Humans have been preoccupied with the appearance of their teeth throughout the ages. "Cleanliness is next to godliness" could have been derived from Mohammed, who said that "the Siwak (chewing stick) is an implement for the cleansing of teeth and a pleasure to God". The oral cavity contains the teeth and its supporting structures, the gums (gingival), surrounded by the periodontium and alveolar bone of the jaw. We acquire our first set of teeth during the first year of life and begin to lose them, prior to replacement with the permanent set, from 6 years of age onward (Walter et al., 1977).

**Plaque and dental diseases**

The common denominator for dental abnormality is dental plaque. Dental plaque is a colourless sticky mixture of bacterial products, mucin, liquid from saliva and food stuff attached to enamel surface. The plaque is the cause of two major dental disease; dental caries and periodontal disease. The way to prevent cavities and gingival and periodontal diseases is simply to eliminate dental plaque from teeth (Kumar, 1994).

**Dental caries**

The destruction of the tooth structure is called caries. Those residing in the gingival crevice also elicit substances that can evoke inflammatory processes, and as the proportion of pathogenic/nonpathogenic species accumulate inflammation of the gums first results in gingivitis, a condition associated with sore, inflamed and bleeding gums. As the infection proceeds, more and more pathogenic species are found, eventually leading to the formation of periodontal pockets, destruction of the periodontal ligaments, and alveolar bone.
Eventually, the tooth loses its structural support and is exfoliated. Caries are infections of the tooth surfaces and are clinically distinct depending on the organisms involved and the age of the patient. Childhood is the time when the teeth are most susceptible to smooth surface caries and the incident is highest between 5 and 15 years of age and drops of dramatically thereafter as immunity develops to Streptococi that cause this type of tooth decay. Oral streptococci, particularly strains of S. mutans and S. sobrinus, usually initiate diseases occurring on the smooth surface of the lingual, buccal and interproximal regions. The bacteria thrive on carbohydrates and produce acids particularly lactic acid and proteolytic enzymes. The calcium salts of teeth are slowly dissolved in a highly acid medium, and once the salts have become absorbed, the remaining organic matrix is rapidly digested by the proteolytic enzymes and as a result cavities are formed. A deep cavity in a tooth as a result of inflammation of the pulp causes pulpitis.

Periodontal disease

The greatest loss of teeth in adults is caused by periodontal disease, which is the progressive destruction of the supporting structures of the teeth; the gingiva, periodontium and alveolar bone. It is the result of the sequential colonization in the gingival sulcus of a vast array of microorganism interdependent regarding structure, nutrition and environmental support. The term periodontal or gum disease caused due to the action of periodontal pathogens, Prevotella intermedia and Porphyromonas gingivalis that gradually destroy the soft tissue of gums. The disease begins with bleeding and inflamed gums and becomes painful, often exuding pus and other exudates as it progresses. The disease may involve in single tooth, as in localized forms of juvenile periodontitis. This disorder was also referred to as pyorrhea. As the supporting periodontal ligament and alveolar bone is destroyed, the tooth becomes more and more at risk of being lost (Suzuki, 1989).

A systematic dental care will eliminate the tooth decay and periodontal disease. Cleanliness in oral cavity will not only save the teeth from plaque but also provide a feeling of freshness. Extensive efforts have been made to search out effective antiplaque agents from a variety of chemical and biological compounds to be incorporated into dental products, thereby reducing plaque-mediated diseases (Mandel, 1988; Marsh, 1992).
However, various adverse effects such as teeth staining are commonly observed with the currently used chemicals (Schie, 1989). These drawbacks justify other research and development of alternative agents that are the safe for the host while retaining antimicrobial activity and efficacy.

Higher plants have been shown to serve as sources of number of diverse antimicrobial agents (Silver et al., 1990). Many plants are useful in pyorrhoea. *Cinnamomum verum* bark is an astringent and is thus useful for checking the bleeding of gums. The bark has essential oil and tannins. The essential oil of *C. verum* has antibacterial properties. *Acacia nilotica* bark and ash of almond kernel can be pulverized together and mixed with common salt to make a highly effective preparation to contain pyorrhoea and for strengthening of gums by making them strong. Use of clove oil is recommended for the alleviation of toothache.

All the drugs discussed in Table 1.1 have significant antibacterial activity. The potency of herbal drugs is significant and they have negligible side effects than the synthetic dental drugs. Isolation and identification of active constituents from these plants and preparation of standardized dose and dosage regimen can play a significant role in improving the...
Table 1.1: Herbal drugs used in dental care

<table>
<thead>
<tr>
<th>Herbal drug Family (Common name)</th>
<th>Method of use</th>
<th>Purpose</th>
<th>Chemical constituents</th>
<th>Biological activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia catechu</em> Willd. Caesalpiniaceae (Kattha)</td>
<td>Fresh twig is used as a toothbrush</td>
<td>To maintain health of gums and teeth</td>
<td>Catechins, catechutannic acid, tannins, flavonoids, resin, gum &amp; mucilage (Deshpande et al., 1981)</td>
<td>Antibacterial and antifungal (Dhar et al., 1968)</td>
</tr>
<tr>
<td><em>Acacia arabica</em> Willd. Caesalpiniaceae (Babul)</td>
<td>Fresh twig is used as a toothbrush</td>
<td>Protection of gums and teeth</td>
<td>Arabin and arabic acid</td>
<td>Antibacterial (Akpana and Akinrimisi, 1977) and anti-inflammatory (Buadu et al., 1973)</td>
</tr>
<tr>
<td><em>Althea officinalis</em> Linn. Malvaceae (Gulkhair)</td>
<td>Water extract of root or leaves is gargled three times a day</td>
<td>Check soreness of throat and inflammation of mouth</td>
<td>Mucilage, asparagine, betaine, lecithin, phytosterol, pectin, tannin, phosphate and fatty oil (Ninov and Ionkova, 1992)</td>
<td>Anti-inflammatory and antibacterial (Jauk et al., 2003)</td>
</tr>
<tr>
<td><em>Anacyclus pyrethrum</em> DC. Asteraceae (Akarkara)</td>
<td>About 1 g of root powder is made into a decoction which is gargled</td>
<td>Treatment of curative teeth and as mouth cleanser.</td>
<td>Anacyclin, pellitorine, enteriyne alcohol, hydroarolin, inulin, volatile oil and (+) sesamin</td>
<td>Antibacterial and analgesic</td>
</tr>
<tr>
<td><em>Azadirachta indica</em> A. Juss Meliaceae (Neem)</td>
<td>Fresh twig is used as a toothbrush (Singh and Singh, 1992)</td>
<td>Care of teeth and gums</td>
<td>Margosine, nimbidin, nimbin, nimboesterol and tannins</td>
<td>Anti-inflammatory (Opkansi and Ezechukwu, 1981), analgesic and antibacterial</td>
</tr>
<tr>
<td><strong>Barleria prionitis</strong> Linn.</td>
<td>Herb mixed with honey is used in toothache and cures bleeding gums (Chatterjee and Prakashi 1997)</td>
<td>To relieve toothache</td>
<td>Tannins and alkaloids</td>
<td>Anti-inflammatory and analgesic</td>
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<tr>
<td><strong>Cinnamomum camphora</strong> Nees &amp; Eberm.</td>
<td>Dry leaves are finely ground and mixed with honey and the mixture is rubbed on teeth</td>
<td>Toothache and gum care</td>
<td>Camphor, campheral, pinene, camphene, caryophyllene, safrole, borneol, heliotropin, vanillin and camphoracene</td>
<td>Antibacterial and analgesic</td>
</tr>
<tr>
<td><strong>Cuminum cyminum</strong> Linn.</td>
<td>Fried cumin and saindiha salt should be used daily as tooth powder</td>
<td>In the cure of tooth and gums</td>
<td>Cuminaldehyde, cuminyl alcohol, p-cymene, dipentene, α-terpenol, anthraquinone and β-phellandrene</td>
<td>Antibacterial and anti-inflammatory</td>
</tr>
<tr>
<td><strong>Eucalyptus globulus</strong> Libill.</td>
<td>Leaf oil is applied to the site of pain</td>
<td>To prevent tooth decay and to provide pain relief</td>
<td>Cineole, oleanolic acid and maslinic acid</td>
<td>Antibacterial, antifungal, antiviral, antiseptic and anti-inflammatory (Kirtikar, and Basu, 1993).</td>
</tr>
<tr>
<td><strong>Gardenia gummosifera</strong> Linn.</td>
<td>Gum of the trunk rubbed on gums</td>
<td>It is given to children due to dentition and alay irritation</td>
<td>Gardenin, 5-dimethyltangeretin, β-sitosterol and flavonoids</td>
<td>Antibacterial and anthelmintic</td>
</tr>
</tbody>
</table>
| **Holarrhena antidysenterica** Wall.  
Apocynaceae (Kurchi) | Hot decoction of the drug is used as gargle | To prevent toothache | Conessine, holarrhine, conassimine and conarrhime (Siddiqui, 1936) | Antibacterial and anthelmintic |
|---|---|---|---|---|
| **Jasminum grandiflorum** Linn.  
Oleaceae (Chameli) | Essential oil from flower is applied to teeth | It is useful in diseases of mouth and teeth, especially in toothache (Kirtikar and Basu, 1993). | Benzyl acetate, benzyl alcohol, linalyl acetate, eugenol, geraniol, linalool, farnesol and nerolidol | Antibacterial and analgesic |
| **Juglans regia** Linn.  
Juglandeaceae (Akhrot) | Stem bark is used as tooth brush | Improve oral hygiene prevent plaque, caries and reduce gingival periodontal infections (Khalid and Al-Lafi, 1995) | Juglone, bisjuglone, regiolone, berberine, β-sitosterol, betulnic acid and ascorbic acid (Talapatra et al., 1988) | Antibacterial (Alkhwajah, 1997), anti-inflammatory and analgesic (Erdenoglu et al., 2003) |
| **Mimusops elengi** Linn.  
Supotaceae (Bakul) | Decoction of bark is used as gargle in salivation of gums & tender twig is used as tooth brush | Protection of gums and teeth (Mitra, 1993). | Triterpenoids, saponins, flavonoids, alkaloids, glycosides, amino acids and fatty acids etc. (Misra et al., 1974) | Antibacterial (Mundhada et al., 2003) |
| **Myrica sapida** Wall.  
Myrieaceae (Kajphal) | Bark is chewed to relieve toothache (Nadkarni, 1998). | Relief in pain | Glycoside myricitrin, quercetin and tannins | Analgesic and anti-inflammatory |
<table>
<thead>
<tr>
<th><strong>Myroxylon balsamum</strong> Harms. Papilionaceae (Tolu Balsam)</th>
<th>Gum is applied to prevent post extraction alveolitis and oil is used as dentifrices</th>
<th>To prevent complications arising from teeth</th>
<th>Benzyl benzoate, benzyl cinnamate, phellendrene, farnesol and vanillin (Anonymous 1985)</th>
<th>Antibacterial and anthelmintic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ochrocarpus longifolius</strong> Benth &amp; Hook Clusiaceae (Naagkesar)</td>
<td>A paste made of dried flower buds is used to fill cavities of carious teeth</td>
<td>Relief from toothache (Nadkarni, 1998).</td>
<td>Steryl acetate, stilbene, squalene, stigmasterol, β-sitosterol, cycloartenoi, vitixin and mesoinositol</td>
<td>Antibacterial, anti-inflammatory and analgesic</td>
</tr>
<tr>
<td><strong>Ocimum sanctum</strong> Linn. Labiatae (Tulsi)</td>
<td>Leaves are chewed as such</td>
<td>Treatment of bad breath</td>
<td>Volatile oil, ascorbic acid, carotene, alkaloids, glycosides, saponins and tannins</td>
<td>Antibacterial</td>
</tr>
<tr>
<td><strong>Origanum vulgare</strong> Linn. Lamiaceae (Marjoram)</td>
<td>Extract made with boiling water is used as gargling material</td>
<td>To check soreness of throat and inflammation of mouth (Kirtikar and Basu, 1987)</td>
<td>Thymol, carvacrol, geranyl acetate, linalool, dipentene and palmitic acid</td>
<td>Anti-inflammatory, analgesic and antibacterial</td>
</tr>
<tr>
<td><strong>Piper longum</strong> Linn. Piperaceae (Jaborandi)</td>
<td>Powder of dry spikes is placed in tooth caries</td>
<td>Toothache (Chatterjee and Prakash, 1994)</td>
<td>Piperine, pipartine, caryophyllene, pipernonaline, pipélongumine, sitosterol and dihydrostigmastanol</td>
<td>Analgesic, anti-inflammatory and anthelmintic</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Part Used</td>
<td>Effect</td>
<td>Constituents</td>
<td>Use</td>
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<tr>
<td><em>Piper nigrum</em> Linn.</td>
<td>Fried powder made from seed is rubbed on teeth; Resin is mixed with other substances used as temporary filling of carious teeth (Parmar and Kaushal, 1982)</td>
<td>Toothache; Chewed to strengthen the gums and a breath sweetener (Yeung, 1985)</td>
<td>Piperine, piperitine, α-thujene, piperonol, piperic acid, ascorbic acid and carotene (Satyavati, 1987)</td>
<td>Antibacterial and anti-inflammatory</td>
</tr>
<tr>
<td><em>Pistacia lentiscus</em> Linn.</td>
<td>Suspension of gum in water is applied to toothache (Kirtikar and Basu, 1993)</td>
<td>Relieve toothache</td>
<td>α-Masticoresene, β-masticoresene, masticonic acid, masticolic acid and α-pinene</td>
<td>anti-inflammatory and analgesic</td>
</tr>
<tr>
<td><em>Pterocarpus marsupium</em> Roxb.</td>
<td>Powder or paste made from bark, fruit or seed is applied to teeth.</td>
<td>Control of dental diseases</td>
<td>Kinotannine acid, kinoin, catechol, protocatechuic acid, epicatechin, pectin and gallic acid</td>
<td>Analgesic</td>
</tr>
<tr>
<td><em>Punica granatum</em> Linn.</td>
<td>Branches are used as tooth brush</td>
<td>Strengthening teeth (Lewis, 1980)</td>
<td>Peltierine, isopeltierine, pseudopeltierine and methyl peltierine</td>
<td>Antibacterial, analgesic, antioxidant, anthelmimnic (Chevallier, 1996)</td>
</tr>
<tr>
<td><em>Salvadora persica</em> Linn.</td>
<td></td>
<td></td>
<td>Trimethylamine, salvadoline, sulphur, saponins, vitamin C, flavonoids, tannins and sterol</td>
<td>Antibacterial and analgesic</td>
</tr>
<tr>
<td><strong>Salvia officinalis</strong> Linn. Lamiaeae (Garden sage)</td>
<td>Herb has been used in mouth washes, gargles and tooth powders (Kirtikar and Basu, 1993)</td>
<td>Mouth cleanser and good dentifrice (Westland, 1999)</td>
<td>Flavonoids, tannins, phenolic acid and essential oil</td>
<td>Antioxidant</td>
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<tr>
<td><strong>Solanum xanthocarpum</strong> Schrad &amp; Wendl. Solanaceae (Kateli)</td>
<td>Heat an iron rod in the fire till red hot, then place some seeds on it and take fumes into the mouth</td>
<td>Inflammation of mouth and toothache (Kirtikar and Basu, 1993)</td>
<td>Solasonine, linoleic acid, palmitic acid, stearic acid and oleic acid</td>
<td>Antibacterial, anti-inflammatory and analgesic</td>
</tr>
<tr>
<td><strong>Symplocos racemosa</strong> Roxb. Symplocaceae (Lodh)</td>
<td>Bark is used as mouth wash</td>
<td>Firmness to spongy and bleeding gums (Watt, 1972)</td>
<td>Loturine, loturidine, colloturine, oxalic acid and 3-monoglucofuranoside</td>
<td>Antibacterial and anti-inflammatory</td>
</tr>
<tr>
<td><strong>Syzygium aromaticum</strong> Linn. Myrtaceae (Laung)</td>
<td>Clove oil is applied to site of pain giving teeth</td>
<td>Pain relief and used in root canal therapy and temporary fillings</td>
<td>Eugenol, eugenol acetate, β-caryophyllene, flavone, myricetin, gallic acid and kaempferol (Lining, 1996)</td>
<td>Antibacterial (Dornun and Deans, 2000), antioxidant and analgesic</td>
</tr>
<tr>
<td><strong>Thalictrum foliolosum</strong> DC Ranunculaceae (Pilijari)</td>
<td>Fine powder is applied on teeth</td>
<td>To relieve toothache</td>
<td>Berberine, magnoflorine, thalictramine (Gupta, 1969)</td>
<td>antibacterial</td>
</tr>
<tr>
<td><strong>Zanthoxylum alatum</strong> Roxb. Rutaceae (Tejphal)</td>
<td>Fruits are used in toothache and branches used as miswak (Raychaudhari, 1992)</td>
<td>Toothache</td>
<td>Linalool, methyl cinnamate, limonene, β-phellandrene, myrcene and p-cymene (Ramidi et al., 1998)</td>
<td>Antibacterial (Mehta et al., 1981), antifungal, anti-inflammatory &amp; analgesic</td>
</tr>
</tbody>
</table>
OBJECTIVES OF THE PRESENT WORK


- Isolation and analysis of volatile oil from the flower buds of *Syzygium aromaticum* Linn. and seeds of *Zanthoxylum alatum* Roxb.

- Standardization, preliminary phytochemical screening, extractive values, physiochemical standardization, chemoprofile and heavy metal analysis of bark of *Juglans regia* Linn., *Mimusops elengi* Linn., *Symplocos racemosa* Roxb., buds of *Syzygium aromaticum* Linn. and seeds of *Zanthoxylum alatum* Roxb.

- Antibacterial activity of ethanolic and aqueous extracts of all the five drugs and volatile oil against oral bacteria.

- Screening of anti-inflammatory and analgesic activities of the aqueous extracts of all the drugs.
REFERENCES


