

## The use of medicinal plants in dental treatment

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### Summary

Phytotherapy has developed basing on folk traditional healing methods by means of herbal extracts. According to modern ideas of etiology and pathogenesis of the diseases, thanks to the evolution of science, phytotherapy has exempted from mostly empirical use of plant medication. It has become more and more popular among practitioners and their patients, which is possible due to progress in gaining information about healing plants as far as their phytochemical, pharmacological and clinical features are concerned.

*Key words: phytotherapy, healing plants, herbal drugs, herbal compounds, dental treatment*

### INTRODUCTION

The key issue of phytotherapy is the use of healing plants' features in the treatment of various diseases. Modern treatment by means of plant drugs is proper use of plant extracts, as well as its combination with other chemotherapeutic agents. Phytotherapy uses complexes of compounds included in plants or substances isolated from plants, which are homogenous compounds of a particular chemical structure [1-10].

Development of chemical and biological science in last century led to development of scientific background of the use of herbs. The aim of the scientific examination is elaboration of a drug of a specific composition and dose, in a modern form which is easy to administer [7].

Plants are the source of many valuable medicines consisting of complex or simple compounds which sometimes cannot be replaced with synthetic chemotherapeutic agents. Plant material are whole plants or parts thereof, as well as products of their physiological or pathological metabolism [1-11].

Research contributed to detect many unknown properties of substances contained in plants, although these compounds had already been known before and used in traditional medicine [1, 8, 12-15].

It is important to take the advantage of synergistic interaction of a herbal drug with a synthetic agent. Association between a synthetic drug and a plant compound often leads to decrease of the drug dosage and as a result lower level of its toxicity [16]. However, many different side effects to herbs have been reported, including effects from biologically active constituencies from herbs, side effect caused by contaminants, and herb-drug interactions [8, 10].

Dental treatment, like other branches of medicine, should restrain the use of antibiotics. Consequences of improper use of this kind of drugs, such as devastation on physiological bacteria, allergic reactions and development of resistant strains should always be taken into consideration [17-22].

## BACKGROUND

Herbal drugs and their therapeutic use in oral cavity diseases has been known and successfully used for a long time. Oral cavity lesions are mostly gingivitis and mucositis as well as periodontal diseases. Specific diseases such as lues or tuberculosis, are uncommon. Herbal compounds are recommended in the treatment of serous and purulent gingivitis and mucositis, superficial periodontitis, catarrhal tongue inflammation, toxic oral cavity inflammation, mycosal infections and difficult healing of post-operative wounds. Herbal medications are also administered to sooth oral symptoms of systemic diseases. Plant compound can be a powerful and the dominant drug when an inflammation caused by local irritating factor appears [1, 23].

Most important features of herbal medicament are its anti-inflammatory, anti-septic, analgesic, astringent, edema-reducing, soothing and healing accelerating properties [2, 3, 8, 11, 14-16, 24, 26].

Oral cavity, like other parts of human body, contains natural bacterial flora. The bacteria population changes in time and varies among different people, especially as far as subspecies and species proportions are concerned. However, the general contents of the flora remains constant [7, 27-30]. Biologic equilibrium of the oral cavity gets broken more often when compared to other parts of the body, and it results in a disease. The reasons may be endogenous (when the immunity gets weaker), when there is an unexpected emergence of bacteria in regions they normally do not exist (e.g. after tooth extraction or other injuries) or exogenous (after administration of antibiotics) [29, 30].

There are many factors predisposing oral cavity inflammations. They can be physiologic (age, pregnancy, malnutrition, xerostomia), general (hormonal disturbances, systemic diseases, the use of antibiotics) or local (injuries or operations in the oral cavity area). Under such circumstances a non-harmful bacteria existing in the oral cavity may become a pathogen, which adheres to the mucosa and cannot be removed by saliva flow. It breaks the protective influence of physiological flora, host's immune system and finally penetrates the tissue. The virulence of microorganisms is their relative capability to cause disease, which is due to intrinsic characteristics of the bacteria called virulence factors [7, 28-33].

Pathological lesions of the oral mucosa are a common problem in dental practice. However, peculiar environment of oral cavity, resulting in minimized effect of the medication, structure and physiology of the mucosa, influence of the physiological flora, the role of saliva and food, temperature and pH changes are important factors restricting the use of the drug [27].

Medicines including herbal compounds are quite often used in dental treatment. Some of them can inhibit bacterial growth, they also have antibacterial, antimycosal and antiviral properties. Herbal drugs of proper concentration of chemically active substances do not irritate and interrupt natural flora [7, 29, 34].

Due to their antibacterial and anti-inflammatory properties herbal drugs are often added to tooth pastes, where they inhibit growth of tooth plaque and bacterial adherence to the pellicle [32, 35-37]. Rinse solutions, aerosols, unguents and gels, containing anti-inflammatory and antibacterial plant substances are widely used in dental treatment [24,27]. They are used locally on affected mucosa. The plant-based medicaments can be either infusions or decoctions, prepared from herbal raw materials, or ready-made tinctures or ethanolic-aqueous extracts [2-4, 24].

Laboratory and clinical examination showed, that tooth pastes containing herbal extracts reduce dental plaque and gingivitis, tooth staining and dental calculus [32, 35-37]. Herbal tooth pastes have antibacterial properties, they inhibit e.g. *Streptococcus sobrinus* and *Streptococcus mutans* growth [31, 38]. It has also been proved that herbal pastes have longer local capacity compared to pastes non-containing natural substances [35, 39].

Oral hygiene solutions, containing natural herbal substances, inhibit forming of tooth plaque, change pH by alkalizing the saliva and reduce gingival bleeding [24, 27]. Herbal mixtures can be used additionally to daily hygiene and in periodontal treatment as well [41-45].

*Miswaki* sticks used for cleansing teeth and chewing in the Third World countries- are in fact a natural toothbrush. Such method of daily oral hygiene is the only oral hygienic procedure in many regions. It has been noticed that the plants *miswaki* are made of contain antibacterial compounds, which prevent caries and gingivitis [7, 40].

It has been proved that some herbs inhibit keratosis and progress of leukoplakia [46]. The use of herbal extracts has also positive effect on treatment of oral lichen planus lesions [19, 37, 39, 47].

Herbs owe their healing properties to biologically active compounds they contain. Some of these compounds were isolated or obtained by bio-guided isolation after previously detected characteristic activity of the part of the plant [25]. These compounds are flavonoids, coumarins, iridoid glycosides, phenolic acids, resins, triterpens, phytoesters, choline, carotenoids, tannins, vitamins and mineral salts (magnesium, iron, lithium) and essential oils. The most popular are flavonoids and essential oils [1-3, 16, 24, 26, 48-51].

Examination explained the most probable effect of flavonoids which seem to be natural antibiotics, also effective against oncogenic viruses and carcinogens. Flavonoids after entering the cell block the DNA and RNA polymerase which results in inhibition of synthesis of bacterial nucleic acids. Bacterial cell division is therefore impossible. Flavonoids can be used in the treatment of infections caused by *Staphylococcus aureus* and gastrointestinal infections [2, 3, 9, 49].

Essential oils show a wide spectrum of biological activities and that is why they are called “volatile phytoncides”. They are a very complex blend of organic compounds. Some of them contain up to 300 ingredients per single oil. Nowadays, approximately 3000 compounds contained of oils are known, mostly isoprenoides, benzene and compounds of sulphur and nitrogen [4-6, 14, 25, 50, 51].

Essential oils show strong destructive effect on viruses, bacteria, saccharomycetes, moulds and protozoans. Phenols, especially carvacrol, thymol and eugenol are those of the strongest activity [50].

Eugenol is widely used in dental treatment. It is the most important compound of dianthus oil with strong antibacterial and anesthetic properties. Eugenol is added to root canal sealers (Endomethasone, Caryosan), to temporary fillings and to pastes used for direct pulp capping (Caryosan, zinc oxide). Eugenol can be also used in disinfection of the tooth canals in the treatment of pulp necrosis or as a precipitator while impregnating the dentin with silver nitrate [2, 3, 14].

Thymol and carvacrol are components of thyme, origanum and satureja oils. Thymol precipitates in the form of blank crystals of strong thyme smell. It has antibacterial and antimycosal properties. It can be used in 1–10% alcohol solutions to disinfect root canals in the treatment of pulp necrosis [14].

Strong antibacterial and antimycosal activity is also a feature of aliphatic alcohols and leaf aldehydes, which are synthesized in almost all green plants. They serve as a carrier of green fragrance (“green leaf”).

A very important characteristic of some of essential oils is their activity against microorganisms resistant to synthetic antibiotics. It is assumed, that microorganisms are unable to become resistant to essential oils. It has been proved in cases when peppermint, eucalyptus and dianthus oils were used. The use of both antibiotic and essential oil has a synergistic effect [5, 20].

The properties of essentials oils have been known since ancient times. The oils have been used in treatment and in protection against “pestilential air” during epidemics. Nowadays, essential oils are used both in prophylactics and treatment [5].

## THE USE IN PRACTICE

*Anthemis nobilis* L., commonly known as Roman Chamomile, *Chamaemelum nobile* L., derives from South and East Europe as well as Anatolia. Nowadays, it is found in the whole Europe, Australia and North America. It is a low perennial plant. The herbal material are the heads, gathered in the beginning of flowering time.

Essential oil is the main healing compound of chamomile. It also contains other compounds like flavonoids, coumarins and slime. Roman Chamomile has anti-inflammatory and spasmolytic properties, especially on plain muscles of the gastrointestinal system. It has been used as a mild sedative. It facilitates wounds healing and is an antibacterial agent. Infusions are used locally externally in the treatment of oral cavity, mucosa, skin inflammations or internally in gastrointestinal and bladder infections. The infusions are used also to make compresses, irrigations and frictions on irritated skin or mucosa, to treat superficial purulent inflammations, chemically irritated areas as well as mild burns and bedsores [2-4, 6, 10, 13, 52].

**Eyebright** (*Euphrasia* L.) is a genus of about 450 species well distributed all over the world. They are semi-parasitic of grasses. Eyebright used as a medicine is a mixture of three species. Parts used are leaves, stem and flowers. The most active compound is aucubin with antibacterial properties also acting as an inhibitor of histamine secretion. Its antibacterial activity is possible thanks to carboxylic acids [2-4, 26]. Tannins in eyebright infusions have a mild astringent activity. Extracts gained from the herb are anti-inflammatory due to decreasing capillary permeability in the mucosa and also antioxidant. Eyebright has also antibacterial activity against staphylococci and streptococci. It also inactivates bacterial toxins [26, 53].

**Arnica montana** (*Arnica montana* L.) is a perennial herb growing wild in some European countries, especially in mountain areas of central Europe, in France, Balkans and the Pyrenees. In Poland it is quite rare, found mostly in the Karkonosze Mountains. It is a protected plant. Its raw material is flower heads [2, 3, 6, 21].

Arnica heads contain many various compounds, e.g. essential oil, triterpenes, flavonoids and lactones. Its specimens are used mostly due to antiseptic, anti-inflammatory, analgesic, antibacterial and antimycotic properties. They intensify blood flow, facilitate granulation, accelerate resorption of hematomas, reduce swellings and inflammations [2, 3, 6, 21].

**Peppermint** (*Mentha piperita* L.) is a hybrid mint, a cross of the watermint (*Mentha aquatica* L.) and spearmint (*Mentha spicata* L.). Nowadays it is widespread cultivated throughout all regions of the world.

The most important compounds are essential oil and menthol. There are also approximately 30 other substances, including tannins and flavonoids. Peppermint is cholagogue, spasmolytic and anti-diarrheal. The essential oil with menthol influences skin and mucosa cold receptors, causing cooling sensation in the place of contact [2-4, 6, 10].

**Sage (*Salvia officinalis* L.)** is a small perennial evergreen subshrub, native to the Mediterranean region. It has been known as a kitchen and medical herb since the ancient times. The plant owes its name to Latin word *salveo* – be healthy [2].

The main material of sage is essential oil. It also contains camphor, flavonoids, catechin tannins and antibacterial carnosol. *Salvia* extracts and infusions have anti-inflammatory, antibacterial, antimycosal, astringent, antihydrotic and antilactative properties. The infusions are used for rinsing oral cavity and throat in cases of inflammations including purulent diseases, in cough and to assist expectoration [2-4, 54, 55].

**Thyme (*Thymus vulgaris* L.)** is native to the Mediterranean region. It is very sensitive to temperature changes [3].

Thyme contains mostly essential oil, the minor compounds are thymol, tannins and gentians. Due to contents of essential oil with phenolic acids thyme has strong disinfecting and analgesic properties, it causes local skin and mucosa hyperemia. It destroys bacteria, sacharomycetes and mycosa. It also stimulates bronchial epithelial fimbres movement and dilutes mucus, making expectoration easier [2, 4, 7, 20]. Thym oil can be used as an antibacterial additive in the treatment of MRSA infections [20].

**Oak (*Quercus* L.)** has a bark, which can be used in medicinal preparations. The source of raw material are both *Quercus robur* L. and *Quercus petraea* L., species extending from cold regions to tropical Asia and the Americas. The bark is rich in tannins which make it astringent. Tannins create permanent and insoluble complexes with microorganisms' proteins. Therefore oak bark has bactericide properties, it may inhibit bacterial growth and inactivate toxins. It also influences the capillaries by minimizing permeability and microbleeding.

Oak bark infusions are used in the treatment of oral cavity and throat inflammations, skin irritations, varicose ulcers, mild bleedings, frostbites and burns [2-4].

**Vilcacora (*Uncaria tomentosa* Willd.)** is a woody vine found in the tropical jungles of South and Central America. It is called „Uña de Gato” or Cat's Claw due to its claw-shaped thorns. For at least 2000 years Peruvian tribes have believed, that vilcacora has magic healing properties. It has been used in the therapy of asthma, cancer, cirrhosis, fever, gastritis, diabetes, arthritis, dysentery, urinary infections and many other diseases [12, 56].

Water extract and infusion gained from vilcacora bark have antioxidant and anti-inflammatory activity due to inhibition of synthesis of TNF- $\alpha$  and regulation of prostaglandin level. The healing properties are provided by many compounds, e.g. phenolic acids, flavonoids and esters. These compounds are antioxidative due to their ability to inactivate free radicals and other reactive substances such as hypochlorous acid (HOCl) and peroxy nitrates (ONOO-). Flavonoids can also chelate metal ions and therefore prevent them from taking part in free radical synthesis reaction. Flavonoids' healing activity, resulting from their antioxidant properties, appears before they are absorbed in the gastrointestinal system. Therefore, they are able to prevent the gastrointestinal system from oxidative damage as well as prevent from stomach, colon and rectum cancer. They can also influence cell synthesis of cytokines and

chemokines, and, as a result, they stimulate immune processes. Antiinflammatory properties of vilcacora flavonoids have also been observed [12, 56].

*In vitro* study of influence on bacterial pathogens inhibiting human oral cavity showed vilcacora's inhibiting influence on colony growth of *Streptococcus mutans*, *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Citrobacter freundii*. However, it does not influence *Candida albicans* and *Pseudomonas aeruginosa* [30, 56].

Balsam of Peru is a pathological excretion gained from mechanical damage of the myroxyton trunk - *Myroxyton balsamum* Harms var. *pereirae*. Myroxyton is well known in South America. It contains phenolic acids and terpens of strong disinfectant properties. Nowadays, it is used in the treatment of dermatoses, difficultly healing wounds, skin and mucosa ulcers, staphylococcal and streptococcal skin infections and assistantly in the treatment of fistulas and erosions [6]. It is often used in the treatment of complications after tooth extraction, especially dry socket [33].

**Ribwort plantain** (*Plantago lanceolata* L.) is a common weed of cultivated land of Europe and Asia, it is also a greater plantain (*Plantago maior* L.) [2-4]. Both species have been used since prehistoric times as herbal remedies. They were believed to cure scorpion and snake bite, dysentery and skin injuries. It has been also a remedy for fatigue and insomnia as well. According to some folk superstitions, *Plantago maior* was a medicament for men, and *Plantago lanceolata*- for women [4, 57]. Plantain raw material are its leaves, containing bacteriostatic and liver-protective iridoid glycosides, some tannins, flavonoids and slime. Plantago leaves extracts are astringent, anti-toxic, antimicrobial, anti-inflammatory, anti-histamine, as well as demulcent, expectorant, styptic, diuretic and antispasmodic. It is also presumed, that the extracts administered internally increase interferon secretion and therefore have antiviral properties [2-4, 57-61]. Sucked or chewed raw or cooked plantain root can soothe a toothache in a specific situation when it is impossible to see a dentist [60].

**Marigold** (*Calendula officinalis* L.) is native to the Mediterranean areas. It contains essential oil, flavonoids, carotenoids, triterpens (arnidiol and faradiol), slime, resin, tannins, apple acid and many more. It is used for the treatment of skin disorders and pain, to facilitate healing after oral surgery and in oral cavity inflammations [2-4, 7, 62, 63]. It has also anti-oedematous activity [62].

**Elder** (*Sambucus nigra* L.) infusions have analgesic properties. Its activity is 160 times weaker than morphine and it does not cause addiction. Berries infusion administered after oral surgery along with anesthesia can reduce pain up to 40% [2, 4].

**Garlic** (*Allium sativum* L.) chopped and held in the mouth for 5 minutes sterilizes the oral cavity, which is due to its strong antibacterial activity. Fresh garlic juice kills *Streptococcus pyogenes* and *Corynebacterium diphtheriae* in 2-3 minutes time [2-4, 6, 8, 25].

**Aloe** (*Aloe arborescens* Mill.) extract is a locally used substance, which is tonic, anti-inflammatory, bactericide and able to boost tissue regeneration. Aloe contains compounds metal and vitamins as well as organic acids, mineral salts (zinc, copper, molybdenum), polysaccharides, amino acids, enzymes, saponins, resins, aloin. It has strong immunomodulating and healing properties [2-4].



## CONCLUSIONS

In the age of intensive investigations aiming to discover new compounds, which can be used in treatment, we shall not forget about natural substances of herbal origin. Plants are a precious source of natural compounds which can be used both in prophylaxis and treatment of oral cavity and teeth diseases. Phytotherapy is useful in the treatment of chronic pathological conditions in which medicines are not well tolerated. Herbal drugs can be used for a long time, they do not cause addiction and allergic reactions. Nowadays, there are many herb-based specimens. Knowledge on their properties may help to choose the optimal one. Herbal compounds should be administered following its instructions, on proper time and dosage.

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## ZASTOSOWANIE ROŚLIN LECZNICZYCH W LECZENIU STOMATOLOGICZNYM

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## Streszczenie

Rozwój fitoterapii dokonywał się przez wieki dzięki ludowym tradycjom leczenia ziołami. Dzięki współczesnym poglądom na temat etiologii i etiopatogenezy chorób i rozwojowi nauki fitoterapia uwolniła się od wyłącznie empirycznych podstaw stosowania leku roślinnego w medycynie. Cieszy się ona coraz większym uznaniem wśród lekarzy i pacjentów dzięki postępowi w poznawaniu właściwości znanych roślin leczniczych pod względem fitochemicznym, farmakologicznym i klinicznym.

**Słowa kluczowe:** *fitoterapia, rośliny lecznicze, leki ziołowe, związki roślinne, leczenie stomatologiczne*