

Formulation and Evaluation of Aloe Vera Dental Gel Containing Clove Oil and Peppermint Oil

Dr. D. K. Vir¹

¹Research Guide, Dept. Of Pharmacology,
Ideal College of Pharmacy and Research

Dr. Smita Takarkhede²

²Principal, Ideal College Of Pharmacy And Research

Jitendra Chouhan³ ; Himanshu Devasi⁴ ; Ritesh Kanojiya⁵ ; HarshalPatil⁶
^{3,4,5,6}Research Scholar, Ideal College Of Pharmacy And Research, Bhal,
Dwarli, Hajimalang Road, Kalyan East, Maharashtra, 421306, India

Abstract:- aloe Vera is a succulent plant that has been used for centuries in traditional medicine due to its medicinal properties. It is known to have anti-inflammatory, anti-bacterial, and wound healing properties, making it a popular ingredient in various health and beauty products. Recently Aloe Vera has been used as a ingredient in dental gel products due to its ability to promote oral health. Clove oil and peppermint oil are also popular natural ingredients known for their medical properties. Clove oil known for its analgesic and anti inflammatory properties making it an effective ingredient in dentalproducts.peppermint oils known for its refreshing and cooling properties making it popular ingredient in dental products.

The combination of aloe Vera, clove oil and peppermint oil in a dental gel can provide several benefits for oral health. This research paper aims to evaluate effectiveness of Aloe Vera dental gel containing clove oil and peppermint oil in promoting oral health.

I. INTRODUCTION

The buccal cavity, commonly known as the mouth, is a complex anatomical structure that plays a crucial role in several physiological processes, including speech, taste, digestion, and oral hygiene. The mouth is composed of various structures, including the tongue, teeth, gums, palate, and the inner lining of the cheeks and lips. The mouth also harbors a diverse microbial community, including beneficial and harmful bacteria, which can impact oral health. Therefore, maintaining good oral hygiene is essential to prevent several dental and oral diseases.

The use of aloe vera dental gel containing clove oil and peppermint oil can provide several benefits for the buccal cavity. The gel can help to prevent the growth of harmful bacteria in the mouth, reducing the risk of dental caries, gingivitis, and periodontitis. The anti-inflammatory properties of aloe vera and peppermint oil can also help to reduce inflammation and swelling of the gums, promoting overall oral health.

Introduction of mouth ulcer: Mouth ulcers, also known as canker sores or aphthous ulcers, are small, painful sores that form in the mouth. They can develop on the inside of the lips, cheeks, tongue, gums, and even the roof of the mouth. These sores can be quite painful and make eating and speaking difficult. Mouth ulcers are quite common and can affect people of all ages, but they are more common in women than men.

There are several different types of mouth ulcers, and each type has a different cause. The most common type of mouth ulcer is called a minor aphthous ulcer. These ulcers are small, shallow sores that usually heal on their own within a week or two. Major aphthous ulcers are less common but more severe, and can take several weeks to heal. Herpetiform ulcers are a type of ulcer that look like clusters of small, painful sores. These ulcers are the least common and can take the longest to heal.

Treatment for mouth ulcers depends on the type and severity of the ulcer. Minor aphthous ulcers usually heal on their own within a week or two and do not require treatment. However, more severe ulcers may require prescription medication, such as corticosteroids or antiviral drugs. Over-the-counter medications, such as numbing gels and mouthwashes, can help alleviate pain and promote healing. In some cases, lifestyle changes, such as avoiding certain foods or reducing stress, may also be recommended.

II. MATERIALS

A. Aloe vera gel:

Aloe vera contains a variety of bioactive compounds, including polysaccharides, anthraquinones, enzymes, vitamins, and minerals. These compounds work together to provide the plant's therapeutic effects. Aloe vera has been found to be effective in treating both gastric and peptic ulcers. The polysaccharides in aloe vera help to reduce inflammation and promote healing of the ulcerated tissues. Aloe vera also contains compounds that help to reduce the production of stomach acid, which can help to prevent further damage to the ulcer.

B. Clove

The primary constituents are volatile oil (15–20%), gallocatechin gallates (10–15%), resin, chromone, and eugenin. The ingredients of the volatile oil found in the oil glands of cloves include eugenol (70 to 90 percent), eugenol acetate, caryophyllenes, traces of esters, ketones, and alcohol. Clove oil is known for its analgesic and antiseptic properties, which can provide relief from pain and inflammation caused by mouth ulcers.

C. Peppermint

Menthol is the main component of peppermint oil, along with lesser amounts of menthyl acetate, isovalerate, menthone, cineol, dormant pinene, limonene, and other compounds. When it is cooled to a low temperature (-22°C), the menthol isolates. Both the ester and the alcoholic components of the oil are responsible for the oil's flavouring qualities, but only the alcoholic components are responsible for the medicinal value. Peppermint oil contains menthol, a compound that has a cooling and soothing effect on the affected area. This can help alleviate the pain associated with mouth ulcers. Peppermint oil can promote healing of mouth ulcers by increasing blood flow to the affected area and promoting cell regeneration.

D. Preparation of gel

- Add aloe vera gel obtained from species *Aloe barbadensis* in a beaker, add equal amount of distilled water in a beaker .
- Now take whole sample into container and grind it with the help of mixer so that uniform texture of aloe vera liquid can be obtained.
- Take accurately weighed amount of glycerin in another beaker and add measured amount of xanthan gum slowly with continuous stirring in it , stir it properly so that homogenous mixture is obtained .
- Add aloe vera liquid in above mixture.. Now add clove oil and peppermint oil slowly with continuous stirring. Add measured amount of citric acid in it.
- The product will be obtained from stirring it vigorously. All the prepared gels were then subjected to evaluation tests in order to select the best formulation

E. Evaluation of gel formulation:

➤ Physical appearance

The physical appearance of the formulation was checked visually

- Color: The color of the formulations was checked out against white background
- Odor: The odor of the gels was checked by mixing the gel in water and taking the smell
- Greasiness: The greasiness was assessed by the application on to the skin.
- Consistency: The consistency was checked by applying on skin.

➤ Determination of pH

The pH of gel was determined using digital pH meter by dipping the glass electrode completely into the gel system. The physicochemical properties, especially pH value of dental medicines, have significant influence on the health of oral cavity tissues. The pH of formulations should correspond to the value of saliva pH (5.5–8.0).

➤ Determination of viscosity

- The viscosity range of dental gels can vary from around 100 cps to over 10,000 cps. However, the viscosity range for most dental gels falls between 1000 and 5000 cps. The optimal viscosity of a dental gel depends on various factors such as its intended use, the patient's oral health condition, and the specific requirements of the treatment
- Viscosities of the formulated gels were determined using Brookfield Viscometer, spindle no. 7 and spindle speed 60 rpm at 25°C were used for gels, the corresponding dial reading on the viscometer was noted.

➤ Determination of Extrude ability

The following are the general steps for conducting a tube extrudability test of dental gel:

- Select a tube of dental gel that has been stored at room temperature for at least 24 hours prior to testing.
- Use a balance to weigh the tube and record its original weight.
- Attach the tube to a standard tube extruder that is designed to apply a constant force to the tube during the test.
- Apply the force to the tube using the extruder, and collect the dental gel that is extruded from the tube into a pre-weighed container.
- Weigh the container with the extruded dental gel and record its weight.
- Calculate the percentage of dental gel extruded by dividing the weight of the extruded gel by the original weight of the tube, and multiply the result by 100.
- Repeat the test at least three times and calculate the average percentage of dental gel extruded.

Table1: Determination of Extrude ability

• Ingredient	• Category	• Quantity
• Aloe vera liquid	• Base	• 20 ml
• Clove oil	• API	• 1ml
• Peppermint oil	• API	• 1ml
• Glycerin	• Solubilizer	• 5ml
• Gum xantham	• Thickening agent	• 1.2gm
• Citric acid	• Preservative	• 0.35gm
• Distilled water	• –	• q.s

The normal range for tube extrudability for dental gel is typically between 80% and 100% of the original weight of the tube. F1, F2, F3, F4 ejects 4.6, 4.7, 4.75, 4.5 gm respectively out of 5gm.

➤ Determination of Homogeneity

Homogeneity testing is performed to ensure that a batch or sample of a substance is uniform in composition and properties. In dentistry, homogeneity testing is often used for dental materials, such as cements, impression materials, and composites, to ensure that each unit or batch of the material meets the required quality standards.

Visual Inspection: The material is visually inspected for any visible signs of non-uniformity, such as variations in color, texture, or consistency.

All the developed gels were tested for homogeneity by visual inspection after the gels have been set in the container. They were tested for their appearance and presence of any aggregates.

➤ Determination of spreadability

The normal range for spreadability is usually between 1 and 7 centimeter(cm), depending on the viscosity and other rheological properties of the gel.

➤ Determination of drug content

The general procedure for the drug content test is as follows:

- The drug content of the gel formulations was determined by dissolving an accurately weighed quantity 1 g of gel in 100 ml of solvent (a mixture of ethanol and phosphate buffer pH 6.8 (60:40) for formulations of clove and peppermint oil).
- The solutions were kept for shaking for 4 h and then kept for 6 h for complete dissolution of the formulations.

- Then the solutions were filtered through 0.45 mm membrane filters and proper dilutions were made and solutions were subjected to the spectrophotometric analysis.
- The drug content was calculated from the given formula.

Drug content (%) = (Absorbance of test / Absorbance of standard) x 100

➤ Antimicrobial Susceptibility test of gel

The following are the general steps for performing AST for dental gels:

- Isolate the microorganism: The microorganism causing the dental infection is isolated from a clinical sample, such as saliva or dental plaque, and grown in culture.
- Inoculate the culture: The bacterial culture is then inoculated onto a special medium that allows the microorganism to grow uniformly.
- Add antimicrobial agents: Small discs impregnated with different antimicrobial agents are placed on the surface of the culture. These discs contain specific concentrations of the antimicrobial agents being tested.
- Incubate the culture: The culture is then incubated under specific conditions for a set amount of time.
- Observe the results: After incubation, the plates are examined to determine the size of the zone of inhibition around each disc. The zone of inhibition is the area around the disc where the microorganisms cannot grow because of the antimicrobial agent.

F. Stability study:

Physically stability study test of the formulation was carried for one week at temperature of 37° C. The formulation was found to be Physically stable at temperature of 37 °C within one week.

Table 2: Composition Of Gel Formulation

Ingredients	F1	F2	F3	F4
Aloe vera liquid (ml)	20	20	20	20
Clove oil (ml)	1	1	1	1
Peppermint oil (ml)	1	1	1	1
Glycerin (ml)	5	5	5	5
Gum xanthan (gm)	1	1.1	1.2	1.3
Citric acid (gm)	0.35	0.35	0.35	0.35
Distilled water (ml)	q.s	q.s	q.s	q.s

Table 3: Characteristics Of Gel Formulation

Formulation	Appearance	pH	Viscosity (cps)	Spreadability (cm)	Tube extrudeability (%)	Homogeneity
F1	Pale yellow	6.43	1130	6.9	92.1	Good
F2	Pale yellow	6.54	3340	6.8	94.2	Very good
F3	Pale yellow	6.66	4560	6.8	95.1	Very good
F4	Pale yellow	6.73	5300	6.7	90.2	Good

Table 4: Absorbance's of batches while considering clove oil as standard

Batches	Absorbance
F1	0.570
F2	0.574
F3	0.585
F4	0.567

The absorbance of standard clove oil at 278 nm is 0.650

Table 5: Absorbance's of batches while considering peppermint oil as standard

Batches	Absorbance
F1	0.357
F2	0.361
F3	0.369
F4	0.344

The absorbance of standard peppermint oil at 234 nm is 0.420.

Table 6: Drug Content Of Formulation

Formulation	Drug Content (%) for clove oil	Drug Content (%) for peppermint oil
F1	87.69	85
F2	88.46	85.95
F3	90	87.85
F4	87.23	81.90

Table 7: Antimicrobial activity of formulation

Microorganisms	Zone of inhibition in mm (F3)
Streptococcus oralis	28.26

Table 8: stability studies (evaluation tests after one week)

Formulation	Appearance	pH	Viscosity (cps)	Spreadability (cm)	Tube extrudeability (%)	Homogeneity
F1	Pale yellow	6.43	1150	6.86	92	Good
F2	Pale yellow	6.54	3380	6.75	93	Very good
F3	Pale yellow	6.66	4600	6.79	95	Very good
F4	Pale yellow	6.73	5390	6.68	90	Good

III. CONCLUSION

The clove oil and peppermint oil was found to have antibacterial activity against *Streptococcus oralis*. The formulations developed from clove oil and peppermint oil using aloe vera as a base showed significant results so it can

be further used commercially to develop dental gels after conducting clinical trials on human beings. Nevertheless further research is still needed in order to determine if they efficiently could substitute the synthetic ulcer gel.

REFERENCES

- [1.] Extraction and Characterization of Peppermint (Menthapiperita) Essential Oil and its Assessment as Antioxidant and Antibacterial
- [2.] Formulation And Evaluation Of Topical Anti Acne Formulation Of Coriander Extract
- [3.] Formulation And Development Of Dental Gel Containing Clove Oil For The Treatment Of Human Periodontal Diseases
- [4.] Formulation And Evaluation Of Dental Gel Containing Essential Oil Of Coriander Against Oral Pathogens
- [5.] Yellanki SA, Singh J and Manvi FV. Formulation, Characterization and Evaluation of Metronidazole gel for local treatment of periodontitis. International Journal of Pharm and Bio Sciences 2010; 2: 1-9.
- [6.] Botelho MA, Nogueira AP, Bastos GM, Fonseca SGC et al. Antimicrobial activity of the essential oil from Lippiasidoides, carvacrol and thymol against oral pathogens. Brazilian Journal of Medical and Biological Research 2007; 40: 349-356. <http://dx.doi.org/10.1590/S0100-879X2007000300010> PMID:17334532
- [7.] Sartoretto A, Lúcia MA, Delarmelina C et al. Composition and antimicrobial activity of essential oils from aromatic plants used in Brazil. Brazilian Journal of Microbiology 2004; 35: 275-280. <http://dx.doi.org/10.1590/S1517-83822004000300001>
- [9.] Pai MR, Acharya LD, Kapur N. Evaluation of anti plaque activity of Azadirachtaindica Leaf extract gel - a 6-week clinical study. J Ethnopharmacol 2004; 90: 99-103. <http://dx.doi.org/10.1016/j.jep.2003.09.035> PMID:14698516