



REVIEW ARTICLE

ALOE VERA- THE BIOHEALER IN PERIODONTICS

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ABSTRACT

Herbal medicines are in use as traditional mode of treatment for various ailments in India, as they produce less side effects and are more economical. Among the herbal medicines, Aloe vera is gaining increased momentum as it is easily available and has numerous health benefits. The utilization of Aloe vera dates back to 4th century. The name Aloe vera is derived from the Arabic word “Alloeh” meaning shining bitter substance, while “Vera” in Latin means true. Aloe vera is known by various terminologies like “lilly of the desert” “plant of immortality” “heaven’s blessing”. The current review article is an attempt to discuss the history, parts, ingredients, general uses, dental uses, periodontal uses, contraindications, and side effects of Aloe vera.

KEY WORDS: Aloe vera, Acemannan, Periodontics

INTRODUCTION

Before the emergence of modern medicine, herbs were considered to be the golden resource and remedy to treat many ailments.¹ The WHO has stated that the medicinal plants are the best source for obtaining various types of drugs². Likewise, the implementation of natural substances for treating dental ailments is attaining popularity among the population. This is due to the attraction and interest in the field of natural medicines, as they are organic and produce comparatively less harmful side effects and are readily available to the people of low socioeconomic level status.^{3,4,5}

Periodontitis is a chronic inflammatory disease, which leads to the destruction of supporting structures of the teeth. There is a multifactorial etiology for periodontitis of which the periodontopathogens play a major role. Since periodontitis is caused by many factors, the treatment of periodontitis is still a challenging task for the dentists. Since the periodontal disease is one of the major health problem of the world, the periodontal treatment mainly aims to cure the inflamed tissue and to decrease the number of pathogenic bacteria to eliminate the periodontal disease. Thus, herbal remedies have come to a rescue as they possess antimicrobial, antioxidant, antiseptic and anti-inflammatory properties.

BENEFITS OF HERBAL DRUGS

Our country India is famous for its rich agro-climatic, cultural and ethnic biodiversity, which makes access easy to medicinal plants. The herbal drugs have a long era of use, and are more easily affordable and accessible than conventional medicines. The herbal drugs are considered to be a reliable source as they have good patient tolerance and better public acceptance. Thus, for many decades, the population around the world have banked on traditional herbal medicine.⁶

ALOE VERA PLANT

Aloe vera is receiving a lot of attention now-a-days. Aloe vera [*Aloe barbadensis*] is a perennial succulent xerophyte which belongs to the family Asphodelaceae [Liliaceae], native to Africa, Aloe vera is universal in availability. The name is derived from Arabic language and 'alloe' means shining bitter substance, due to the bitter liquid found in leaves, while vera means true. There are more than 400 known species of this plant which is of two species,

1. *Aloe barbadensis* miller
2. *Aloe arborescens*

These are significant species which grow more commonly in tropical climate and in low rainfall area.

HISTORY OF ALOE VERA

In the field of medicine, the utilization of Aloe vera and its products dates back to 4th century.⁷ The Egyptian queens Nefertiti and Cleopatra used Aloe vera in their routine beauty regimens. Alexander, the Great and Christopher Columbus used it to treat the wounded soldiers in war. The ancient Chinese and Egyptians used Aloe vera in the treatment of burns, wounds and to reduce fever. In 1944, Japanese soldiers exposed to bomb attacks used Aloe vera gel in their wounds and reported faster healing and reduced scarring. In ayurvedic medicine, which is the traditional medicine in India, the Aloe vera is used as a laxative, antihelminthic and uterine stimulant. Aloe are also used for decorative purposes and is grown indoors.

PARTS OF ALOE VERA

The Aloe vera is a stiff gray green plant with lance shaped leaves.⁸ Aloe vera leaf has two parts,

1. Central mucilaginous part
2. Peripheral bundle sheath

The central part is made of parenchymal tissue and produces a clear, thin, tasteless jelly like material made up of water, with glucomannans, amino acids, lipids, sterols and vitamins.^{9,10} This is known as Aloe vera gel from which cosmetic and medicinal products are obtained.

The mucilage layer holds the plant together and acts as a barrier to keep the inner gel sterile. The peripheral bundle of sheath cells forms a bitter, yellow, latex containing anthraquinones and glycorides named as aloes /sap/aloe juice. These anthraquinones acts as a powerful laxative.

INGREDIENTS OF ALOE VERA

More than 75 active ingredients are recognized from the inner gel of Aloe vera.^{8,9}

CLASS	COMPOUND	CURATIVE PROPERTY
Aminoacids	Isoleucine, leucine, lysine, methionine, valine, threonine, phenylalanine.	In the body, it houses proteins and muscle tissues.
Anthraquinone	Aloe-emodin, aloetic acid, aloin A and B, isobarbodin, emodin	Acts as Analgesic and antibacterial

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Vitamins	B1, B2, A, C, E, B6, folic acids, alpha tocopherols	Antioxidants neutralizes the free radicals
Minerals	Calcium, chlorine, copper, iron, chromium, magnesium, zinc, sodium, potassium and phosphorus	vital for good health
Enzymes	Alkaline phosphatase, amylase, carboxypeptidase, catalase, bradykinase, cyclooxygenase, peroxidase, lipase, oxidase, superoxide dismutase, carboxypeptidase.	Anti-fungal, anti-viral but toxic at high concentrations
Steroids	Lupeol	Anti-inflammatory lupeol – antiseptic and analgesic
Sugars	Glucose and fructose	Anti-viral, immune modulating activity of acemannan
Carbohydrates	Pure mannan, acetylated mannan, acetylated glucomannan, galactan, xylan, cellulose, glucogalactomannan	Contributes plastic property of the gel
Salicylic acid		Analgesic
Saponins		Cleaning and antiseptic

ALOE VERA IN VARIOUS FORMS

The following forms of Aloe vera are currently in use.^{10,11}

1. Toothpaste
2. Mouthwash
3. Aloe vera topical spray – for throat infections, painful teeth eruptions, joint pains

4. Aloe vera juice as systemic – acts as a detoxifying agent, immune enhancer
5. As a powerful nutritional supplement.
6. Aloe vera in gel form for better healing in burns, stings, insect bites and in skin lesions.

GENERAL USES OF ALOE VERA**1. In wound healing:**

Aloe vera helps in wound healing by the following steps.¹²

1. Keeps the wound moist.
2. Increases migration of epithelial cells and collagen.
3. Decreases inflammation.

Glucomannan, a mannose – rich polysaccharide and gibberellin, a growth hormone - when applied topically leads to the proliferation of fibroblasts, increases collagen III synthesis and improves breaking strength.¹³ It also increases the formation of hyaluronic acid and dermatan sulphate in the granulation tissue of wound healing.¹⁴ Thompson et al reported that topical application of Aloe vera derived allantoin gel stimulate fibroblastic activity and collagen proliferation.¹⁵ Yagi et al, reported that Aloe vera has a glycoprotein with cell proliferating activity. Davis et al noted that Aloe vera rinse [Carrington wound rinse] improves wound healing by providing increase of blood supply through oxygenation.¹⁶

2.Anti – inflammatory property:

Bradykinin an inflammatory substance, that induces pain, is broken down by Bradykinase, a peptidase obtained from Aloe vera.¹⁷ Aloe vera gel [Alcortin A] also inhibits the cyclooxygenase pathway which in turn reduces PGE₂ synthesis from arachidonic acid¹⁸. C-glucosyl chromone is a recently identified novel anti – inflammatory compound from the gel extracts of Aloe vera. Aloe vera [Savila] also plays a vital role as an effective analgesic.

3.Antibacterial property:

Aloe vera [Povizest ointment] has proved to be effective against both gram-negative and gram-positive bacteria.¹⁹ Aloe vera plays a role in amplification of wound healing by getting rid of the bacteria, which intensifies the inflammation.²⁰ Aloe vera gel is proved to be bactericidal against pseudomonas aeruginosa and inhibits streptococcus pyogenes and streptococcus fecalis.²¹ When used in-vitro, the inner leaf gel from Aloe vera inhibits the growth of shigella and streptococcus species.²²

4.Antifungal property:

Candida paraprilo, Candida krusei and Candida albicans species are susceptible to the antifungal activity of purified aloe protein.²³

5. Anti-viral property:

This property can be direct /indirect, direct due to aloe emodin and indirect due to stimulation of immune system.²⁴ Herpes simplex virus [HSV] type 1 and 2 virus, pseudorabies virus and influenza virus are susceptible to the virucidal action of aloe emodin.²⁵ The inner leaf of Aloe vera yields anthraquinones, which shows antiviral property. In a study with two cultured target cell lines, acemannan, which is present in Aloe vera showed a reducing effect in HSV infection. In cell culture, actins which are the fractions of AV gel inhibits cytomegalovirus proliferation by interfering with its protein synthesis.^{26,27}

6. Anti-oxidant property:

The anti-oxidant effects of Aloe vera occurs by superoxide dismutase enzymes, phenolic compounds, and due to the presence of vitamins A, E, and C. They act as a free radical scavenger and removes toxins and carcinogenic substances.²⁸

7. Antimicrobial property:

The growth of disease-causing microorganisms is inhibited by the important constituents of Aloe vera [Biodine -M] like sulphur, salicylic acid, cinnamic acid, urea, nitrogen and phenol. The bacterial, viral and fungal origin infections are also diminished successfully.²⁹

8. Aloe vera on immune system:

Aloe vera boosts natural immunity and balances body's defense and adaptive mechanisms. Acemannan, which contains 90% rhodium and iridium acts as a stimulant and increases the WBC and T cells, activation of macrophages leads to immunomodulating effects, which generates nitric oxide, cytokines [TNF – alpha, IL-1, IL-6, and interferon- gamma], which in turn leads to necrosis and regression of cancerous cells.¹⁸

9. Antitumour effect:

Glycoproteins [lectins] and polysaccharides from Aloe vera showed anticancer effects. There is a reduced tumor necrosis and prolonged survival rates noted with Aloe vera gel.¹⁶

10. Anti – aging effect:

The Aloe vera [Acofar derm] skin gel stimulates fibroblast, which produces collagen and elastin fibers, and it makes the skin more elastic and less wrinkled.³⁰ The higher concentration [0.25% w/w and 0.5% w/w], improved skin hydration by humectant mechanism, whereby aloe vera attracts water from the dermis and retains it in the stratum corneum.¹⁶ Aloe vera softens the skin by exerting cohesive effects on superficial flaking epidermal cells by making them stick together.³¹

ALOE VERA IN DENTISTRY

The dental uses of Aloe vera are enormous. Aloe vera when used to treat oral diseases proved to be beneficial in many ways.

1. Oral lichen planus

Topical application of Aloe vera [Real aloe] for oral lichen planus, gave excellent results when compared to triamcinolone due to its minimal side effects. Aloe vera when applied for 3 times a day, reduces the pain and severity of oral lesions. The oral life quality of patients is also improved.³²

2. Recurrent aphthous stomatitis

Aloe vera 2% oral gel [Regenecare] is effective in decreasing patient's ulcer size and accelerates wound healing. A reduction in the erythema and exudation was observed due to the presence of acemannan.^{18, 33}

3. Oral submucous fibrosis

Aloe vera when used topically [Lidotrex] manifested better response in reducing the burning sensation and increased mouth opening, compared to the antioxidant effect.³⁴ Aloe vera on application leads to dilatation of capillaries at the injured site which improves healing.³⁵ Aloe vera has proved to be effective in the treatment of burning mouth syndrome.

4. Radiation induced oral mucositis

Aloe vera by its anti – inflammatory mechanism prevents oral mucositis, by hastening of wound healing and reduces oral candidiasis in patients undergoing head and neck radiotherapy, through its anti-fungal and immunomodulatory action.³⁶

5. Alveolar osteitis

A freeze- dried pledget namely salicet patch, containing acemannan hydrogel when placed in an extracted socket showed improved healing and formation of blood clot, compared to clindamycin soaked gelfoam.³⁷ The active component of Aloe vera acemannan was found to be effective in bone regeneration.³⁸

6. Denture adhesive

The content acemannan a complex of mannose carbohydrate, was tried as a denture adhesive and it has proved to be a stable adhesive in terms of bond strength and minimum cytotoxicity was noted.³⁹ The saponins are soapy substances containing glycosides, and are used as denture cleansers.

7. Aloe vera as anti-cariogenic agent

The cariogenic and periodontopathic bacteria are susceptible to Aloe vera gel [Aloe vera]. The Aloe vera gel is capable of producing inhibition zones against all oral bacteria tested.⁴⁰

8. Aloe vera in obturation of primary teeth

Aloe vera when mixed with sterile water was found to be having better antimicrobial activity when compared to zinc oxide, calcium hydroxide with iodoform when used as a obturating material in primary teeth.⁴¹

9. Aloe vera in denture stomatitis

Denture stomatitis is most commonly due to the fungus candida albicans. Aloe vera mouthwash [Aloe vera] as it contains natural anthraquinones helps to treat the denture stomatitis.⁴²

ALOE VERA IN PERIODONTOLOGY

1. Gingivitis

The anti-inflammatory and wound healing activity of Aloe vera due to the presence of mannose -6-phosphate, makes it an adjunct to mechanical therapy for the treatment of plaque induced gingivitis. Aloe vera when used for gingivectomy showed better healing.⁴³ The sterols and lupeols present in Aloe vera acts as antiinflammatory and antiseptic respectively, and leads to a decrease in gingival index.

2. Periodontitis

Subgingival delivery of Aloe vera, showed improved periodontal conditions in terms of plaque index, gingival index, probing pocket depth and levels of plaque accumulation. Reduced swelling, soft tissue edema and gingival bleeding are noted with Aloe vera.⁴⁴

3. Aloe vera as tooth gel

Since it does not contain the abrasive elements, Aloe vera tooth gel is less harsh on the teeth, making it as a good alternative for sensitive teeth and gums. Aloe vera gel has proved to be an effective anti-bacterial agent against variety of species like *streptococcus mitis*, *prevotella intermedia*, *enterococcus faecalis* etc.⁴⁵ The Aloe vera toothpaste was found to be effective against *streptococcus mutans*, *candida albicans* and *enterococcus faecalis*.⁴⁶

4. Aloe vera as LDD

There was a significant reduction in the pocket depth when Aloe vera used as local drug delivery agent. Aloe vera when given sub gingivally, as an adjunct to scaling and root planning in patients with chronic periodontitis was proved to be effective.³¹

5. Aloe vera containing dental floss

The antimicrobial and healing properties of Aloe vera increases the efficacy of flossing, and aids in prevention of periodontal disease and caries. On comparison with the synthetic floss [nylon] and organic floss[beeswax], the Aloe vera containing floss is gentle and has smoother finish.⁴⁷

6. Implants

Aloe vera is found to be effective in reducing inflammation by its anti- microbial and anti – inflammatory property around implants. Thus, it helps to improve bone implant interface and prevents peri-implantitis. Aloe vera gel also stimulates bone growth around and onto the surface of endosseous dental implants placed in sites with extended peri-implant osseous defects.⁴⁸

CONTRAINDICATIONS OF ALOE VERA

1. Aloe vera is contraindicated in children under 10 years of age as more incidences of stomach pain, cramps and diarrhea was reported.
2. After topical application of Aloe vera, dermatitis and hypersensitivity were noted in some cases²³.
3. Aloe vera should be used cautiously in pregnancy and in lactating mothers as it leads to stimulations of uterine contractions and gastrointestinal stress respectively.
4. Aloe vera interacts with hypoglycemic drugs and further intensifies hypoglycemia.³¹
5. The risk of potassium depletion is observed when Aloe vera and furosemide are used together. This leads to the increase in the adverse effects of digoxin and digitoxin and reduces its effectiveness.

SIDE EFFECTS

TOPICAL

Redness, burning sensation, rarely generalized edema are noted in sensitive individuals, thus it should be first tested in a small area for any allergic reaction.³¹

ORAL

Acute toxicity leads to abdominal cramps, diarrhea, while on prolonged use it increases the risk of colorectal cancer. The laxative effect causes electrolytic imbalances leading to low potassium levels.³¹

CONCLUSION

Aloe vera possess a wide array of biological properties, such as anti-microbial, antioxidant, anti-inflammatory effects and thus it is acclaimed worldwide

since many years for its beneficial properties. The utilization of the herbs in dentistry is becoming well known these days, as they relatively produce less harmful side effects and are more economical. Thus, medicinal herbs must be incorporated in regular oral health care practices to obtain maximum benefits. Though there are many advantages of Aloe vera been proved, the studies available in literature are all short-term studies, thus long-term studies are needed to be conducted with large sample size. Further attention and research is required in standardization and quality assurance and long-term side effects of Aloe vera products. Thus, a proper diagnosis, knowledge about the risks and benefits of traditional herbs like Aloe vera is very essential in ensuring success. Thus, Aloe vera is indeed a nature's gift to humanity, provided we utilize the benefits effectively.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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