

# The effects of aloe vera on periodontal health

Running title: Aloe vera and periodontal health

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**Abstract:** *Periodontal disease is a chronic inflammatory disease that leads to the destruction of the bone support of the tooth. Its clinical manifestation varies from a simple gingivitis to a periodontitis. The main cause of this pathology is plaque buildup. Various chemical compounds have been introduced with antibacterial and anti-plaque properties. The main one is chlorhexidine gluconate. With the increased use of natural derivative compounds, interest in aloe vera (AV) has increased. AV has various effects on the human being, among which it promotes wound healing, has an anti-inflammatory effect, has an antibacterial and antiviral effect. Therefore the purpose of this review is to evaluate the antibacterial power of an aloe vera based mouthwash formulation. Several articles were considered through a systematic review of the different search engines. Three articles were examined which compared the effectiveness of an aloe vera-based mouthwash with a chlorhexidine-based mouthwash. Experiments on humans have been considered. The 3 papers showed a completely similar efficacy of chlorhexidine compared to aloe vera. In fact, studies have shown that this natural product has the same anti-plaque beneficial effects as chlorhexidine. It does not have the side effects of chlorhexidine. further clinical trials will be needed to assess whether long-term side effects of aloe vera are actually present. The studies analyzed have a short follow-up, so some long-term effects could not be assessed.*

**Keywords:** *Aloe vera, periodontal diseases, mouthwashes*

## 1. INTRODUCTION:

Gingivitis and periodontitis are mainly caused by the accumulation of plaque and are very common pathologies in clinical practice. This pathology is caused by the accumulation of bacteria on the tooth surface, mainly due to a lack or inadequate hygiene <sup>1</sup>. The clinical manifestations of gingivitis are redness, swelling and bleeding. Gingivitis is the first phase of periodontal disease and involves redness and bleeding, however if left untreated it leads to irreversible loss of the bone component. There are several strategies for the treatment of these pathologies. First of all the main methods are the chemical control of the plaque and its mechanical removal. Methods include mechanical removal of dental plaque with a

toothbrush, dental floss etc. However, mechanical procedures are not sufficient to completely control the plaque. Therefore, in order to allow greater plaque removal, the use of antimicrobial agents must also be combined with the mechanical methods<sup>2</sup>. Specifically, antimicrobial mouthwashes prevent plaque formation by inhibiting its growth. The most widely used antimicrobial agent is chlorhexidine gluconate, together with mechanical removal. Therefore the combination of chlorhexidine and brushing represents the most effective method for the treatment of gingivitis. However, the increased popularity of phytotherapies, aloe-based mouthwashes have been introduced for the treatment of gingivitis and periodontitis. Aloe vera or aloe barbadensis is plant belonging to the Liliaceae family<sup>3</sup>. Cosmetics and medicines the products are made from the mucilaginous tissue in the center of the aloe vera leaf. Aloe is known for numerous beneficial effects on the individual. The main components of aloe vera are aloin, aloemodin, aloemannan, acemannan, haloeride, naftoquinones, methylchromones, flavonoids, saponin, sterols, amino acids and vitamins. In some countries like Egypt, South Africa, India, China, Mexico and Japan aloe is used to treat burns, hair loss, skin infections, hemorrhoids, sinusitis and gastrointestinal pain<sup>4</sup>. It is used for the treatment of sunburn, wounds, skin and digestive tract problems. The effects of aloe are mainly immunomodulatory, anti-inflammatory, antioxidant and antibacterial properties. Aloe promotes the healing of wounds by promoting the migration of epithelial cells and promotes the maturation of collagen. Assomannan, a component of aloe, turns out to have osteogenic properties. Therefore it is used in recent years for the treatment of lichen planus, submucosal oral fibrosis, aphthous stomatitis, gingivitis and periodontitis<sup>5</sup>. The purpose of this work is to evaluate the effectiveness of aloe vera as an antibacterial and anti-plaque. In fact, in this review it will be considered in the form of mouthwash or gel to be applied topically on the gingiva. Due to its antibacterial and anti-inflammatory effect it could be a good substitute for chlorhexidine. In fact, chlorhexidine is a molecule with many side effects related to its long-term use.

## **2. MATERIALS AND METHODS:**

The study was conducted utilizing the main scientific databases (PUBMED, MEDLINE, and WEB of SCIENCE). The time window considered for the electronic search was from 1st March 2007 to 1st April 2020. The term “Aloe vera” was first combined with “mouthwashes” and then with “chlorhexidine”. The web search was assisted using MESH (Medical Subjects Headings). The criteria for this review are described in PRISMA flow diagram. The purpose of this review is to answer to the following questions using a PICO method (P: patient problem/population; I: intervention; C: comparison; O: outcome):

1) Is aloe effective in the prevention and treatment of periodontal disease compared to the normal mouthwashes used?

The following inclusion criterion were used: articles in English, human studies and clinical trials. Two independent people search with the same keywords all article and select the article founding. The risk of bias in this phase is solved by an independent author that conduct the same search. The phase of screening is carried out by the two independent research that excluded the article duplicated, review and animal study. The article found in this phase are

13. 3 articles are excluded because are duplicates and they do not respect the topic proposed in this review.

The phase of eligibility is conducted by other two reviewers. These authors compare the article founding and select the article that asked the PICO. Articles which did not contain data regarding aloe vera and mouthwashes are excluded. The authors read first the abstract of all articles, excluded which did not respect the inclusion criteria, after read the complete test of the remains articles. In this phase are excluded 2 articles. In this phase the risk of bias is solved by an independent author, completely external and unknown to the authors. The number of articles remaining in this phase are 8. One article is excluded because did not use the periodontal index and treats only of oral health. The synthesis of data is carried out by the authors. All data were extracted. The author reads first the abstract of all articles, after read the complete test of the articles. All the reviewers extract the data regarding the implant failure and the use of SSRI. Articles which not contain the data and the previous keywords were excluded. All doubts, regarding the included articles, are solved contacting the author (Table I).

### **3. RESULTS:**

Two independent scientists searched the previously mentioned keywords, read the titles and summarized the abstracts of articles. During an initial reading, they excluded the articles that did not respect the topic. Therefore, articles that responded to the key characteristics were selected. These remaining articles were read. The complete text of the 7 remaining articles was read, and 4 were excluded because not respect the inclusion criteria. In conclusion, 3 articles were included in the present review. The scientists extrapolated the following data: periodontal index in patients taking mouthwashes of aloe vera, comparing with chlorhexidine. Kamat's study aims to analyze the effects on gum health of 2 natural compounds such as aloe vera and tea tree oil. Kamat performed a double-blind prospective study on a population of children between 8 and 14 years old. The study patients were divided into 4 groups according to the type of mouthwash used. Group 1 was administered aloe vera, group 2 chlorhexidine, group 3 tea tree oil and group 4 placebo. In these groups the plaque index, the gingival index, the streptococcus mutans species count at time 0, after 4 weeks of use of the mouthwash and after 2 weeks of suspension of the mouthwash were evaluated. The study is made up of 89 boys and 63 girls. During the period of use of the aloe-based and tea-based mouthwash, there was a statistically significant reduction in all the indices studied ( $p < 0.001$ ). The differences between the 3 groups studied is not statistically significant<sup>6</sup>. The Pradeep study evaluated the effectiveness of applying an aloe vera based gel after scaling and root planing on a group of diabetes patients. 60 patients with periodontal disease who had a probing depth  $\geq 5$ mm and clinical attachment level (CA)  $\geq 3$ mm were enrolled. The patients were divided into 2 groups. The study group was given an aloe vera gel, while group 2 was given a placebo gel. Plaque index, modified sulcus bleeding index, probing depth and clinical attachment level were measured both at time 0 and then at intervals of 3 and 6 months. At the end of the control period it was shown that the group of patients treated with aloe vera had a significantly greater average reduction in the plaque index, the modified sulcus bleeding index and pocket depth and a level gain clinical attack

after 3 months of treatment. It was also shown that the increase in the clinical attack level was significantly greater in all measurements made over the different time frames<sup>7</sup>. The Gupta study aims to evaluate the effects of aloe vera on periodontal health. In fact, he compared the effect of aloe vera compared to chlorhexidine. 300 patients were enrolled without any systemic pathology and were divided into 3 groups. In group 1, 100 patients were assigned and treated with aloe vera. In group 2, 100 patients were assigned and treated with chlorhexidine. In group 3, 100 patients were enrolled and treated with saline. The periodontal indexes at time 0 were measured, including the index gingival index (GI) and the plaque index (PI). After that, a professional hygiene and polishing session was performed to bring the plate to 0 and the patient was told not to have to brush or mechanically clean for 4 days, but only to take the mouthwash. The results after 4 days showed that aloe vera is as effective as chlorhexidine in reducing bacterial plaque formation. In all 2 study groups there was a significant reduction in dental plaque and there was no statistically significant difference between the 2 groups ( $p > 0.05$ )<sup>8</sup>.

#### 4. CONCLUSION:

Dental plaque has an etiological role in the two main oral diseases, including caries and periodontal disease<sup>9</sup>. Dental plaque is a microbial aggregate that colonizes dental surfaces. *Streptococcus mutans* is one of the main microorganisms of the bacterial plaque and is the etiological agent of caries. The dental plaque provides protection for microorganisms, in fact these bacteria are protected from the body's immune and systemic mechanisms because the plaque is not accessible by the host's blood or fluids<sup>10</sup>. However antimicrobial agents administered topically and with high permeability in the plaque, can reach microorganisms and provide adequate control of the plaque<sup>11</sup>. In fact, it is shown that in the absence of adequate mechanical removal of the plaque by brushing, the topical antimicrobial action has a protective role. The main antimicrobial agents used are chlorhexidine and triclosan<sup>12</sup>. A research field on natural products or a herbal base is currently being developed in numerous fields of medicine. Aloe vera is a natural product very studied for its beneficial properties on the human organism. The main component with beneficial capacity is the acemannan polysaccharide, a  $\beta$ - (1,4) –acetylated polimannose<sup>13</sup>. Recent studies have shown that it has osteogenic capabilities<sup>14</sup>. Aloe vera is included in the Liliaceae family. Its main effects are helpful in many fields of medicine. It has effects mainly on wound healing, has an analgesic, antioxidant, antibacterial, antiviral effect, antifungal<sup>15</sup>. It also has important anti-inflammatory properties. Therefore, given its important antibacterial and anti-inflammatory properties, in some studies it has been used as a mouthwash. Most of the studies considered compare the effects of aloe vera with those of chlorhexidine. Mouthwashes based on chlorhexidine gluconate are the most used in dental practice and are adjuvants to mechanical therapy in patients suffering from gingivitis or periodontitis<sup>16</sup>. It is a very effective molecule in reducing bacterial plaque. However, many side effects have occurred with the use of this mouthwash for a long time<sup>17</sup>. The main side effects are coloring of teeth and tongue, temporary alteration of taste perception, increased stone deposits, burning sensation and genotoxicity of buccal epithelial cells. All the studies examined in this review confirm the ameliorative effects on periodontal health. In the various studies it has been taken into account that these natural products are free of side effects compared to chlorhexidine or

triclosan<sup>18</sup>. Therefore natural products, such as aloe vera, can help control plaque, and are completely free of adverse effects such as chlorhexidine. Will be needed a new studies to be able to confirm these claims since the studies in this field are completely small. In fact, we cannot know whether these natural products can have long-term adverse effects as the duration of the studies is limited to a maximum of 6 months.

Table 1: Flow chart of the review process

<b>Identification of articles</b>	<b>Papers identified through principal database (PUBMED, MEDLINE, WOS) N:13</b>
<b>Screening time</b>	After an initial read of titles and abstract N excluded:5
<b>Eligibility</b>	A full text reading and a check of inclusion or exclusion criteria N excluded:7
<b>Included</b>	Studies included N:3

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