WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 6, 356-365. Review Article ISSN 2277– 7105

ALOE VERA – THE ATAVISTIC HERB USED IN DENTISTRY

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Article Received on
22 March 2017,

Revised on 12 April 2017,
Accepted on 02 May 2017

DOI: 10.20959/wjpr20176-8519

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ABSTRACT

In the present century of cosmopolitan life, fast remedy to any dental and health issues is obtained by allopathic medication. Introduction of herbal medication is being a revolution across the globe where similar benefits with minimal side effects have been obtained. Herbal products have gained immense popularity in the western world as well as in the developing countries because of its effectiveness and benign economy. It can be used by the people with middle and low socio-economic status in the urban and the rural communities. One of the oldest herbal medications is Aloe vera which has been used by Cleopatra during her times and also by Alexander the Great during the times of war. There have been 130 varieties of Aloe vera which exhibits excellent medicinal properties. The Aloe vera plant contains various active components with various properties which have been utilized in the field of dentistry for the treatment of various diseases. In dentistry, Aloe vera being used as a local drug delivery system, because of its various benefits, i.e., easy availability, easily applicable with Minimal equipments cheap and minimal side effects.

KEYWORDS: Aloe vera, Dentistry, Gel, Herbal, Medicinal plant, Topical.

INTRODUCTION

Enormous amount of research conducted around the globe has introduced the traditional knowledge based approaches to health sustenance and healing, with particular emphases on the employment of plant medicines in the prevention and treatment of human disease. Over centuries various experiments done on plant medicine has been utilized worldwide, which has

well proven its worth. Herbal medications are attributed to its minimal side effects, highly effective treatment. It could be of benefit to low socio-economic level in urban and rural communities. Aloe vera is one of the oldest plants known to be used from thousands of years for medicinal purpose.[1] Aloe vera belongs to Liliaceae family. It is used in Ayurvedic, Homeopathic and Allopathic streams of Medicine. The name Aloe vera is derived from the word "Alloeh" meaning "Shining bitter substance" in Arabic, while "vera" means "true" in Latin. It is a perennial succulent plant which develops water storage tissue in leaves to survive in dry areas of low or erratic rainfall.[2] The plant is commercially cultivated in Aruba, Bonaire, Haiti, India, South Africa, The United states of America and Venezuela[3], while the finest quality of Aloe is grown in desert of southern California. In India, it is found in Rajasthan, Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu.[4] This plant has been known by number of names as "wand of heaven", "heaven's blessing", "the silent healer" and also as "lily of desert" as it is commonly seen in tropical environment.

History

The use of Aloe vera for its medicinal purpose has been used since centuries in Greece, Egypt, India, Mexico, Japan and China in several cultures. History states that Alexander and Christopher Columbus used Aloe vera for treating wounded soldiers.[5] Cleopatra used it as part of regular beauty regimes. In the history, according to Hannibal states that war have been fought to obtain control over the growing area in North Africa around 1750 BC. It was described how the whole leaf of Aloe vera was used to treat radiation dermatitis in a modern medical paper that was published in 1934. In 20th century many studies have focused the Aloe role on anti-diabetic, antimicrobial and anti-cancer properties of the whole leaf, gel or juice of the plant.[6]

The plant

The leaves of Aloe vera plant are very thick and fleshy, green to grayish green in color, with serrated edges. The leaf has 3 layers[7]:

a) The outer layer: It is called Rind and has a protective function, synthesizes carbohydrates and proteins.
b) Middle layer: It has a yellow sap which is bitter and contains anthraquinones and glycosides.
c) An inner layer: Is clear gel and contains 99% water, the rest is made of amino acids, lipids, sterols and vitamins.

Aloe vera components with its properties[8-10]

Aloe vera is a herbal medication which has a series of 75 components which is potentially active. The active components are (Figure 1):

1. Vitamin: Aloe vera contains vitamins A, C and E, which are antioxidants. It also contains vitamin B12, folic acid, and choline. Antioxidant neutralizes free radicals.
2. Enzymes: It contains 8 enzymes: aliiase, alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Bradykinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.
3. Minerals: Aloe vera contains calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium andzinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.
4. Sugars: It provides monosaccharides and polysaccharides - These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. The most prominent monosaccharide is mannose-6-phosphate, and the polysaccharides are called glucomannans. With advancement, a glycoprotein with antiallergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from Aloe vera gel.

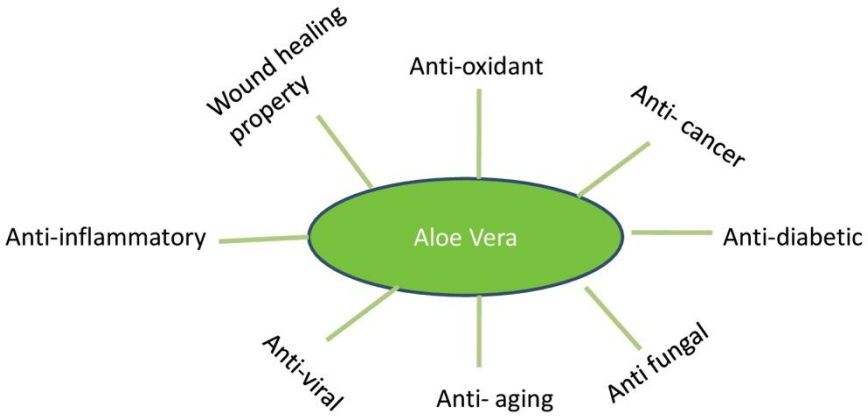

Figure 1

5. Anthraquinones: It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, antibacterials and antiviral agent.

6. Fatty acids: It provides 4 plant steroids; Cholesterol, campesterol, β-sisosterol and lupeol. All these have anti- inflammatory action and lupeol also possesses antiseptic and analgesic properties.
7. Hormones: Auxins and gibberellins that help in wound healing and have an anti-inflammatory action.
8. Others: 20 of the 22 human required amino acids, 7 of the 8 essential amino acids, salicylic acid that possesses anti-inflammatory and antibacterial properties, Lignin, which enhances penetrative effect of the other ingredients into skin, Saponins that have a cleaning and antiseptic properties.

Mechanism of action

1. Healing properties: Glucomannan, a mannose-rich polysaccharide and gibberellins, a growth hormone, interacts with growth factor receptors on the fibroblast and stimulates the activity of Aloe vera. This increases collagen synthesis after topical and oral Aloe vera. Aloe vera increases the collagen content of the wound and increases the degree of collagen cross linking which accelerates the wound contraction. (Figure 2).

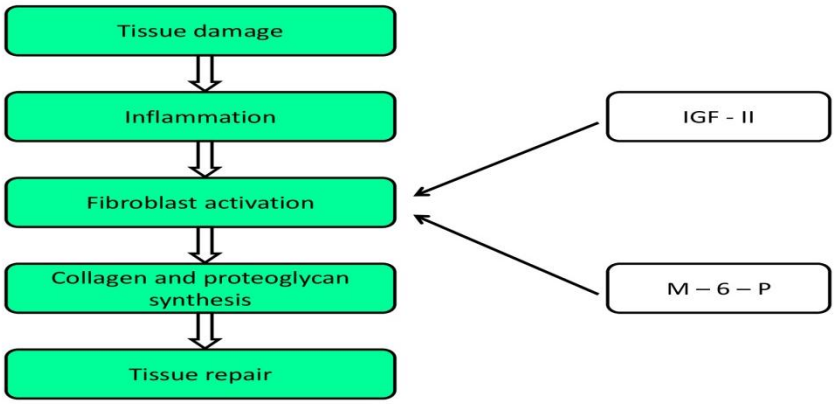

Figure 2

2. Effects on skin exposure to UV and gamma radiation: Aloe vera gel protects the skin from radiation damage because of the anti-oxidant protein, metallothionein which is generated in the skin and that scavenges the hydroxyl radical. This prevents the suppression of superoxide dismutase and glutathione peroxidase in the skin, which inhibits the release of interleukin-10 and suppresses the delayed type hypersensitivity.
3. Anti-inflammatory action: Aloe vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production from arachidonic acid. With advancement a recent anti-inflammatory compound called C-glucosyl chromone was isolated from gel extracts.

4. Effects on the immune system: Alprogen present in Aloe vera inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells. Studies conducted in mice previously implanted with murine sarcoma cells and acemannan stimulates the synthesis and release of interleukin-1 and tumor necrosis factor from macrophages in mice, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells. Several low-molecular-weight compounds are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils.
5. Laxative effects: Anthraquinones present in latex are a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis.
6. Antiviral and antitumor activity: These actions of Aloe vera may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthraquinone aloin inactivates various enveloped viruses such as herpes simplex, varicella zoster and influenza. In recent studies, a polysaccharide fraction has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby preventing the formation of potentially cancer-initiating benzopyrene-DNA adducts. An induction of glutathione S-transferase and an inhibition of the tumor-promoting effects of phorbol myristic acetate has also been reported which suggest a possible benefit of using Aloe gel in cancer chemoprevention.
7. Moisturizing and anti-aging effect: Mucopolysaccharides help in binding moisture into the skin. Aloe stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores. Its moisturizing effects has also been studied in treatment of dry skin associated with occupational exposure where Aloe vera gel gloves improved the skin integrity, decreases appearance of fine wrinkle and decreases erythema. It also has anti-acne effect.
8. Antiseptic effect: Aloe vera contains 6 antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur. They all have inhibitory action on fungi, bacteria and viruses.
9. Painkilling properties: Salicylic acid found in Aloe vera, is metabolized in the body to an aspirin‑like compound which, together with lupeol, provide some of its painkilling properties

Aloe vera used in dentistry

Oral cavity is a breeding ground for many bacteria, if oral hygiene is not maintained properly it may lead to major oral diseases. Aloe vera has many anti-bacterial properties which is said to be very effective in preventing in diseases.

1. Oral lichen planus (OLP): Choonhakarn C *et al.*[11] conducted a study to check the efficacy of Aloe vera gel in the treatment of oral lichen planus where he observed statistically significant efficacy in Aloe vera than placebo in inducing clinical and symptomatological improvement of oral lichen planus. Aloe vera mouthwash is an effective substitute for triamcinolone acetonide in treatment of OLP.
2. Oral submucous fibrosis: Sudarshan R *et al.*[12] carried out a preliminary study to compare the efficacy of Aloe vera with antioxidants in the treatment of oral submucous fibrosis (OSMF). In this study, 20 subjects with OSMF were included. Patients are divided into two groups, Group A received 5 mg of Aloe vera gel 3 times daily for 3 months and Group B received antioxidant capsules twice daily for 3 months. He concluded that Aloe vera group showed a better treatment response (reduced burning sensation and enhanced mouth opening) than the antioxidants group. Hence, it can be applied topically and effective in the treatment of OSMF.
3. Recurrent aphthous stomatitis: Babaee N *et al.*[13] conducted a double-blind clinical trial to evaluate the topically administered Aloe vera gel on oral cavity minor aphthous. It was concluded that Aloe vera 2% oral gel is not only effective in decreasing the patient's pain score and wound size, but also decreased the aphthous wound healing period.
4. Radiation-induced oral mucositis: Ahmadi A[14] postulated that oral Aloe vera mouthwash prevents radiation-induced mucositis by its wound healing and antiinflammatory mechanism and reduce oral candidiasis of patients undergoing head and neck radiotherapy due to its antifungal and immunomodulatory properties.
5. Gingivitis: Ajmera N *et al.*[15] conducted a study to evaluate the anti-inflammatory property of Aloe vera mouthwash on plaque-induced gingivitis. Forty-five patients who were diagnosed with plaque-induced gingivitis were included in the study. They were divided into three groups with fifteen patients in each group. First group was asked to rinse with 10 ml of Aloe vera mouthwash twice daily for 3 months. Second group were treated with scaling only. Third group patients were asked to rinse with Aloe vera mouthwash and scaling was done. The result suggested reduction in gingival

inflammation in all the three groups, but it was more reduction in the Aloe vera mouthwash and scaling group. Davis RH *et al.*[16] tested the anti-inflammatory and wound healing activity of Aloe vera due to the presence of growth substance mannose-6 phosphate. Hence, it was concluded that Aloe vera had a significant anti-inflammatory property. Thus, it can be used as an adjunct to mechanical therapy for treating plaque-induced gingivitis. Bovik EG[17] in 1966 used Aloe vera for the gingivectomy sites and showed that healing was better and fast.

6. Periodontitis: Bhat G *et al.*[18] evaluated the effects of subgingival application of Aloe vera gel in periodontal pockets of adult periodontitis patients after mechanical debridement. In his study, 15 subjects were evaluated for clinical parameters such as plaque index, gingival index, probing pocket depth at baseline, followed by scaling and root planning. Test site comprised of scaling and root planning, followed by intra-pocket placement of Aloe vera gel, which was compared with the control site in which only scaling and root planning was done and clinical parameters were compared between the two sites at 1-month and 3 months from baseline. It was observed that Aloe vera gel resulted excellently in improvement of periodontal condition and can be used as a local drug delivery system in periodontal pockets.
7. Tooth gel: Aloe vera tooth gel is effective in controlling bacteria that causes dental caries because it has the ability to kill and remove harmful microorganisms. This is because Aloe vera contains anthraquinones, which are anti-inflammatory agents. Aloe vera gel does not contain the abrasives and hence cause no abrasion which is acceptable for patients with sensitive tooth. George D *et al.*[19] conducted similar studies where it was observed that Aloe vera tooth gel was effective than the commercial toothpastes in controlling all the organisms, namely Streptococcus mutans, Candida albicans, Lactobacillus acidophilus, Streptococcus mitis, Enterococcus faecalis, Prevotella intermedia and Peptostreptococcus anaerobius. In addition, the Aloe vera gel demonstrated superior antibacterial effect against Streptococcus mitis despite the absence of additional fluoride.[20]
8. Alveolar osteitis: Poor MR *et al*.[21] compared the incidence of alveolar osteitis in patients treated with either clindamycin-soaked Gelfoam or Sali Cept Patches. The Sali Cept Patch is a freeze-dried pledget that contains Acemannan Hydrogel obtained from the

inner gel of Aloe vera. The results suggested that the SaliCept Patch significantly reduced the incidence of alveolar osteitis compared with clindamycin‐soaked Gelfoam.

9. Denture Cleanser and Adhesive: Patients with sore ridges and ill‐fitting dentures can benefit from fungal and bacterial contamination as Aloe vera reduces the inflammatory irritations.[22] The sticky and viscous nature of acemannan, aprototype acemannan was formulated into a denture adhesive and evaluated for adhesive strength in both wet and dry conditions; the adhesive also was used to evaluate cytotoxicity to human gingival fibroblasts. An optimal formula with a high and relatively stable adhesive bond strength and minimum cytotoxicity was observed.[23]
10. Dental Implants: Aloe vera reduces the inflammation caused by bacteria around dental implants.[22]
11. Storage of Gutta Percha Cones: Prakash PA *et al.*[24] in his study concluded that Aloe vera is an effective indeed gutta percha (GP) decontaminant and it holds a promising future as a medium for storage of GP cones.
12. Root Canal Filling Material in Deciduous Teeth: Kriplani *et al.*[25] conducted a study to evaluate the antimicrobial effectiveness of Aloe vera with sterile water zinc oxide and eugenol, zinc oxide‐eugenol (ZOE) with Aloe vera, calcium hydroxide and sterile water, calcium hydroxide with sterile water and Aloe vera, calcium hydroxide and iodoform (metapex) and vaseline (control) against 18 strains of bacteria isolated from infected root canals of primary molar teeth using agar diffusion assay. It was concluded that Aloe vera along with sterile water was found to have superior antimicrobial activity against most of the microorganisms, followed by Zinc Oxide Eugenol along with Aloe vera, calcium hydroxide along with Aloe vera, Zinc Oxide Eugenol, calcium hydroxide, Metapex in the descending order and Vaseline showed no inhibition.

Advantages of Aloe vera[4]

Aloe vera can be used as a local drug delivery system because of its various benefits

• Easily available

• Easily applicable with minimal equipments

• Cheap

• No adverse effects.

CONCLUSION

Aloe vera has been known for its healing properties and its cosmetic properties since ancient times, but its use in dentistry has been limited due to lack of clinical studies. Presently various studies around the globe is being made which substantiates the usefulness of this herbal remedy for oral lesions. Owing to its various properties it can be an effective, cheap and natural substitute to costly treatment for many oral lesions. Aloe vera has a promising future in dentistry and further studies are being conducted to popularize its widespread use.

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