



Original Research Article

A comparative clinical evaluation of the effect of chamomile, Aloe Vera and chlorhexidine 0.12% mouthwash on gingival health among visually impaired

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ABSTRACT

Introduction: Oral health is considered of paramount importance for visually impaired individuals due to the difficulties they face to maintain a good oral hygiene practice in different aspects, knowledge, physical and social. Thus, the provision of adequate training and education about oral health and the chemical role of mouthwashes is required for this group of society. This research aims at comparing the effect of various types of mouthwashes on gingival health among visually impaired persons.

Materials and Methods: 92 students with a vision impairment of ages between (10-20) years suffering from gingivitis caused by dental plaque accumulation were included in this research. The sample was divided into 4 groups according to the type of used mouthwash as follows:

1) Chamomile group, 2) Aloe Vera group, 3) Chlorhexidine group, 4) Distilled water group.

Dental plaque index (PI) and gingival index (GI) were recorded before the initiation of the treatment and after 15 days. One-way (ANOVA test) and the (Bonferroni test) were used for results analysis at $p < 0.05$. Statistical analyses were completed using (SPSS) software –v13.

Results: Aloe Vera and CHX groups have improved the dental plaque index (PI) without significant statistical differences. Both (CHX and Aloe Vera) have proven superiority over the Chamomile group which was statistically significant. Gingival index (GI) has improved in the Chamomile, Aloe Vera, and CHX groups without any statistical differences.

Conclusion: Within the limitation of our study, we concluded that (Aloe Vera) mouthwashes can be used as a substitute to CHX in controlling plaque accumulation and gingival inflammation among visually impaired persons. Also, Chamomile mouthwashes have a distinguished impact on gingival inflammation, yet more researches are required.

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1. Introduction

Oral health is a paramount part of the overall health of each individual,¹ especially those who suffer from vision problems.² Vision impairment, known as the lack of vision or blindness, is the reduction in the ability to vision which leads to complicated problems that cannot be fixed with usual methods like glasses.³

Visually impaired individuals face an everyday challenge maintaining their oral health, which is strongly attached to their social and psychological status.⁴ Conventional

methods of oral health care include visual images, dental plaque detectors and periodic rehearsals to the dental clinic. Unfortunately, these methods are not sufficient for visually impaired.⁵ The major difference between them and other individuals who are not suffering from this impairment is the difficulty in performing brushing and other routine oral health practices. Besides, visually impaired individuals cannot see the dental plaque which leads to a continuous accumulation of the dental plaque associated with gingival bleeding and periodontal pockets formation despite performing oral care instructions,⁶ so it is necessary to improve and facilitate these instructions for this category.⁷

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The use of mouthwashes is highly recommended among visually impaired persons as an adjunctive method of controlling dental plaque accumulation.⁸

Chlorhexidine is an antiseptic chemical solution that belongs to the biguanides family, and it is considered to be of low toxicity. It has a wide bacterial spectrum⁹ that includes Gram-positive and Gram-negative bacteria, yeasts, a group of fungi strains and some viruses.¹⁰ There is a solid evidence that chlorhexidine mouthwash reduces the formation of dental plaque and gingival inflammation.¹¹ However, it causes teeth staining, taste disorder, and other undesirable side effects.¹² Moreover, recent studies have shown some bacterial resistance against CHX.¹³

German Chamomile is one of the Asteraceae\ Composita species plants. It consists of Kumarins, flavonoids, volatile oils, and other ingredients such as amino acids and polysaccharides. Chamomile has several significant properties such as anti-spasm, antihypertensive, analgesic, anti-inflammatory, and anti-bacterial,¹⁴ and it is used as a popular medication for treating wounds, ulcers, and burns.¹⁵ Chamomile continues to be used as one of the future medications because it contains effective vital elements that provide therapeutic effects, as Chamomile helps to improve cardiovascular conditions, stimulates the immune system, and secures some cancer prevention.¹⁶ Chamomile mouthwashes have shown a considerable decrease in both dental plaque and gingival bleeding.¹⁷

Aloe Vera plant belongs to the (Liliaceae) species. It contains more than 75 nutrients and over 200 complex compounds with biological effectiveness.¹⁸ Aloe Vera has been widely known for its many uses in cosmetics, skincare,¹⁹ and pain-relieving.¹⁸ Also, it has been applied to treat burns, rashes, skin allergies,²⁰ treatment of rheumatoid arthritis,²¹ support of the immune system, and as a protection from some cancerous diseases.²² Aloe Vera has recently entered the world of dentistry for its powerful effect on bacteria and inflammation. Furthermore, the administration of Aloe Vera gel is beneficial in the treatment of aphthous ulcer and enhancing the overall periodontal status.²³

As a result of the side effects of chemical drugs and the formation of new bacterial strains that are resistant to them, searching for new natural, less toxic and less expensive materials is a hot spot nowadays.²⁴ Thus, in our research, we have emerged interests in Aloe Vera and Chamomile and their broad uses.

2. Materials and Methods

A single-blind randomized clinical trial was performed to compare the effect of Chamomile, Aloe Vera and chlorhexidine mouthwashes in preventing dental plaque accumulation and gingival inflammation among visually impaired individuals.

The sample size was calculated with the (G power) program, and the study included 92-students suffering from vision impairment. Their age ranges between 10-20 years, including both genders chosen from schools for the rehabilitation of the blind in Damascus city. Ethical approval was obtained from the ministry of social affairs and labor and written informed consent was acquired from the participants and their superiors.

2.1. Preparation of the mouthwashes

All types of mouthwashes were formulated at the department of pharmacy in Damascus university by a pharmaceutical specialist.

Chamomile mouthwashes preparation: Dried Chamomile flowers were immersed in ethanol 55% at room temperature, and impurities were removed from the mixture. Ethanol was completely evaporated at a temperature of 79 °C by the rotary evaporator device. The pure Chamomile extract was obtained and then dissolved in distilled water, and spearmint flavor was added to the mixture.

Aloe Vera mouthwashes preparation: After washing the Aloe Vera leaves, the gel extract from the leaves was mixed with: distilled water, coconut oil, preservative material, and spearmint flavor.

All mouthwashes were kept in similar containers, and the same flavor of spearmint was added to the mixture. All containers were coded and distributed.

2.2. Methodology

The study was conducted for 15 days. Plaque removal and Scaling were carried out in the institute infirmary. The study participants were randomly allocated into four groups (23 persons in each group) through the lottery method, as the following:

1. Chamomile mouthwashes 2% group.
2. Aloe Vera mouthwashes group.
3. Chlorhexidine mouthwashes 0.12% group.
4. Distilled water group (control group).

Plaque index, (PI) and gingival index (GI) scores were recorded at baseline and after 15 days using the UNC-15 periodontal prop.

The instructions of oral health care maintenance, how to brush and how to use 10 ml of the mouthwashes twice daily were explained through (touch-feel-hear) technique. Moral reinforcement and motivation were presented to ensure that the instructions are carried out, in the presence of the responsible social counselor, to provide the feeling of security and confidence. When dealing with visually impaired individuals, it is necessary to take caution not to use words that offend them. Also, patience is needed by repeating information, and allowing the visually impaired

to touch and feel the tools to recognize them while applying the instructions.

All participants received the same type of toothbrush and toothpaste.

Inclusion criteria: All participants should have a vision impairment, plaque index score, gingival index score more than (1), and the capability to use the mouthwash without swelling.

Exclusion criteria: Individuals with history of systematic disease, the use of antibiotics, orthodontic appliances, and sensitivity to any component of the used mouthwashes.

Statistical analyses were completed using (SPSS) program software v13.

3. Results

A total of 92 visually impaired individuals between 10-20 years participated in our study. The results of 8 participants were excluded due to the research procedures. Thus, the study sample became 84 participants, both males, and females were distributed into 4 groups according to the type of mouthwash. (Table 1)

Table 1: Distribution of the research sample according to the type of them mouthwashes

Percentage (100%)	Sample (n)	Type of mouthwash
22.6	19	Chamomile
26.2	22	Aloe vera
23.8	20	Chlorhexidine
27.4	23	Distilled water
100	84	Overall

One-way ANOVA test was used to study the variation of change for all studied parameters (PI and GI) among the 4 groups. After 15 days, plaque index (PI) was highly improved in the CHX group (33, 73%) followed by the Aloe Vera group (33.06%), the Chamomile group (7.15%), and the distilled water group (1, 75%) and this was statistically significant $p < 0.05$.

Also, gingival index values were improved after 15 days. The highest improvement was in the Aloe Vera group (32.31%) followed by the CHX group (31, 13%), the Chamomile group (29.76%), and the distilled water group (0.53%). This was statistically significant $p < 0.05$. (Table 2)

A Bonferroni test was applied for intergroup comparison to find out which group is fundamentally different from the others considering all studied parameters.

In the plaque index: There was a significant difference $p < 0.05$ between groups as the following:

1. CHX group & distilled water group
2. Aloe Vera group & distilled water group
3. Chamomile group & Aloe Vera group
4. Chamomile group & CHX group

However, there was no significant difference $p > 0.05$ between the Chamomile group & distilled water group, the CHX group & Aloe Vera group. (Table 3)

In the gingival index: There was a significant difference $p < 0.05$ between groups as the following:

1. Chamomile group & distilled water,
2. CHX group & distilled water
3. Aloe Vera group & distilled water group

However, there was no significant difference $p > 0.05$ between the Chamomile group with Aloe Vera group, Chamomile group with CHX group and the CHX group with Aloe Vera group. (Table 4)

4. Discussion

Visually impaired individuals, in particular, face a special challenge of maintaining good oral health since they cannot see the dental plaque accumulation.⁴ Therefore, brushing their teeth must be accompanied by adjunctive methods such as mouthwashes because they are easy to use.²⁵

Chlorhexidine has achieved the best clinical outcomes in controlling dental plaque and preventing gingival inflammation.²⁶ Nevertheless, CHX has many reciprocal side effects, so its long-term use is limited.²⁷

In this context, the world health organization turned to herbal medicine for therapeutic purposes due to its low cost, ease of access and an apparent absence of side effects.²⁸

A comparison between the effect of Chamomile, Aloe Vera, and chlorhexidine mouthwashes on gingival health among visually impaired was conducted in this research. There was a marked decline in plaque index values in both CHX group and Aloe Vera group without any significant difference. Meanwhile, the reduction was less important in the Chamomile group.

(GI) values showed a sharp reduction in the Aloe Vera group followed by CHX and Chamomile without any significant differences among the three groups.

Chlorhexidine is a chemical agent that is widely used to reduce dental plaque Accumulation, also used as a disinfectant or Sterilant depending on its concentration, and effective against a large group of bacteria as well as some fungi and viruses.²⁹

In the study of (Charles in 2004) and the study of (Overholser in 1990), the decrease in plaque formation was found by 21.5% - 50.3%.^{30,31}

Chlorhexidine prevents bacterial adhesion to the teeth surfaces and oral mucous membranes, and it causes damage to bacteria by increasing the permeability of the bacterial cell walls and changing the osmotic balance. Besides, it has an inhibitory effect on both Gram-negative and Yeast-positive bacteria.³²

Aloe Vera's ability to decrease the accumulation of dental plaque can be referred to its components represented by Anthraquinone which is an antibacterial

Table 2: The results of one-way ANOVA test

Plaque index score variation						
Type of mouthwash	Number of participants	Average mean	Standard variation	F value	Significance level	Indication
Chamomile	19	-7.15	8.01	43.634	0.000	Significant
Aloe Vera	22	-33.06	14.17			
Chlorhexidine	20	-33.73	17.19			
Distilled water	23	-1.75	2.54			
Gingival index score variation						
Type of mouthwash	Number of participants	Average mean	Standard variation	F value	Significance level	Indication
Chamomile	19	-29.76	13.02	39.643	0.000	Significant
Aloe Vera	22	-32.31	14.55			
Chlorhexidine	20	-31.13	12.59			
Distilled water	23	-0.53	1.62			

Table 3: The results of the Bonferroni test for the plaque index score

Plaque index score variation					
Type of mouthwash (I)	Type of mouthwash (J)	Difference between the two means (I-J)	Standard variation	Significance level	Indication
	Aloe Vera	25.91	3.69	0.000	significant
Chamomile	Chx	26.59	3.78	0.000	significant
	Distilled water	-5.40	3.66	0.860	insignificant
Aloe Vera	chx	0.68	3.64	1.000	insignificant
	Distilled water	-31.31	3.52	0.000	significant
Chlorhexidine	Distilled water	-31.99	3.61	0.000	significant

Table 4: The results of the Bonferroni test for gingival index score

Gingival index score variation					
Type of mouthwash (I)	Type of mouthwash (J)	Difference between the two means (I-J)	Standard variation	Significance level	Indication
	Aloe Vera	2.55	3.60	1.000	insignificant
Chamomile	CHX	1.36	3.68	1.000	insignificant
	Distilled water	-29.24	3.56	0.000	significant
Aloe Vera	CHX	-1.18	3.55	1.000	insignificant
	Distilled water	-31.79	3.43	0.000	significant
Chlorhexidine	Distilled water	-30.60	3.51	0.000	significant

and antifungal material.³³ Moreover, Aloe Vera is distinguished by its anti-inflammation properties. It contains Carboxypeptidase which activates bradykinin. Bradykinin inhibits the production of prostaglandin resulting in reducing inflammation and pain.³⁴ These data were consistent with (Gupta, 2014), his findings showed a similar effect of CHX and Aloe Vera on dental plaque Accumulation.³⁵ (Swathi, 2016) demonstrated in his study that Aloe Vera and CHX mouthwashes are both equally effective in lowering gingival inflammation without significant differences which confirms our results.³⁶

(Andi Mardiana Adam 2018), studied the effect of Aloe Vera juices after scaling, and he found a decrease in the values of gingivitis from (1.2780 to 0.4113), with significant differences from the control group.³⁷

Also (Sravan Kumar Yeturu 2015), compared the effect of chlorhexidine and Aloe Vera in patients

(over 18 years of age) receiving orthodontic treatment, where gingivitis decreased by 16.30% and 9.88%, respectively, and the chlorhexidine group excelled without statistical differences.³⁸

On the other hand, the influence of Chamomile mouthwashes on the dental plaque was not as strong as CHX

or Aloe Vera mouthwashes. However, it showed powerful impact on gingival inflammation. That can be interpreted by the presence of salicylic acid and flavonoids which are considered as anti-inflammatory agents.¹⁷ The results of our study were similar to Ana Luiza's 2014 which showed a reduction in gingival inflammation among patients with gingivitis and chronic periodontitis stating that both Chamomile and CHX have the same ability in preventing gingival inflammation.³⁹ However, our results disagreed with (Paul's 2016) study which stated that Chamomile mouthwashes are as effective as CHX in controlling dental plaque among orthodontic patients aged between (10-40) years.⁴⁰ This variation might be because of the age differences between the two studies or the follow-up period which lasted for 30 days in Paul's study.

Our study coincided with the study of Renuka in 2017 that compared chlorhexidine rinses with herbal extracts containing Chamomile and found that despite the improvement in dental plaque index values of the in the herbal rinses group, Chlorhexidine remains the gold standard in controlling plaque.⁴¹

We also agreed with the study of (Azimi 2016) which compared the effect of Chlorhexidine mouthwashes with Chamomile in patients who had endotracheal intubation. The sample was divided into three groups: The Chlorhexidine group, the Chamomile group, and the third group that used saline, where the Chlorhexidine group outperformed in its effect on the bacteria, while there was no difference between the Chamomile group and the control group, noting that the used Chlorhexidine concentration was 0.2%.⁴² Our study differed from (Pourabbas's 2010) that demonstrated the Chamomile mouthwashes ability to reduce the value of plaque index score to 22% with statistically significant differences from the control group that used Saline, while in our study we did not find significant differences between the both groups,¹⁷ and perhaps the reason for the difference is the period of using the mouthwashes which was for 30 days while in ours was limited to 15 days.

Chamomile is introduced as a standard medicinal plant due to its many therapeutic benefits. It has antibacterial, antiviral and anti-fungal effects. Besides, it contains active ingredients against *Staphylococcus aureus* and *Candida*.⁴³

5. Conclusion

Within the limitation of our study, we concluded that Aloe Vera mouthwashes could be used as an alternative of CHX in controlling plaque accumulation and gingival inflammation among visually impaired persons. Also, Chamomile mouthwashes have a distinguished impact on gingival inflammation yet more researches are required.

6. Source of Funding

None.

7. Conflict of Interest

None.

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