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USE OF ALOE VERA IN DENTISTRY

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Search Strategy:
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1  (aloe adj vera),tw. (813)
2  limit 1 to dentistry journals (39)
3  exp Tooth Diseases/ (145760)
4  exp Periodontal Diseases/ (72291)
5  exp Oral Surgical Procedures/ (53018)
6  1 and (3 or 4 or 5) (10)
7  (tooth or teeth or gingiv$ or periodont$ or dental$ or dentist$ or dentition).ti. (222634)
8  1 and 7 (27)
9  2 or 6 or 8 (53)
10 limit 9 to english language (52)

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Unique Identifier 26015726
Status PubMed-not-MEDLINE
Authors Mangaiyarkarasi SP; Manigandan T; Elumalai M; Cholan PK; Kaur RP.
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Kaur,Roopam Pal. Department of Pharmacology, Sree Balaji Dental College and Hospital, Pallikaranai, Chennai, Tamil Nadu, India.
Title Benefits of Aloe vera in dentistry. [Review]
Other ID Source: NLM. PMC439686

Abstract Aloe vera (Aloe barbadensis) is a plant that belongs to Liliaceae family. The name Aloe derives from the Arabic word "Alloeh" meaning shining bitter substance while "vera" in Latin means true. It contains various minerals and vitamins. It has got various properties such as immunomodulatory, antiviral and antiinflammatory in nature. A. vera can play a significant role in dentistry in treatment of lichen planus, oral submucous fibrosis, recurrent aphthous stomatitis, alveolar osteitis, periodontitis, etc.

Publication Type Journal Article.  Review.
Date Created 20150527
Year of Publication 2015

Unique Identifier 25821369
Status PubMed-not-MEDLINE
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Deepak,B M. Department of Pedodontics and Preventive Dentistry, Bapuji Dental College and Hospital, Davangere, Karnataka, India.
Title Cavity disinfection in minimally invasive dentistry - comparative evaluation of Aloe vera and propolis: A randomized clinical trial.
Other ID Source: NLM. PMC4374313

Abstract CONTEXT: The survival of atraumatic restorative treatment (ART) restorations would probably increase if near total elimination of cariogenic microorganisms could be done in the process of cavity cleaning before going ahead with the restoration. Thus, use of naturally occurring disinfecting agents for achieving this goal could herald a new beginning in the field of contemporary minimum intervention dentistry.
AIMS: To evaluate the efficacy of hand instruments in excavating dental caries and comparatively evaluate the roles of Aloe vera and propolis as potential cavity disinfecting agents after minimally invasive hand excavation of dental caries.

SETTINGS AND DESIGNS: Experimental, in vivo intergroup split mouth, randomized clinical trial.

SUBJECTS AND METHODS: The study included Group I (Control), Group II (A. vera) and Group III (propolis). Ten patients with three teeth each have occlusal/occlusoproximal lesions suitable for ART were selected. Dentinal samples were collected three times from each tooth viz., preexcavation, postexcavation and postdisinfection of the cavities. These dentinal samples were subjected to microbiological analyses for total viable count.

STATISTICAL ANALYSIS USED: Repeated measures of analysis of variance (ANOVA) with Bonferroni post-hoc test and one-way ANOVA with Tukey post-hoc test.

RESULTS: In all the three groups, significant amount of bacteria were left behind after hand excavation. Group II and Group III, in which cavities were treated with A. vera and propolis extracts respectively, showed a significant reduction in the bacterial counts when compared to control the group.

CONCLUSIONS: Hand excavation alone does not completely eliminate bacteria, which may predispose treated teeth to secondary caries. Both propolis and A. vera extracts can be used as potential natural disinfecting agents, thereby embracing the concept of phytotherapy in minimum intervention dentistry.

Title: Effect of Aloe vera mouthwash on periodontal health: triple blind randomized control trial.
Abstract
BACKGROUND: With the increasing incidence of periodontal diseases and development of antibiotic resistance, the global need for alternative treatment modalities, safe, effective, and economical products is the need of time. Aloe vera is a medicinal plant which has the greater medicinal value and enormous properties for curing and preventing oral diseases.

AIM: The aim of the study was to access the effect of Aloe vera mouthwash on the dental plaque and gingivitis and comparing it with the bench mark control chlorhexidine and placebo.

MATERIAL AND METHODS: 345 healthy subjects were randomly allocated in 3 groups to the test group (n=115) - mouthwash containing Aloe vera, Control group (n=115) - chlorhexidine group, Distilled water - Placebo (n=115). Plaque Index (PI) and Gingival Index (GI) were assessed at days 0, 15 and 30. Subjects were asked to rinse their mouth with the stated mouthwash, twice a day, during a 30-day period.

RESULTS: Our result showed that Aloe vera mouthrinse is equally effective in reducing periodontal indices as Chlorhexidine. The results demonstrated a significant reduction of gingival bleeding and plaque indices in both groups over a period of 15 and 30 days as compared to placebo group. There was a significant reduction on plaque and gingivitis in Aloe vera and chlorhexidine groups and no statistically significant difference was observed among them (p>0.05). Aloe vera mouthwash showed no side effects as seen with chlorhexidine.

CONCLUSION: The results of the present study indicate that Aloe vera may prove to be an effective mouthwash owing to its ability in reducing periodontal indices.
USE OF ALOE VERA IN DENTISTRY

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Prasad,T Srinivasa. Professor & H.O.D, Department of Oral & Maxillofacial Surgery, Dental College & Hospital, Thalambur, Chennai, India.

Title
Aloe vera in dentistry.

Source

Other ID
Source: NLM. PMC4253296

Abstract
Aloe vera is a medicinal plant which has been used for thousands of years. The health benefits of aloe vera is well known and the dental uses of this plant is multiple. Interest is gathering among researchers regarding the use of this plant. Studies have proved the antiseptic, anti inflammatory, antiviral and antifungal properties of aloe vera and the use of this plant is proved beneficial. This plant is proved to be non allergic and very good in building up the immune system. Aloe vera is gaining popularity in dentistry as it is completely natural and there is no side effects being reported with its use. This paper gives an overview of the uses of this miracle plant and its uses in dentistry.

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Journal Article.

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2014

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In-Process

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Institution

Title
Diffusion of hydroxyl ions from calcium hydroxide and Aloe vera pastes.

Source
Brazilian Dental Journal. 25(3):212-6, 2014.

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Abstract
This study evaluated the diffusion through the dentinal tubules of hydroxyl ions from different calcium hydroxide (CH) pastes containing Aloe vera. Sixty single-rooted bovine teeth were used. The tooth crowns were removed, the root canals were instrumented and the specimens were assigned to 4 groups (n=15) according to the intracanal medication: Group CH/S - CH powder and saline paste; Group CH/P - CH powder and propylene glycol paste; Group CH/A - calcium hydroxide powder and Aloe vera gel paste; Group CH/A/P - CH powder, Aloe vera powder and propylene glycol paste. After placement of the root canal dressings, the teeth were sealed coronally and apically with a two-step epoxy adhesive. The teeth were placed in identified flasks containing deionized water and stored in an oven with 100% humidity at 37 degreeC. After 3 h, 24 h, 72 h, 7 days, 15 days and 30 days, the deionized water in the flasks was collected and its pH was measured by a pH meter. The obtained data were subjected to statistical analysis at a significance level of 5%. The results demonstrated that all pastes provided diffusion of hydroxyl ions through the dentinal tubules. The combination of Aloe vera and CH (group CH/A) provided a constant release of calcium ions. Group CH/A/P showed the highest pH at 24 and 72 h. In conclusion, the experimental pastes containing Aloe vera were able to enable the diffusion of hydroxyl ions through the dentinal tubules.

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Journal Article. Research Support, Non-U.S. Gov't.

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Nejaim, Yuri. Department of Oral Diagnosis, Piracicaba Dental School, State University of Campinas.
The aim of this study was to evaluate the radioprotective and reparative effects of compounds based on aloe vera, zinc, and copper against salivary gland dysfunction in Wistar rats. A total of 150 Wistar rats were randomly divided into 12 groups, in which the animals received aloe vera and/or zinc and copper. In eight of these groups the animals were also subjected to irradiation before or after administration of the substances. After 27 days, sialometry tests were performed. Data were analyzed using ANOVA and the Tukey test (P < 0.05). Rats that had been administered aloe vera before or after irradiation showed a significantly higher salivary flow rate than rats that had been simply irradiated. When both substances were administered, a statistically significant difference in the salivary flow rate was observed in comparison with the irradiation alone group seven days after irradiation. The present results suggest that aloe vera exerts positive protective and reparative effects, and can be considered a potential radioprotective substance.

**Title**
Evaluation of radioprotective effect of aloe vera and zinc/copper compounds against salivary dysfunction in irradiated rats.

**Source**

**Abstract**
The aim of this study was to evaluate the radioprotective and reparative effects of compounds based on aloe vera, zinc, and copper against salivary gland dysfunction in Wistar rats. A total of 150 Wistar rats were randomly divided into 12 groups, in which the animals received aloe vera and/or zinc and copper. In eight of these groups the animals were also subjected to irradiation before or after administration of the substances. After 27 days, sialometry tests were performed. Data were analyzed using ANOVA and the Tukey test (P < 0.05). Rats that had been administered aloe vera before or after irradiation showed a significantly higher salivary flow rate than rats that had been simply irradiated. When both substances were administered, a statistically significant difference in the salivary flow rate was observed in comparison with the irradiation alone group seven days after irradiation. The present results suggest that aloe vera exerts positive protective and reparative effects, and can be considered a potential radioprotective substance.
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Authors
Boonyagul S; Banlunara W; Sangvanich P; Thunyakitpisal P.

Title
Effect of acemannan, an extracted polysaccharide from Aloe vera, on BMSCs proliferation, differentiation, extracellular matrix synthesis, mineralization, and bone formation in a tooth extraction model.

Source

Abstract
Aloe vera is a traditional wound healing medicine. We hypothesized acemannan, a polysaccharide extracted from Aloe vera gel, could affect bone formation. Primary rat bone marrow stromal cells (BMSCs) were treated with various concentrations of acemannan. New DNA synthesis, VEGF, BMP-2, alkaline phosphatase activity, bone sialoprotein, osteopontin expression, and mineralization were determined by [(3)H] thymidine incorporation assay, ELISA, biochemical assay, western blotting, and Alizarin Red staining, respectively. In an animal study, mandibular right incisors of male Sprague-Dawley rats were extracted and an acemannan treated sponge was placed in the socket. After 1, 2, and 4 weeks, the mandibles were dissected. Bone formation was evaluated by dual-energy X-ray absorptiometry and histopathological examination. The in vitro results revealed acemannan significantly increased BMSC proliferation, VEGF, BMP-2, alkaline phosphatase activity, bone sialoprotein and osteopontin expression, and mineralization. In vivo results showed acemannan-treated groups had higher bone mineral density and faster bone healing compared with untreated controls. A substantial ingrowth of bone trabeculae was observed in acemannan-treated groups. These data suggest acemannan could function as a bioactive molecule inducing bone formation by stimulating BMSCs proliferation, differentiation into osteoblasts, and extracellular matrix synthesis. Acemannan could be a candidate natural biomaterial for bone regeneration.

Authors
Dhingra K.

Title
Aloe vera herbal dentifrices for plaque and gingivitis control: a systematic review.

Source

Abstract
OBJECTIVES: To evaluate the effectiveness of aloe vera containing herbal dentifrices in improving plaque control and gingival health.

METHODS: A manual and electronic literature (MEDLINE and Cochrane Central Register of Controlled Trials) search was performed up to July 2012, for randomized controlled trials presenting clinical, microbiological, immunological, and patient-centered data for the efficacy of aloe vera herbal dentifrices for controlling plaque and gingival inflammation in patients with gingivitis.

RESULTS: From 79 titles and abstracts, eight full-text articles were screened and finally two randomized controlled trials were selected. These randomized controlled trials reported that aloe vera dentifrices were similar in efficacy to control dentifrices in effectively reducing plaque and gingival inflammation in gingivitis patients based on the assessment of clinical, microbiological, and patient-centered treatment outcomes. However, many important details (composition and characteristics of aloe vera and control dentifrices along with appropriate randomization, blinding, and outcomes assessed) were lacking in these trials, and therefore, the quality of reporting and methods was generally flawed with high risk of bias.

CONCLUSION: Even though there are some promising results, the clinical effectiveness of aloe vera herbal dentifrices is not sufficiently defined at present and warrants further investigations based on reporting guidelines of herbal CONSORT statement.

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Title
Aloe vera herbal dentifrices for plaque and gingivitis control: a systematic review.

Source

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Abstract
OBJECTIVES: To evaluate the effectiveness of aloe vera containing herbal dentifrices in improving plaque control and gingival health.

METHODS: A manual and electronic literature (MEDLINE and Cochrane Central Register of Controlled Trials) search was performed up to July 2012, for randomized controlled trials presenting clinical, microbiological, immunological, and patient-centered data for the efficacy of aloe vera herbal dentifrices for controlling plaque and gingival inflammation in patients with gingivitis.

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CONCLUSION: Even though there are some promising results, the clinical effectiveness of aloe vera herbal dentifrices is not sufficiently defined at present and warrants further investigations based on reporting guidelines of herbal CONSORT statement.
Clinical and radiographic evaluation of zinc oxide with aloe vera as an obturating material in pulpectomy: an in vivo study.

**Authors:** Khairwa A; Bhat M; Sharma R; Satish V; Maganur P; Goyal AK.
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**Abstract**

**BACKGROUND:** Pulp therapy for pulpally involved primary teeth continues to be a challenge to clinicians. One of the major areas of continued research is in the area of finding obturating materials to suit the specific properties of these teeth. Zinc oxide eugenol is used frequently in pulpectomy for the obturation of the primary teeth.

**AIMS:** To evaluate clinically and radiographically a mixture of zinc oxide eugenol and aloe vera gel as an obturating material.

**MATERIALS AND METHODS:** A total of 50 children, aged between 4 and 9 years, who were screened for unilateral or bilateral carious deciduous molars were studied. Out of these, 15 children were randomly selected for endodontic treatment. Obturation was done with a mixture of zinc oxide powder and aloe vera gel. Clinical and radiographic evaluation was done after 7 days, 1 month, 3 months, 6 months, and 9 months. The data were statistically analyzed.

**RESULTS AND CONCLUSION:** Endodontic treatment using a mixture of zinc oxide powder and aloe vera gel in primary teeth has shown good clinical and radiographic success. A detailed observational study with longer follow-up will highlight the benefits of aloe vera in primary teeth as an obturating medium.
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**Comparison of the antibacterial effect of sodium hypochlorite and aloe vera solutions as root canal irrigants in human extracted teeth contaminated with *Enterococcus faecalis***

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- Motamedifar, M. Dept. of Microbiology, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran.

**Purpose:** The aim of the present study is to compare the antimicrobial effect of Aloe Vera solution with sodium hypochlorite on *E. faecalis* in the root canals of human extracted teeth.

**Method:**
- Sixty human extracted single rooted teeth were selected for this in vitro study. The teeth recruited in this study had no cracks, internal resorption, external resorption and calcification. Enterococcus faecalis was injected in the root canals of all teeth. The teeth were then divided into three groups randomly. Each group consisted of 20 teeth that were all rinsed with one of the following solutions: sodium hypochlorite 2.5%, Aloe vera and normal saline. Subsequent to rinsing, root canals of all teeth were sampled. The samples were cultured and growth of the bacteria was assessed after 48 hours. The number of colonies of the bacteria was then counted.

**Results:** The difference between the inhibitory effect of Aloe vera and normal saline on *E. faecalis* was not significant according to independent t-test (p= 0.966). The inhibitory effect of sodium hypochlorite on *E. faecalis* was much greater than that of Aloe vera and normal saline (p< 0.001).

**Conclusion:** Aloe vera solution is not recommended as a root canal irrigator, but future studies are suggested to investigate the antibacterial effect of Aloe vera with longer duration of exposure and as an intra canal medicament.
runt-related transcription factor 2, expression of vascular endothelial growth factor, bone morphogenetic protein-2 and type I collagen, alkaline phosphatase activity, and mineralized nodule formation were determined using [(3)H]-thymidine incorporation, reverse transcription-polymerase chain reaction, enzyme-linked immunosorbent assay, biochemical assay and alizarin red staining, respectively. In our in vivo study, premolar class II furcation defects were made in four mongrel dogs. Acemannan sponges were applied into the defects. Untreated defects were used as a negative control group. The amount of new bone, cementum and periodontal ligament formation were evaluated 30 and 60 d after the operation.

RESULTS: Acemannan significantly increased periodontal ligament cell proliferation, upregulation of growth/differentiation factor 5, runt-related transcription factor 2, vascular endothelial growth factor, bone morphogenetic protein 2, type I collagen and alkaline phosphatase activity, and mineral deposition as compared with the untreated control group in vitro. Moreover, acemannan significantly accelerated new alveolar bone, cementum and periodontal ligament formation in class II furcation defects.

CONCLUSION: Our data suggest that acemannan could be a candidate biomolecule for periodontal tissue regeneration.Copyright © 2013 John Wiley & Sons A/S. Published by John Wiley & Sons Ltd.
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Mishra, Sumit. Department of Prosthodontics, T.M.D.C. & R.C., Moradabad, Uttar Pradesh, India.

Title
Preliminary antiplaque efficacy of aloe vera mouthwash on 4 day plaque re-growth model: randomized control trial.

Source

Other ID
Source: NLM. PMC4006208

Abstract
BACKGROUND: Due to increasing resistance to antibiotics and rising incidence of oral diseases, there is a need for alternative treatment modalities to combat oral diseases. The aim of the present study was to access the effect of Aloe vera mouthwash on the dental plaque in the experimental period of 4 days and to compare it with the bench mark control chlorhexidine and placebo (saline water).

MATERIAL AND METHODS: A total of 300 systemically healthy subjects were randomly allocated into 3 groups: Aloe vera mouthwash group (n=100), control group (=100), chlorhexidine group and saline water.Placebo (n=100). To begin with, Gingival index (GI) and plaque index (PI) were recorded. Then, baseline plaque scores were brought to zero by professionally cleaning the teeth with scaling and polishing. After randomization of the participants into three groups they were refrained from regular mechanical oral hygiene measures. Subjects were asked to swish with respective mouthwash (Aloe vera mouthwash, 0.2%chlorhexidine gluconate mouthwash, or normal saline) as per therapeutic dose for 4 days.

RESULTS: The results showed that Aloe vera mouthrinse is equally effective in reducing plaque as Chlorhexidine compared to placebo over a period of 4 days. There was a significant reduction on plaque in Aloe vera and chlorhexidine groups and no statistically significant difference was observed among them (p>0.05). Aloe vera mouthwash showed no side effects.

CONCLUSION: The results of the present study indicated that Aloe vera may prove an effective mouthwash due to its ability in reducing dental plaque.

Publication Type
Comparative Study. Journal Article. Randomized Controlled Trial.

**Authors:** Doddanna SJ; Patel S; Sundarrao MA; Veerabhadrappa RS.

**Institution:** Doddanna, Sunitha Jagalur. Department of Oral Pathology and Microbiology, Teerthanker Mahaveer Institute of Dental Sciences and Research Centre, Teerthanker Mahaveer University, Bagarpur, Delhi Road, Moradabad, Uttar Pradesh, India.

**Title:** Antimicrobial activity of plant extracts on Candida albicans: an in vitro study.

**Source:** Indian Journal of Dental Research. 24(4):401-5, 2013 Jul-Aug.

**Abstract:**

BACKGROUND AND OBJECTIVES: Plants as sources of medicinal compounds have continued to play a predominant role in the maintenance of human health since ancient times. Even though several effective antifungal agents are available for oral candida infections, the failure is not uncommon because isolates of Candida albicans may exhibit resistance to the drug during therapy. The present study was conducted to evaluate the antimicrobial effects of few plant extracts on Candida albicans. An additional objective was to identify an alternative, inexpensive, simple and effective method of preventing and controlling Candida albicans.

MATERIALS AND METHODS: Fine texture powder or paste form of leaves was soaked in sterile distilled water and 100% ethyl alcohol, which were kept in refrigerator at 4degreeC for 24 h. Then filtrates were prepared and kept in a hot air oven to get a black shining crystal powder/paste form. Stock solutions of plant extracts were inoculated on petri plates containing species of Candida albicans and incubated at 25 ± 2degreeC for 72 h.

RESULTS: Alcoholic curry leaves showed the maximum zone of inhibition on Candida albicans followed by aqueous tea leaves. The other plant extracts like alcoholic onion leaves, alcoholic tea leaves, alcoholic onion bulb, alcoholic aloe vera, and alcoholic mint leaves also inhibited the growth of Candida albicans but lesser extent.

CONCLUSION: The present study renders few medicinal plants as an alternative medicines to the field of dentistry which can be used adjunct to conventional therapy of oral candidasis.

**Antiseptic mouth rinses: an update on comparative effectiveness, risks and recommendations.**

**Authors:** Osso D; Kanani N.

**Institution:** Osso, Diane; Kanani, Nehal.

**Title:** Antiseptic mouth rinses: an update on comparative effectiveness, risks and recommendations.

**Source:** Journal of Dental Hygiene. 87(1):10-8, 2013 Feb.

**Abstract:**

PURPOSE: Antiseptic mouth rinses are widely recommended and marketed to improve oral health. This article summarizes current studies on the comparative effectiveness of selected antiseptic mouth rinses in controlling plaque and gingivitis, as well as risks associated with daily usage, including salivary flow rate, oral cancer and wear of composite restorations.

METHODS: Electronic database searches were conducted using Google Scholar and PubMed to identify articles comparing the effectiveness of 4 commercially marketed antiseptic mouth rinses differing in active ingredients (0.12% chlorhexidine gluconate, essential oils (menthol, thymol and eucalyptol) and methyl salicylate, 0.7% cetylpyridinium chloride and 20% aloe vera gel) for controlling plaque and gingivitis. Criteria for inclusion included controlled clinical trials and systematic reviews appearing in English language publications evaluating the comparative effectiveness of the mouth rinses in controlling plaque and gingivitis, as well as risks associated with daily usage.

RESULTS: The majority of studies have shown mouth rinses containing chlorhexidine gluconate or essential oils and methyl salicylate provide clinically significant anti-gingivitis and anti-plaque benefits. Cetylpyridinium chloride has been found to provide only limited clinical benefits compared to inactive control mouth rinse. Inadequate evidence is available to evaluate the clinical effectiveness of aloe vera gel. Chlorhexidine, essential oils and
Use of Aloe Vera in Dentistry

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Cetylpyridinium have been found to be safe. However, limited data are available on the effects of the mouth rinse on wear patterns of dental restorations. Studies reviewed reported no significant difference in salivary flow rate related to alcohol based mouth rinse.

Conclusion: Research supports the effectiveness of antiseptic mouth rinses in reducing plaque and gingivitis as an adjunct to home care. Insufficient evidence is available to support the claim that oral antiseptics can reduce the risk of developing periodontitis or the rate of progression of periodontitis.

Objective: Aloe vera is the oldest medicinal plant that has maintained its popularity over the course of time. It is widely known for its medicinal uses in wound healing, as an analgesic, and for its anti-inflammatory properties.

Aim: The aim of this study is to evaluate the anti-inflammatory property of aloe vera mouthwash on plaque-induced gingivitis.

Materials and Methods: 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. Group 1 was asked to rinse with 10 ml of aloe vera mouthwash twice daily for three months. Group 2 were treated with scaling only. Group 3 patients were asked to rinse with aloe vera mouthwash and scaling was done. The clinical changes were evaluated with Loe and Silness gingival index (1963) and Muhlemann and Son's Sulcus bleeding index (1971) at baseline, after one month and three months, respectively.

Results: The data obtained was compared statistically. The paired t-test was done for intragroup comparison and one-way analysis of variance with a post hoc Tukey test was used for intergroup comparison. The data was obtained at the baseline, end of first month, and end of the third month. The result suggested reduction in gingival inflammation in all the three groups, but it was more in the aloe vera mouthwash and scaling group. 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.

Context. Dental unit waterlines may be heavily contaminated with microorganisms and are a potential source of infection for both practicing staff and immunocompromised patients. Contamination of dental unit water lines could be inhibited with the use of disinfectants. The present study investigates the effect of aloe-vera-based disinfectant in reducing the microbial growth in dental unit water lines (DUWLs). Aims. To compare the efficacy of aloe vera, hydrogen peroxide (H2O2), and 5% sodium hypochlorite (NaOCl) in controlling microbial contamination of DUWLs. Materials and Methods. After obtaining baseline water samples, the dental unit waterlines were treated with aloe vera, 10% hydrogen peroxide, and 5% sodium hypochlorite. Each of the three disinfectants was used in increasing
concentrations and their inhibiting effect was compared. Water samples were analyzed for microbiological quality by the total viable count (TVC) method. Statistical Analysis Used: SPSS 16. Results: There was significant reduction in mean CFU/ml when treated with disinfectants each for a period of one week. Aloe-vera solution was found to be the most effective in reducing the microbial colonies. Conclusions: Improving the water quality from dental unit water lines is of considerable importance; chemical-based disinfectants can be replaced with herbal disinfectants for treating microbial contamination in dental unit waterlines.

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Institution: Thongprasom, Kobkan. Oral Medicine Department, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand.

Title: Novel therapies for oral lichen planus. [Review]


Abstract: Oral lichen planus (OLP) is a chronic mucocutaneous disorder commonly found in middle-aged women. Despite the progress in research and advance in knowledge on OLP, a successful management is still difficult to achieve. The main aim of OLP treatment is to control the symptoms of the affected patients. Steroids and other immunosuppressive drugs have been recommended and widely used in the treatment of OLP. Topical corticosteroids are the mainstay of OLP treatment, but strong evidence on their effectiveness is lacking. The effectiveness of alternative ways of managing OLP has been recently reported. Topical aloe vera, topical pimecrolimus and oral curcuminoids are the most promising of the new treatment modalities. Other interesting modalities are topically applied thalidomide and amlexanox. Nevertheless, the careful assessment between the risks and benefits of these drugs is crucial and larger and well-conducted trials need to confirm the above encouraging results. Copyright © 2013 John Wiley & Sons A/S. Published by John Wiley & Sons Ltd.

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Title: Aloe vera as cure for lichen planus.


Abstract: Oral lichen planus is a difficult condition to treat because of its chronic nature. Various treatment modalities have resulted in partial regression of symptoms but not a complete cure. Aloe vera, a product with minimal adverse effects, can be tried to treat this disorder. A 38-year-old male patient diagnosed with lichen planus of the skin and the oral mucosa was suffering from severe pain and a burning sensation intraorally and pruritus of the skin lesions. Considering the extensive involvement, an herbal alternative was considered. The patient was prescribed aloe vera juice and gel application for two months. At the nine-month follow-up, the patient was symptom-free and totally cured of the intraoral and skin lesions.
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USE OF ALOE VERA IN DENTISTRY

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MEDLINE
Authors
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Abstract
OBJECTIVE: Definitive therapy is not defined for the management of oral submucous fibrosis (OSMF). This study evaluated the efficacy of aloe vera gel as an adjuvant treatment of OSMF.

STUDY DESIGN: A double-blind, placebo-controlled, parallel-group randomized controlled trial was conducted on 60 subjects with OSMF divided into medicinal treatment (submucosal injection of hyaluronidase and dexamethasone, n = 30) and surgical treatment (n = 30) categories. Each category was randomly divided into groups A (with aloe vera, n = 15 per category) and B (without aloe vera, n = 15 per category). Follow-up assessment for various symptoms was performed, and results were analyzed using paired and unpaired Student t tests.

RESULTS: The group receiving aloe vera had a significant improvement in most symptoms of OSMF (P < .01) compared with the non-aloe vera group, in both the medicinal and surgical categories.

CONCLUSIONS: Aloe vera gel was effective as an adjuvant in treatment of OSMF.

Bhardwaj A; Velmurugan N; Sumitha; Ballal S.
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Abstract
Efficacy of passive ultrasonic irrigation with natural irrigants (Morinda citrifolia juice, Aloe Vera and Propolis) in comparison with 1% sodium hypochlorite for removal of E. faecalis biofilm: an in vitro study.

Source
MATERIALS AND METHODS: The commercially available dental gel formulations were Corsodyl (COG, 1% chlorhexidine), Cervitec (CEG, 0.2% chlorhexidine + 0.2% sodium fluoride), Forever Bright (FOB, aloe vera), Gengigel (GEG, 0.2% hyaluronic acid), 35% fluoride, Forever Bright (FOB, aloe vera), Gengigel (GEG, 0.2% hyaluronic acid), 35% fluoride), Corsodyl (COG, 1% chlorhexidine), and 0.5% chlorhexidine gel. Direct and transdentinal (indirect) agar diffusion was performed by applying gel to a vacuum pump and adding 0.1 ml of the gels to each well. Transdentinal (indirect) agar diffusion was performed by applying gel to the wells and the dentin discs were measured and analyzed using Kruskal-Wallis and Mann-Whitney U tests with Bonferroni correction (p < 0.01).

RESULTS: Direct agar diffusion tests showed significant differences among all gel formulations (p < 0.01) except for COG and CEG (p > 0.01). COG and CEG exhibited higher antibacterial effects compared to FOB and GEG (p < 0.01) in both direct and transdentinal (indirect) testing procedures. GEG did not show any antimicrobial activity in transdentinal (indirect) testing.

CONCLUSION: Commercially available dental gels inhibited S. mutans, which may indicate their potential as cavity disinfectants.
To request copies of any of these articles please use one of our request forms. Articles can be emailed or posted for a charge of £3.00 each.
Abstract

BACKGROUND AND OBJECTIVES: Oral submucous fibrosis (OSMF) is a potentially malignant disorder of the oral mucosa, mainly associated with the practice of chewing gutka and betel quid. The pathogenesis is obscure, and till date, no definitive therapy is available for the management of OSMF. Hence, this preliminary study was carried out to compare the efficacy of Aloe vera with antioxidants in the treatment for OSMF.

METHODS: Twenty study subjects with OSMF were included in the study. Patients were divided into two groups. There were 10 patients in each group; group A subjects received 5 mg of aloe vera gel to be applied topically three times daily for 3 months and group B subjects received antioxidant capsules twice daily for 3 months. The results were analyzed with paired ‘t’ test and unpaired ‘t’ test.

RESULTS: Aloe vera responded better in all the parameters assessed and responded in all the clinicohistopathological stages particularly in those with mild-stage clinically and early-stage histopathologically. Aloe vera showed a statistically significant reduction in burning sensation (P = 0.008), improvement in mouth opening (P = 0.02), and cheek flexibility (P = 0.01) on comparing with the antioxidant group.

INTERPRETATION AND CONCLUSION: Overall assessment of the parameters depicted that Aloe vera group showed a better treatment response compared to the antioxidants group. It reduces the burning sensation and improves mouth opening thereby enhanced the patients' compliance. It proves to be a relatively safe, can be applied topically, easily available, economical, noninvasive, and efficacious in the treatment for OSMF.

Methods: A randomized, double-blind, clinical trial was designed. The study sample constituted 40 patients (23 males and 17 females) who were randomly divided into two equal groups. Group A patients received aloe vera gel, while group B patients received triamcinolone acetonide.

RESULTS: Forty patients were included in the study. Most of the sample presented with erosive (n = 18) and atrophic (n = 14) variants of oral lichen planus. When clinical signs and symptoms were observed after 8 weeks of therapy, it was determined that aloe vera gel was more effective than triamcinolone acetonide in the treatment of oral lichen planus.

CONCLUSION: Aloe vera gel can be considered a safe alternative treatment for oral lichen planus.

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MEDLINE
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Title
Clinical and microbiologic effects of commercially available dentifrice containing aloe vera: a randomized controlled clinical trial.
Source
Abstract
BACKGROUND: Certain plants used in folk medicine serve as a source of therapeutic agents that have antimicrobial and other multipotential effects. This prospective, randomized, placebo, and positively controlled clinical trial was designed to evaluate the clinical and microbiologic effects of a commercially available dentifrice containing aloe vera on the reduction of plaque and gingival inflammation in patients with gingivitis.
METHODS: Ninety patients diagnosed with chronic generalized gingivitis were selected and randomly divided into three groups: group 1, placebo toothpaste; group 2, toothpaste containing aloe vera; and group 3, toothpaste with polymer and fluoride containing triclosan. Clinical evaluation was undertaken using a gingival index, plaque was assessed using a modification of the Quigley-Hein index, and microbiologic counts were assessed at baseline, 6 weeks, 12 weeks, and 24 weeks. A subjective evaluation was also undertaken by questionnaire.
RESULTS: Toothpaste containing aloe vera showed significant improvement in gingival and plaque index scores as well as microbiologic counts compared with placebo dentifrice. These improvements were comparable to those achieved with toothpaste containing triclosan.
CONCLUSION: Toothpaste containing aloe vera may be a useful herbal formulation for chemical plaque control agents and improvement in plaque and gingival status.
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Comparative Study.  Journal Article.  Randomized Controlled Trial.
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MEDLINE
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Title
Inhibitory activity of Aloe vera gel on some clinically isolated cariogenic and periodontopathic bacteria.
Source
Abstract
Aloe vera is a medicinal plant with anti-inflammatory, antimicrobial, antidiabetic and immune-boosting properties. In the present study we investigated the inhibitory activities of Aloe vera gel on some cariogenic (Streptococcus mutans), periodontopathic (Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis) and an opportunistic periodontopathogen (Bacteroides fragilis) isolated from patients with dental caries and periodontal diseases. Twenty isolates of each of these bacteria were investigated for their sensitivity to Aloe vera gel using the disk diffusion and microdilution methods. S. mutans was the species most sensitive to Aloe vera gel with a MIC of 12.5 micro g/ml, while A. actinomycetemcomitans, P. gingivalis, and B. fragilis were less sensitive, with a MIC of 25-50 micro g/ml (P < 0.01). Based on our present findings it is concluded that Aloe vera gel at optimum concentration could be used as an antiseptic for prevention of dental caries and periodontal diseases.
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Journal Article.  Research Support, Non-U.S. Gov't.
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USE OF ALOE VERA IN DENTISTRY

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Title
Aloe vera: Nature’s soothing healer to periodontal disease.
Source
Other ID
Source: NLM. PMC3200013
Abstract
BACKGROUND: Recent interest and advances in the field of alternative medicine has promoted the use of various herbal and natural products for multiple uses in the field of medicine. Aloe vera is one such product exhibiting multiple benefits and has gained considerable importance in clinical research. This clinical study focuses on Aloe vera and highlights its property when used as a medicament in the periodontal pocket.

MATERIALS AND METHODS: A total number of 15 subjects were evaluated for clinical parameters like plaque index, gingival index, probing pocket depth at baseline, followed by scaling and root planing (SRP). Test site comprised of SRP followed by intra-pocket placement of Aloe vera gel, which was compared with the control site in which only SRP was done, and clinical parameters were compared between the two sites at one month and three months from baseline.

RESULTS: Results exhibited encouraging findings in clinical parameters of the role of Aloe vera gel as a drug for local delivery.

CONCLUSION: We conclude that subgingival administration of Aloe vera gel results in improvement of periodontal condition. Aloe vera gel can be used as a local drug delivery system in periodontal pockets.

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2011
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Title
Antimicrobial capacity of Aloe vera and propolis dentifrice against Streptococcus mutans strains in toothbrushes: an in vitro study.
Source
Other ID
Source: NLM. PMC3928769
Abstract
OBJECTIVES: This study evaluated in vitro the efficiency of Aloe vera and propolis dentifrice on reducing the contamination of toothbrush bristles by a standard strain of Streptococcus mutans (ATCC 25175; SM), after toothbrushing.

MATERIAL AND METHODS: Fifteen sterile toothbrushes were randomly divided into 5 toothbrushing groups: I (negative control): without dentifrice; II: with fluoridated dentifrice; III: with triclosan and gantrez dentifrice; IV (positive control): without de

RESULTS: There was statistically significant difference (p<0.05) for the reduction of bristle contamination comparing groups II, III, IV and V to group I.

CONCLUSIONS: It may be stated that after toothbrushing, the Aloe vera and propolis dentifrice reduced the contamination of toothbrush bristles by SM, without differentiation from the other chemical agents used.
Herbs have been used for centuries to prevent and control disease. Herbal extracts are effective because they interact with specific chemical receptors within the body and are in a pharmacodynamic sense, drugs themselves. By using herbal medicines, patients have averted the many side effects that generally come with traditional medicines, but this does not mean that side effects do not occur. Only knowledgeable practitioners can prescribe the right herb and its proper dosage. Herbal medicines had been considered in every culture, however, pharmaceutical companies overturned this type of thinking. Now, pharmaceuticals are called traditional and herbs are labeled as the ‘alternative’. The biggest challenge and problem is lack of information about the effect of herbs in oral tissues, mechanism of effect, and side effects. Several popular conventional drugs on the market are derived from herbs. These include aspirin (from white willow bark), digitalis (from foxglove), and sudafed (modelled after a component in the plant ephedra). Herbal products can vary in their potency. Therefore, care must be taken in selecting herbs, even so, herbal medicines have dramatically fewer side effects and are safer to use than conventional medications. The herbs described in this article are Bloodroot, Caraway, Chamomile, Echinacea, Myrrh, Peppermint, Rosemary, Sage, Thyme, Aloe Vera, Propolis, and a summary of other herbs that are useful and safe when used with radiated head and neck cancer patients.

METHOD AND MATERIALS: Seven commonly used topical oral agents -0.12% chlorhexidine with alcohol, 0.12% chlorhexidine without alcohol, baking soda-salt rinse, 0.4% stannous fluoride gel, 0.63% stannous fluoride rinse, calcium phosphate mouthrinse, and acemannan hydrogel (aloe vera) rinse - were evaluated in vitro for their antimicrobial efficacies against four common microorganisms. A combination of baking soda-salt rinse and 0.4% stannous fluoride gel was evaluated as the eighth agent. The microorganisms used were Staphylococcus aureus, group B Streptococcus, Escherichia coli, and Candida albicans. An ELISA reader was used to measure the turbidity of microbial culture wells and optical density (OD) values for each of the 960 wells recorded. Mean OD values were rank ordered based on their turbidity. One-way ANOVA with Tukey HSD post hoc analysis was used to study differences in OD values (P < .05).

RESULTS: Mean OD values classified for topical agents from lowest to highest were chlorhexidine with alcohol, chlorhexidine without alcohol, baking soda-salt rinse, 0.4% stannous fluoride gel, 0.63% stannous fluoride rinse, calcium phosphate mouthrinse, and acemannan hydrogel (aloe vera) rinse. The antimicrobial efficacy of different topical agents on the four microorganisms is unknown. The purpose of this study was to evaluate the antimicrobial efficacies of various oral topical agents on common microorganisms associated with radiated head and neck cancer patients.

CONCLUSION: A significant difference among the antimicrobial efficacies of topical agents was evident for each of four microorganisms (P < .05). There was also a significant difference among the antimicrobial efficacies of the same topical agent on the four microorganisms tested (P < .05).
Efficacy of topical Aloe vera in patients with oral lichen planus: a randomized double-blind study.

**Source**

**Abstract**
BACKGROUND: Different treatments have been used in application to symptomatic oral lichen planus (OLP), with variable results, perhaps caused by the refractory nature of the disease. The objective of this study was to evaluate the efficacy of the topical application of aloe vera (AV) in OLP compared with placebo.

METHODS: A total of 64 patients with OLP were randomized in a double-blind study to either AV (32 patients) or placebo (32 patients), at a dose of 0.4 ml (70% concentration) three times a day. A Visual Analog Scale was used for rating pain, with the application of a clinical scale for scoring the lesions, the Oral Health Impact Profile 49 (OHIP-49), and the Hospital Anxiety-Depression (HAD) scale. The patients were evaluated after 6 and 12 weeks.

RESULTS: No statistically significant differences were recorded between both groups in relation to pain after 6 and 12 weeks. In the AV group, complete pain remission was achieved in 31.2% of the cases after 6 weeks, and in 61% after 12 weeks. In the placebo group, these percentages were 17.2% and 41.6%, respectively. There were no adverse effects in any of the groups. In relation to quality of life, significant differences were observed between the two groups in the psychological disability domain and total OHIP-49 score.

CONCLUSION: The topical application of AV improves the total quality of life score in patients with OLP.
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**USE OF ALOE VERA IN DENTISTRY**

**Comparative evaluation of the antimicrobial efficacy of aloe vera tooth gel and two popular commercial toothpastes: an in vitro study.**

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**Title**
Comparative evaluation of the antimicrobial efficacy of aloe vera tooth gel and two popular commercial toothpastes: an in vitro study.

**Source**

**Abstract**
Aloe vera (Aloe barbadensis Miller) has been suggested for a wide variety of ailments but its use in dentistry is limited. This article reviews the uses of the plant and describes an in vitro investigation that compared the antimicrobial effectiveness of aloe vera tooth gel with two popular, commercially available dentifrices. The preliminary results showed that aloe vera tooth gel and the toothpastes were equally effective against Candida albicans, Streptococcus mutans, Lactobacillus acidophilus, Enterococcus faecalis, Prevotella intermedia, and Peptostreptococcus anaerobius. Aloe vera tooth gel demonstrated enhanced antibacterial effect against S. mitis.

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Journal Article.

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20091012

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2009

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**Acemannan stimulates gingival fibroblast proliferation; expressions of keratinocyte growth factor-1, vascular endothelial growth factor, and type I collagen; and wound healing.**

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**Title**
Acemannan stimulates gingival fibroblast proliferation; expressions of keratinocyte growth factor-1, vascular endothelial growth factor (VEGF), and type I collagen production; and oral wound healing in rats. [3H]-Thymidine incorporation assay and ELISA were used. Punch biopsy wounds were created at the hard palate of male Sprague Dawley rats. All treatments (normal saline; 0.1% triamcinolone acetonide; plain 1% Carbopol; and Carbopol containing 0.5%, 1%, and 2% acemannan (w/w)) were applied daily. Wounded areas and histological features were observed at day 7 after treatment. From our studies, acemannan at concentrations of 2, 4, 8, and 16 mg/ml significantly induced cell proliferation (P<0.05). Acemannan concentrations between 2 - 16 mg/ml significantly stimulated KGF-1, VEGF, and type I collagen expressions (P<0.05). Wound healing of animals receiving Carbopol containing 0.5% acemannan (w/w) was significantly better than that of the other groups (P<0.05). These findings suggest that acemannan plays a significant role in the oral wound healing process via the induction of fibroblast proliferation and stimulation of KGF-1, VEGF, and type I collagen expressions.

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Journal Article. Research Support, Non-U.S. Gov't.

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**Year of Publication**
2009

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**Effect of a dentifrice containing Aloe vera on plaque and gingivitis control. A double-blind clinical study in humans.**

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**Institution**
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**Title**
Effect of a dentifrice containing Aloe vera on plaque and gingivitis control. A double-blind clinical study in humans.
The effect of Aloe vera on the reduction of plaque and gingivitis was evaluated in a randomized, parallel and double-blind clinical trial. Subjects were randomly allocated to the test group (n=15) - dentifrice containing Aloe vera - or the control group (n=15) - fluoridated dentifrice. Plaque index (PI) and gingival bleeding index (GBI) were assessed at days 0 and 30. Subjects were asked to brush their teeth with the control or test dentifrice, three times a day, during a 30-day period. There was a significant reduction on plaque and gingivitis in both groups, but no statistically significant difference was observed among them (p>0.01). The dentifrice containing Aloe vera did not show any additional effect on plaque and gingivitis control compared to the fluoridated dentifrice.
REDUCTION IN THE INCIDENCE OF ALVEOLAR OSTEITIS IN PATIENTS TREATED WITH THE SALICEPT PATCH, CONTAINING ACEMANNAN HYDROGEL.

PURPOSE: In the present study, we compared the incidence of alveolar osteitis (AO) in patients treated with either clindamycin-soaked Gelfoam (Pharmacia and Upjohn Co, Kalamazoo, MI) or Salicept patches (Carrington Laboratories, Inc, Irving, TX). The Salicept Patch is a freeze-dried pledget that contains Acemannan Hydrogel (Carrington Laboratories) obtained from the clear inner gel of Aloe vera L.

PATIENTS AND METHODS: A retrospective evaluation was performed of the records of 587 patients (1,031 sockets) whose extraction sites had been treated with clindamycin-soaked Gelfoam. A prospective trial was conducted in which 607 patients (1,064 sockets) had 2 Salicept Patches placed immediately after extraction. The same surgeon treated all patients.

RESULTS: Analysis restricted to mandibular third molar sites showed that 78 of 975 sites (8.0%) in the Gelfoam group developed AO, whereas only 11 of 958 sites (1.1%) in the Salicept group developed AO (P <.0001). Further analysis of all extraction sites revealed that the incidence of AO in the Gelfoam group was 7.6% compared with 1.1% in the Salicept-treated group (P <.0001).

CONCLUSIONS: The study results suggest that the Salicept Patch significantly reduces the incidence of AO compared with clindamycin-soaked Gelfoam. Copyright 2002 American Association of Oral and Maxillofacial Surgeons
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Title
The M and M's of aloe vera--is it for dentistry?.
Source
Publication Type
Historical Article.  Journal Article.
Date Created
20010420
Year of Publication
2001
Unique Identifier
10687438
Status
MEDLINE
Authors
Hayes SM.

Title
Lichen planus--report of successful treatment with aloe vera.
Source
Local Messages
THIS JOURNAL IS AVAILABLE IN THE BDA LIBRARY
Abstract
Lichen planus is a disease that involves the skin and mucous membranes. It is characterized by unique eruptions. The cause of this disease is unknown, but has been linked to emotional stress, and has also been attributed to viral infections. A case is described of a successful treatment of lichen planus.
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Case Reports.  Journal Article.
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20000301
Year of Publication
1999
Unique Identifier
9830646
Status
MEDLINE
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Title
Effectiveness of a medicament containing silicon dioxide, aloe, and allantoin on aphthous stomatitis.
Source
Local Messages
THIS JOURNAL IS AVAILABLE IN THE BDA LIBRARY
Abstract
This research protocol was designed to test the effectiveness of a gel containing silicon dioxide, aloe vera, and allantoin in the healing of recurrent aphthous ulcers. The subjects were patients with histories of developing multiple ulcers on the oral mucosa during a 3- to 4-month period. The parameters used to evaluate healing were number of lesions during a 3- to 4-month period, length of the interval between ulcers, size of ulcers, and pain from ulcers. An approach was used in which data were accumulated from diaries maintained by the subjects throughout the study intervals. Because 3 active substances were present in the gel, a preliminary study (study I) was performed to indicate the effect of each active substance and each combination. In this phase, different combinations of the substances were compared with the use of the 2(3) factorial experimental design. The results of this study demonstrated that statistical differences in the durations of lesions (P = .017) were present when all 3 substances were included in the gel. In the next study (study II), which was initiated to test the results of study I, additional subjects were divided into 2 groups; one used a control gel with silicon dioxide, and the other a gel with all 3 active substances. Study II found no statistical differences in the parameters when the 2 groups were compared. In study III, a modified crossover design was used with the subjects of study II, and a significant difference was found in lesion-free intervals (P = .0335) and length of time for the study (P = .0001). The differences in lesion intervals may have been caused by the differences in study length. Alteration in the occurrence of aphthous ulcers was demonstrated by the reduction in numbers of lesions in study I and by the increase in length of intervals between lesions in study III. However, a consistent pattern was not present; this indicated a lack of effect of the gel on aphthous ulcers.
Publication Type
Clinical Trial.  Journal Article.  Randomized Controlled Trial.  Research Support, Non-U.S. Gov't.
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19990113
Year of Publication
1998
Unique Identifier
9807143
**USE OF ALOE VERA IN DENTISTRY**

**OBJECTIVE:** Acemannan, a complex mannose carbohydrate derived from the aloe vera plant, has an inherent stickiness/viscosity. Prototype Acemannan denture adhesive formulations were evaluated for pH changes, cytotoxicity to human gingival fibroblasts and adhesive strength in both dry and wet conditions.

**METHOD AND MATERIALS:** The denture adhesive formulations consisted of five combinations of Acemannan with varying concentrations of preservatives and two other formulations without preservatives. The pH of each formulation was measured over 24 hours. Assessment of cytotoxicity was accomplished using the in vitro, tetrazolium-based colorimetric assay on cultures of human gingival fibroblasts after exposure to the adhesive formulations for up to 24 hours. The adhesive strength was evaluated with a universal testing machine under initial dry conditions and after immersion in a constant-temperature water bath for up to 20 minutes.

**RESULTS:** Formulations 1 and 2 achieved and maintained pH values above 6.0 (the critical pH for hydroxyapatite dissolution) approximately 6 hours into the study. None of the prototypes demonstrated an initial pH above the critical pH. Formulations 1, 2, 3, and 5 exhibited significant cytotoxicity to human gingival fibroblasts over 24 hours. Formulations 4, 20:1, and 150:1 demonstrated minimal cytotoxicity. Formulation 1 exhibited the poorest adhesive strength, while the most viscous formulation (prototype 150:1) was by far the best performer. Generally, adhesive bond strengths for all prototypes were quite high and relatively stable over time in a wet environment.

**CONCLUSION:** To achieve the ideal adhesive in terms of strength, pH, and cytotoxicity, Acemannan formulation 150:1 should be adjusted to contain the preservative concentration of formulation 4 and have an initial pH value of 6.0 or higher.