anti-inflammatory property. Licoricidin and licorisoflavan A, two major isoflavonoids isolated from the licorice extract, have been shown to be responsible for the anti-inflammatory effect (La et al, 2011).

Choi (2005) reported that glabridin has a direct stimulatory effect on bone formation by enhancing the proliferation of osteoblasts (bone-forming cells) as well as their ability to synthesize collagen.

ORAL CANDIDIASIS AND LICORICE: Oral candidiasis is an opportunistic infection of the oral cavity caused by an overgrowth of *Candida* species, the most common being *Candida albicans*.

Few studies have investigated the effect of licorice on *C. albicans*. Motsei et al (2003) reported the antifungal effect of organic solvent extracts of *G. glabra* on *C. albicans*. In a recent study, Messier and Grenier (2011) investigated the effects of two licorice polyphenolic compounds (licochalcone A and glabridin) on the growth, killing, biofilm formation, and adherence of *C. albicans*.

RECURRENT APHTHOUS ULCERS AND LICORICE: Recurrent aphthous ulcers are among the most common oral mucosal disease encountered in children and adults. Three types of recurrent aphthous ulcers have been described: minor (the most common), major, and herpetiform. In a very preliminary study involving 20 subjects, Das et al (1989) reported that the use of a mouthwash containing a deglycerinized licorice extract for 2 weeks tends to provide pain relief and accelerate the healing of aphthous ulcers. In a more recent study, Moghadamnia et al (2009) investigated the efficacy of licorice bioadhesive hydrogel patches to promote healing and pain relief.

ADVERSE EFFECTS:

Liquorice Toxicity: Consumption of glycyrrhizin is considered safe at 200mg per day, a dose accepted as recommendation to Japanese. The accepted daily intake (ADI) for glycyrrhizin at 0.2mg/kg/day is deemed safe; up to 1200mg/day liquorice flavonoid oil shows no clinical noteworthy change of hematological or related biochemical parameters. In the United States of America, glycyrrhizin is classified “as generally recognised as safe” as a flavouring agent, although not as a sweetener. Commercially liquorice flavoured sweets rarely have any serious medicinal side effects, especially if consumed irregularly, in moderate amounts, of less than 25g of liquorice per day.

CONCLUSION:

Studies have suggested the potential of licorice and its bioactive constituents for the management of oral diseases, more particularly periodontal diseases. Considering the possible adverse effects, especially hypertension, of a prolonged intake of high doses of licorice, a localized application of these bioactive substances may be more appropriate.

9 TRIPHALA

Dr Kulkarni Shriram G, Dr Shivakumar KM

INTRODUCTION:

Ayurveda is considered as the “science of life,” because the ancient Indian system of health care focused views of man and his illness. Conventional drugs usually provide effective antibiotic therapy for bacterial infections, but there is an increasing problem of antibiotic resistance and a continuing need for new solutions. Hence, now a days, herbal drugs are preferred to synthetic antibiotics. 'Triphala' is a well-known powdered preparation in the Indian system of medicine (ISM). Triphala has been extensively used in Ayurveda because of its various properties and therapeutic uses. Triphala, meaning "three fruits, an herb originating in India, has been found to act as a complete body cleanser.



FIGURE: 08 TRIPHALA- COMBINATION OF AMALAKI, BIBHITAKI AND HARITAKI



FIGURE: 09 TRIPHALA- COMBINATION OF AMALAKI, BIBHITAKI AND HARITAKI

Triphala is a combination of three medicinal plants, Amalaki *Phyllanthus emblica* (syn. *Emblica officinalis*) Phyllanthaceae family, Haritaki (*Terminalia chebula*) Combretaceae family, and Bahera (*Terminalia bellirica*) Combretaceae family.

MAIN CHEMICAL CONSTITUENTS OF TRIPHALA BASED ON INGREDIENTS:

- 1) Tannins:** “Tannin” is a general descriptive name for a group of polymeric phenolic substances capable of tanning leather or precipitating gelatin from solution, a property known as astringency. Many human physiological activities, such as stimulation of phagocytic cells, host-mediated tumor activity, and a wide range of anti-infective actions, have been assigned to tannins.
- 2) Quinones:** Quinones are known to complex irreversibly with nucleophilic amino acids in proteins, often leading to inactivation of the protein and loss of function. Probable targets in the microbial cell are surface-exposed adhesins, cell wall polypeptides, and membrane-bound enzymes. Quinones may also render substrates unavailable to the microorganism.
- 3) Flavones, flavonoids, and flavonols:** Flavones are phenolic structures containing one carbonyl group (as opposed to the two carbonyls in quinones). Their activity is probably due to their ability to complex with extracellular and soluble proteins and to complex with bacterial cell walls. More lipophilic flavonoids may also disrupt microbial membranes. These compounds have been shown to inhibit *Vibrio cholera O1*, *Shigella*, *Streptococcus mutans in vitro*. Inhibition of isolated bacterial glucosyltransferases in *S. mutans*, and reduction of fissure caries by about 40% has also been demonstrated.
- 4) Vitamin C:** Fruit juice of *Emblica officinalis* (EO) contains the highest vitamin C (478.56 mg/100 mL) content. Vitamin C in EO accounts for approximately 45-70% of the antioxidant activity. Evidences have been reported for the relation between vitamin C and periodontal disease. Significant gum bleeding can occur in vitamin C deficiency. Vitamin C along with bioflavonoid helps to speed up the healing process.

INDIVIDUAL COMPONENTS OF TRIPHALA:

- 1) *Emblica officinalis* (Amalaki):** (Individual chemical ingredient: Vitamin C, carotene, nicotinic acid, riboflavin, and tannins). Amalaki is known by the botanical name *Emblica officinalis* and also known in Sanskrit as Dhatri (The nurse), which is a reference to its

incredible healing properties. Amalaki can be taken individually in powder form, a decoction or as a confection. Amalaki fruit is known to be one of the best rasayanas in Ayurveda, with anti-oxidant and anti-aging properties. It has its beneficial role in cancer, diabetes, liver treatment, heart trouble, ulcer, anemia, and various other diseases. Similarly, it has application as immunomodulatory, anti-pyretic, analgesic, cytoprotective, anti-tussive, and gastroprotective agent.

2) Terminalia chebula (Hiritaki or Black myrobalan): (Individual chemical ingredient: Tannins, anthraquinones, and polyphenolic compounds). *Terminalia chebula* is a plant species belonging to the genus Terminalia, family Combretaceae. The chief constituents of tannin are chebulic acid, chebulagic acid, corilagin, and gallic acid. It also exhibits anti-fungal and anti-viral properties.

3) Terminalia bellerica (Bibhitaki): (Individual chemical ingredient: Gallic acid, tannic acid, and glycosides).

Terminalia bellerica Roxb. (Combretaceae), commonly known as “belleric myrobalan” and locally as “bahera,” is a large deciduous tree, found throughout central Asia and some other parts of the world. *T. bellerica* possesses antioxidant, anti-spasmodic, bronchodilatory, hypercholesterolemic, anti-bacterial, cardioprotective, hepatoprotective, hypoglycemic, and hypotensive properties.

MARKETED FORMULATION OF TRIPHALA: Triphala tablet, Triphala choorna

Formulation of choornam: This is a dry fine powder form of the drug choornam, which can be used both internally and externally.

Preparation: The drug selected is washed cleaned and dried. It is crushed to a fine powder using a pulverizer. The fineness of the powder improves the therapeutic efficacy. In case of compound choorna, each drug should be powdered separately, and finally all individual drug powders are mixed together. The choorna should be fine of at least 80 mesh sieve.¹⁵⁰

Decoction form: This form can be used as an eyewash or mouthwash.

Preparation: After cleaning the dried fruits and removing seeds, the powder is made separately from the three dried fruits. Three powders are mixed together in equal amounts to form a uniform mixture. This mixture is added to 16 times water for an hour and then boiled till half of the water

remains. The decoction is filtered through fine cotton cloth and stored in a clean bowl or jug. Slightly warm decoction should be used for washing eyes at the earliest after its preparation.¹⁵⁰

TRIPHALA IN DENTISTRY

- 1) Anti-caries activity:** Despite several anti-plaque agents available in the market, the search for an effective agent still continues. Several undesirable side-effects associated with these agents stimulated the search for alternate agents.

Terminalia chebula is valuable in the prevention and treatment of several diseases of the mouth such as dental caries, spongy and bleeding gums, gingivitis, and stomatitis. The extract of *T. chebula* may be an effective agent in the treatment of carious teeth, owing to its ability to inhibit the growth and accumulation of *S. mutans* on the surface of the tooth. This would prevent the accumulation of acids on the surface of the tooth, and thus the further demineralization and the breakdown of the tooth enamel.

- 2) Triphala as a root canal irrigant:** Primary endodontic infections are caused by oral microorganisms, which are usually opportunistic pathogens that may invade a root canal containing necrotic tissue and establish an infectious process. Triphala has shown significant anti-bacterial activity against three and six week biofilms. The use of herbal alternatives as a root canal irrigant might prove to be advantageous considering the several undesirable characteristics of NaOCl.
- 3) Anti-collagenase activity of Triphala:** Matrix metalloproteinases play a vital role in periodontal destruction, and this knowledge lead to a new concept involving the chemotherapeutic inhibition of these enzymes. Triphala has strong inhibitory activity against PMN-type collagenase, especially MMP-9 at a 1500 µg/ml concentration, which is well within the safety profile of toxicological studies.
- 4) Anti-microbial and anti-oxidant effect of Triphala:** Anti-microbial and anti-oxidant effect of Triphala has been proven *in-vitro* as it has been shown to inhibit *Streptococcus mutans* at concentrations as low as 50µg/ml. This anti-plaque effect probably may be due to the tannic acid in Triphala, which is adsorbed well to the groups on the surface of the bacterial cells, which result in protein denaturation and ultimately to bacterial cell death. The strong antioxidant activity of Triphala may be attributed to *T. belerica*, which is the most active antioxidant followed by *E. officinalis* and *T. chebula*.

5) Triphala as a mouth rinse: According to the Sushruta Samhita, Triphala can be used as a gargling agent in dental diseases. Abraham et al. reported the strong inhibitory activity of triphala against the polymorphonuclear leukocytes-type collagenases, particularly matrix metalloproteinase-9, and confirmed the use of triphala in periodontal diseases.

Triphala mouth rinse when combined with scaling and root planing showed significant reduction in the plaque, gingival, and oral hygiene indices which was comparable to reduction obtained by chlorhexidine mouth rinse in combination with scaling and root planing.

CONCLUSION:

Triphala is a novel drug with an array of therapeutic activities gifted by Ayurveda to the world. Triphala seems to fulfill most of these requirements without any adverse effect on oral tissues and at very minimal cost as compared to commercially available products today. Hence, further research exploring various therapeutic actions of Triphala should be encouraged in dentistry.

10

NEED FOR AYURVEDA IN DENTISTRY

Dr Ankita Gupta

Ayurveda is the ancient Indian system of health-care and longevity. It involves a holistic view of man, his health and illness. Ayurvedic treatment is aimed at patient as an organic whole and treatment consists of salubrious use of drugs, diets and certain practice.

Oral diseases continue to be a major health problem world-wide. Dental caries and periodontal diseases are among the most important global oral health problems, although other conditions like oral and pharyngeal cancers and oral tissue lesions are also of significant concern. The link between oral diseases and the activities of microbial species that form part of the micro biota of the oral cavity is well-established. The global need for alternative prevention and treatment options and products for oral diseases that are safe, effective and economical comes from the rise in disease incidence (particularly in developing countries), increased resistance by pathogenic bacteria to currently used antibiotics and chemotherapeutics, opportunistic infections in immunocompromised individuals and financial considerations in developing countries. Hence, the search for alternative products continues and natural phytochemicals isolated from plants used in traditional medicine are considered as good alternatives to synthetic chemicals.

Plants and natural products from time immemorial used for their pharmacological applications viz. antiulcerogenic, wound healing, anti-inflammatory, antimicrobial, antioxidant properties etc.

Here is a list of few of these:

1. Aloe vera may find a promising role in various branches of dentistry in future. Proper diagnosis, knowledge of the traditional medicine and implementation of that knowledge to the treatment plan are important in ensuring success with this dental therapeutic agent. Further, controlled studies are also required in future to prove the effectiveness of aloe vera under various conditions. Also, the potential

long term side effects of Aloe vera need to be studied and evaluated.

2. As the global scenario is now changing towards the use of nontoxic plant products having traditional medicinal use, development of modern drugs from neem should be emphasized for the control of various diseases. Once the Neem tree extracts become the mainstay for the management of various oral diseases, it can be truly regarded as "aristha", which means "reliever of sickness" in Sanskrit.
3. The curative properties of honey bees and their products have been seen with an eye of speculation since ancient times. The ancient Greeks, Romans, Chinese and Egyptians used honey to heal wounds and to cure gut disease. In its ancient usage there was no recognition of its antibacterial properties - it was just known to be an effective remedy. Now it can be seen that the effectiveness of honey in many of its medical uses is probably due to its antibacterial activity. It is well established that honey inhibits a broad spectrum of bacterial species. The therapeutic properties of honey is evident in its usage in wound care which clearly give it potential for therapeutic use in field of dentistry, but there is need for the trials to be carried out before its usefulness is known. Risk of caries is reduced by selecting honey having a high level of antibacterial activity, but literature is sparse as far as the field of dentistry is concerned. However it looks like, 'apitherapy' as dental spa holds a promising future.
4. Turmeric is considered a safe, nontoxic, and effective alternative for many conventional drugs due to its distinguished therapeutic properties and multiple effects on various systems of the body. Its role in the treatment of cancers is very promising. However, there is scarcity of information and research in this field. Therefore, further research is required to determine the optimal dosage, bioavailability, and bio-efficacy of curcumin-based drugs.
As the number of research studies on therapeutic effects of curcumin keeps on increasing across the globe, it appears that turmeric (*curcuma longa*) truly holds a promising future in therapeutic applications including dentistry.
5. Green tea is a leading beverage in the far-east for thousands of years. It is one of the most popular beverages consumed worldwide. Moreover, during the last two decades it has received much attention in regard to its beneficial effects on various human health problems. There are various studies supporting green tea's role in maintaining oral health, yet there are no conclusive benefits to human. It is not completely clear whether green tea potency is because of its active

phenolic ingredients or other nutritional components. More research is needed in order to advocate for green tea for prevention and treatment of specific oral morbidities.

6. The use of *Salvadora persica* (miswak) as an oral hygiene aid is effective. Descriptive and experimental studies have provided considerable evidence that the *S. persica* plant and its extracts exert beneficial effects on the oral tissues and help to maintain good oral hygiene. The use of *S. persica* miswak alone or in combination with conventional toothbrushes, when performed judiciously, will result in superior oral health and hygiene. The World Health Organization has recommended and encouraged the use of these sticks as an effective and alternative tool for oral hygiene. This recommendation is also consistent with the principles of the Primary Health Care Approach that focus on prevention, community participation, and the use of appropriate technology. Thus, *S. persica* miswak may be recommended for regular use, given its favourable effects on oral health, low cost, ready availability, and simplicity of use.
7. Liquorice, or licorice, is a uniquely tasting herb derived from *Glycyrrhiza glabra*, and has been used in medicine for thousands of years. Liquorice, commonly known as “mulethi” in the Indian subcontinent, has been used extensively over the centuries for sore throat and cough. It is also used as a flavorant in a variety of edibles, medicine, and tobacco, and is often innocently consumed in vast amounts without any regard or only with vague concepts of side effects liquorice may produce. Considering antimicrobial and cariostatic efficacy of liquorice extracts, it is recommended that liquorice can be used as a preventive regimen in paediatric practice.
8. Triphala is a novel drug with an array of therapeutic activities gifted by Ayurveda to the world. It has potential to treat a variety of human ills with minimal or no side-effects. Dentistry is still in search of a drug for diseases affecting hard and soft tissues of oral cavity. Triphala seems to fulfill most of these requirements without any adverse effect on oral tissues and at very minimal cost as compared to commercially available products today.

Therapeutic approaches with ayurvedic medicine are often staggered due to lack of data on safety and efficacy and meticulous clinical trial evidence. It is recommended that more researches should be undertaken.

■ *Ayurveda In Dentistry*

The traditional knowledge of Ayurveda should be integrated with the modern dentistry. For this, the active principles of plants should be incorporated into modern oral health-care practices and dentists should be encouraged to use natural remedies in various oral health treatments. This will make dentistry much safer, affordable and more accessible for the lower socio-economic groups in society.

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