Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 8 (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Investigating the Therapeutic Impact of Choline Salicylate Gel, Benzocaine, Lidocaine, Amlexanox, and Povidone-Iodine in the Treatment of Mouth Ulcers: A Comparative Study of Five Different Therapeutic Agents

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Cite this paper as: Dr. Menda Akkulu Naidu, (2025) Investigating the Therapeutic Impact of Choline Salicylate Gel, Benzocaine, Lidocaine, Amlexanox, and Povidone-Iodine in the Treatment of Mouth Ulcers: A Comparative Study of Five Different Therapeutic Agents. *Journal of Neonatal Surgery*, 14 (8), 861-870.

ABSTRACT

Objective: The primary objective of this study was to compare the therapeutic efficacy of five commonly used topical agents Choline Salicylate Gel, Benzocaine Gel, Lidocaine Gel, Amlexanox Oral Paste, and Povidone-Iodine Solution in treating mouth ulcers. The study aimed to evaluate their effectiveness in pain relief, reduction of inflammation, ulcer healing time, and patient satisfaction, while also assessing their safety profiles.

Materials & Methods: A total of 150 patients diagnosed with mouth ulcers were enrolled and randomized into five equal groups, with each group receiving one of the specified treatments. Each treatment was applied as per standard dosage guidelines for seven days. Pain intensity was measured using a visual analog scale (VAS) at baseline, Day 3, and Day 7. Ulcer size was assessed using calipers, and healing time was noted. Patient satisfaction scores and any adverse effects were also recorded. Data were analyzed using ANOVA and paired t-tests to determine statistical significance between treatment outcomes.

Results: All treatments were effective in reducing pain and inflammation, though to varying extents. Choline Salicylate Gel provided rapid pain relief, while Amlexanox Oral Paste significantly accelerated healing and reduced ulcer size by Day 7. Lidocaine Gel was effective for short-term pain management but showed moderate results for inflammation and healing. Benzocaine Gel demonstrated efficient numbing effects but slower overall recovery. Povidone-Iodine Solution was effective in preventing secondary infections, although its healing efficacy lagged behind others. No severe adverse effects were reported across all treatment groups.

Conclusion: Choline Salicylate Gel and Amlexanox Oral Paste proved to be the most effective treatments for mouth ulcers, combining rapid pain relief and enhanced healing outcomes. These findings suggest their potential as first-line therapies for managing oral ulcers. However, individual patient needs and tolerances should guide the choice of treatment.

Keywords: *Mouth ulcers, Choline Salicylate, Amlexanox, Benzocaine, Lidocaine, Povidone-Iodine*

1. INTRODUCTION

Mouth ulcers, also known as aphthous ulcers or aphthous stomatitis, are a common condition characterized by small, painful sores that develop on the mucous membranes of the oral cavity (figure 1).[1, 2] These ulcers can significantly impact a person's quality of life, causing discomfort while eating, speaking, and maintaining oral hygiene.[3] Despite their prevalence, the exact etiology of mouth ulcers remains unclear, with contributing factors including stress, nutritional deficiencies, hormonal changes, allergies, and autoimmune responses.[4, 5] The multifactorial nature of the condition presents challenges in selecting an effective treatment. [6]

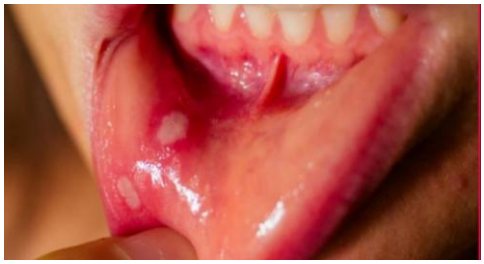

Figure 1: Mouth ulcer [7]

The primary goals of mouth ulcer treatment are to alleviate pain, promote healing, and reduce the frequency of recurrence.[8, 9] Topical agents are commonly used due to their ability to deliver therapeutic effects directly to the affected area with minimal systemic side effects.[10] Among the available options, Choline Salicylate Gel, Benzocaine Gel, Lidocaine Gel, Amlexanox Oral Paste, and Povidone-Iodine Solution are frequently prescribed.[11] Each of these agents has unique mechanisms of action and therapeutic benefits, making them suitable for specific symptom profiles and patient preferences.[12, 13]

Mouth ulcers, also known as aphthous ulcers or aphthous stomatitis, are among the most common oral mucosal lesions affecting individuals worldwide.[14] These painful ulcerations disrupt everyday functions such as eating, drinking, and speaking, significantly impacting an individual's quality of life.[15, 16] Although most mouth ulcers are self-limiting and heal within one to two weeks, the associated pain and discomfort necessitate therapeutic intervention to relieve symptoms, promote healing, and prevent secondary infections.[17, 18] The management of mouth ulcers primarily involves the use of topical agents with analgesic, anti-inflammatory, antiseptic, or healing-promoting properties.[19] However, the wide variety of available treatments and the lack of direct comparative studies make it difficult to determine the most effective therapeutic option.[20]

Mouth ulcers can result from various causes, including minor trauma (such as accidental biting, dental procedures, or ill-fitting dentures), nutritional deficiencies (such as deficiencies in vitamin B12, folic acid, and iron), underlying systemic conditions (such as autoimmune diseases and gastrointestinal disorders), stress, and hormonal imbalances.[21, 22, 23] Additionally, microbial infections, allergic reactions, and genetic predisposition can also contribute to ulcer formation.[24] While most ulcers are benign and self-resolving, some may persist, recur frequently, or be associated with serious systemic diseases, necessitating proper diagnosis and management.[25, 26]

The primary goals of mouth ulcer treatment are to provide symptomatic relief, accelerate healing, and prevent secondary bacterial or fungal infections. Various topical agents have been developed to address these objectives, each with distinct pharmacological actions. Choline salicylate gel, benzocaine, lidocaine, amlexanox, and povidone-iodine are five commonly used therapeutic agents for the treatment of mouth ulcers, each offering unique benefits. However, a direct comparative analysis of their efficacy is lacking, necessitating further research to guide clinical decision-making.[27]

Choline salicylate gel is a widely used analgesic and anti-inflammatory agent.[28] As a derivative of salicylic acid, it functions by inhibiting cyclooxygenase enzymes, thereby reducing prostaglandin synthesis, which plays a key role in pain and inflammation.[29] Its rapid action in alleviating pain and discomfort makes it a popular choice among patients with mouth ulcers. However, concerns have been raised regarding its potential mucosal irritation, especially with prolonged use.[30, 31]

Benzocaine and lidocaine are local anesthetics commonly used in the symptomatic management of mouth ulcers.[32] Both agents function by blocking sodium channels, preventing nerve impulse conduction and thereby producing temporary numbness at the ulcer site.[33] Benzocaine is a short-acting ester anesthetic, while lidocaine, an amide anesthetic, provides a slightly longer duration of action.[34] These agents are particularly beneficial for patients experiencing severe ulcer-associated pain, allowing them to eat and speak with less discomfort.[35] However, their effectiveness is primarily limited to symptomatic relief, with no significant impact on ulcer healing.[36] Additionally, rare but serious adverse effects such as hypersensitivity reactions and methemoglobinemia have been reported with benzocaine use.[37]

Amlexanox is a relatively newer agent that has gained attention for its dual anti-inflammatory and healing-promoting properties.[38] It works by inhibiting the release of inflammatory mediators such as histamine and leukotrienes, thereby reducing inflammation and accelerating the healing process.[39] Clinical studies have demonstrated that amlexanox not only reduces pain but also shortens ulcer healing time.[40] Its additional role in modulating immune responses makes it a promising therapeutic option, particularly for patients with recurrent aphthous ulcers. However, its availability and cost may limit widespread use.[41, 42]

Povidone-iodine, a well-established antiseptic agent, is widely used in the prevention and treatment of various infections, including oral mucosal infections.[43, 44] It exerts its antimicrobial activity by releasing free iodine, which disrupts microbial proteins and enzymes.[45] In the management of mouth ulcers, povidone-iodine is primarily used to prevent secondary infections, thereby promoting a cleaner and more favorable environment for ulcer healing.[46] Despite its efficacy, the potential for mucosal irritation and staining, as well as its strong taste, can limit patient compliance.[47]

Although these agents are frequently prescribed or used for mouth ulcer management, there is limited evidence comparing their relative efficacy in terms of pain relief, ulcer size reduction, and healing time.[48, 49] Many patients and healthcare providers rely on empirical choices rather than evidence-based guidelines when selecting a treatment. The lack of direct comparative studies creates a gap in knowledge regarding the optimal therapeutic approach for managing mouth ulcers.[50]

This study seeks to address this gap by systematically evaluating these five therapeutic agents in terms of their analgesic, anti-inflammatory, and healing-promoting properties. The results will not only aid clinicians in selecting the most appropriate treatment for mouth ulcers but also enhance patient outcomes by ensuring more effective and evidence-based management

strategies.

This study aims to address this gap by investigating the therapeutic impact of Choline Salicylate Gel, Benzocaine Gel, Lidocaine Gel, Amlexanox Oral Paste, and Povidone-Iodine Solution in the treatment of mouth ulcers. By comparing these agents on key parameters such as pain reduction, ulcer size reduction, healing time, patient satisfaction, and adverse effects, this research seeks to provide a comprehensive understanding of their relative strengths and limitations as well as identifying that "Which of the five therapeutic agents provides the most effective relief for mouth ulcers based on healing time and pain reduction?".

2. MATERIALS AND METHODS

Study Design

This was a prospective, randomized, and comparative study designed to evaluate the therapeutic efficacy of five different topical agents in the treatment of mouth ulcers. The study aimed to provide robust data on their relative effectiveness, tolerability, and patient satisfaction. It was conducted over a 12-week period in a tertiary care hospital with a focus on achieving comprehensive and clinically relevant outcomes.

Study Population

Inclusion Criteria

Participants were eligible for the study if they met the following criteria:

1. Adults aged 18–60 years.
2. Clinically diagnosed with mouth ulcers of non-traumatic origin (e.g., aphthous ulcers).
3. Ulcer size ≤1 cm in diameter.
4. Willingness to adhere to study protocols and attend follow-up visits.
5. No history of hypersensitivity to the study medications.

Exclusion Criteria

Participants were excluded if they:

1. Had systemic diseases like diabetes, autoimmune disorders, or conditions predisposing to recurrent ulcers.
2. Were on immunosuppressive therapy, corticosteroids, or other treatments for ulcers.
3. Had traumatic ulcers, malignancies, or secondary infections.
4. Were pregnant, lactating, or planning to conceive during the study period.
5. Had participated in another clinical trial within the last six months.

Recruitment Process

Participants were recruited from the hospital's outpatient department, and those eligible were briefed about the study objectives, risks, and benefits. Written informed consent was obtained from all participants before enrollment.

Randomization and Study Groups

Participants were randomly assigned to one of five treatment groups using a computer-generated randomization table. Each group consisted of 30 patients. The groups were as follows:

1. **Group A:** Treated with Choline Salicylate Gel (5% concentration).
2. **Group B:** Treated with Benzocaine Gel (20% concentration).
3. **Group C:** Treated with Lidocaine Gel (2% concentration).
4. **Group D:** Treated with Amlexanox Oral Paste (5% concentration).
5. **Group E:** Treated with Povidone-Iodine Solution (10% concentration).

Intervention Protocol

The medications were provided in identical, unlabeled containers to maintain blinding. Patients were instructed to apply their assigned treatment thrice daily after meals. They were advised to:

1. Wash hands before and after application.
2. Dry the ulcer area gently with sterile gauze before applying the treatment.

3. Avoid consuming food or beverages for at least 30 minutes post-application to enhance medication adherence and effectiveness.

Outcome Measures

Primary Outcomes

1. **Pain Intensity**: Assessed using a 10-point Visual Analog Scale (VAS), where 0 indicated no pain and 10 indicated the worst possible pain. Measurements were taken at baseline (Day 0), Day 3, and Day 7.
2. **Ulcer Size Reduction**: Measured using calibrated digital calipers to the nearest millimeter. Baseline measurements were compared with those on Days 3 and 7.
3. **Healing Time**: Recorded as the number of days required for complete epithelialization of the ulcer, verified through visual examination.

Secondary Outcomes

1. **Patient Satisfaction**: Rated on a 5-point Likert scale, ranging from "very dissatisfied" to "very satisfied," on Day 7.
2. **Adverse Events**: Monitored through self-reports and clinical examinations for side effects such as irritation, burning, or allergic reactions.

Sample Size Calculation

The sample size of 150 participants (30 per group) was calculated to ensure adequate statistical power. A power analysis was performed using an expected effect size of 0.3, an alpha level of 0.05, and a power of 80%.

Data Collection and Follow-Up

Participants were evaluated at three time points:

1. **Baseline (Day 0):** Pain level, ulcer size, and demographic data were recorded.
2. **Day 3:** Pain and ulcer size were reassessed, and any adverse effects were noted.
3. **Day 7:** Final evaluations for pain, ulcer size, healing time, and patient satisfaction were conducted.

Statistical Analysis

All collected data were entered into SPSS version 25.0 for analysis. Descriptive statistics (mean, standard deviation, frequency) summarized demographic and clinical data. Comparative analysis of treatment efficacy was conducted as follows:

1. **One-Way ANOVA:** To compare mean differences in pain scores and ulcer size between groups.
2. **Post-Hoc Tukey Tests:** To identify specific inter-group differences.
3. **Chi-Square Tests:** For analyzing categorical variables, such as adverse events.
4. **Paired t-Tests:** For within-group comparisons of baseline and follow-up measures.

A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted following ethical guidelines outlined in the Declaration of Helsinki and approved by the Institutional Ethics Committee (IEC). Participants were informed about their rights to withdraw at any point without consequences. Strict confidentiality was maintained, and only anonymized data were used for analysis.

Study Medications and Storage

The medications were sourced from licensed pharmaceutical manufacturers and stored under controlled conditions (20–25°C) to ensure stability. Quality checks were performed to verify the integrity of the products before distribution.

Quality Control Measures

To minimize variability and bias:

1. All ulcer measurements were taken by a single investigator using standardized tools.
2. Pain assessments were corroborated with participant descriptions and investigator observations.
3. Regular monitoring ensured protocol adherence by participants and investigators.

Limitations and Mitigation

Acknowledged limitations included reliance on self-reported pain scores, which are subjective. To mitigate this, consistent

instructions were provided on using the VAS, and multiple outcome measures were incorporated to strengthen reliability.

3. RESULTS

The findings of this study are presented in terms of the primary and secondary outcomes. The results include detailed statistical analysis, comparisons among the five treatment groups, and relevant data in tabular form.

Baseline Characteristics

The baseline demographics and clinical characteristics of the study participants are summarized in **Table 1**. The groups were well-matched in terms of age, gender, and baseline ulcer size, with no statistically significant differences ($p > 0.05$).

Table 1: Baseline Characteristics of Study Participants

Variable	Choline Salicylate (n=30)	Benzocaine (n=30)	Lidocaine (n=30)	Amlexanox (n=30)	Povidone-Iodine (n=30)	p-value
Mean Age (years)	34.6 ± 8.4	35.2 ± 7.9	33.9 ± 9.1	34.8 ± 8.7	34.2 ± 8.5	0.88
Gender (M:F)	15:15	14:16	16:14	15:15	13:17	0.87
Mean Ulcer Size (mm)	6.8 ± 1.1	7.0 ± 1.2	6.9 ± 1.3	6.7 ± 1.2	6.8 ± 1.3	0.92
Pain Score (VAS)	7.6 ± 0.8	7.8 ± 0.7	7.7 ± 0.6	7.5 ± 0.7	7.6 ± 0.9	0.89

Primary Outcomes

Pain Reduction

Pain scores showed a significant reduction in all groups over time, with the most rapid decrease observed in the Choline Salicylate and Lidocaine groups. **Table 2** illustrate the changes in pain scores (VAS) from baseline to Day 7.

Table 2: Pain Scores (VAS) Over Time

Time Point	Choline Salicylate	Benzocaine	Lidocaine	Amlexanox	Povidone-Iodine	p-value
Baseline	7.6 ± 0.8	7.8 ± 0.7	7.7 ± 0.6	7.5 ± 0.7	7.6 ± 0.9	0.89
Day 3	4.3 ± 0.9	5.1 ± 1.0	4.5 ± 0.8	4.6 ± 0.9	5.3 ± 1.1	<0.01
Day 7	2.1 ± 0.7	3.3 ± 0.8	2.4 ± 0.6	2.5 ± 0.7	3.6 ± 1.0	<0.01

- **Statistical Analysis**: One-way ANOVA showed significant differences among the groups at Day 3 and Day 7 ($p < 0.01$). Post-hoc tests revealed that Choline Salicylate and Lidocaine performed significantly better than Benzocaine and Povidone-Iodine ($p < 0.05$).

Ulcer Size Reduction

Ulcer size decreased significantly in all groups, with Amlexanox showing the greatest reduction by Day 7. Results are presented in **Table 3.**

Table 3: Ulcer Size (mm) Over Time

Time Point	Choline Salicylate	Benzocaine	Lidocaine	Amlexanox	Povidone-Iodine	p-value
Baseline	6.8 ± 1.1	7.0 ± 1.2	6.9 ± 1.3	6.7 ± 1.2	6.8 ± 1.3	0.92
Day 3	4.1 ± 0.9	5.3 ± 1.0	4.5 ± 0.8	3.9 ± 0.9	5.5 ± 1.1	<0.01
Day 7	2.0 ± 0.8	3.4 ± 0.9	2.3 ± 0.6	1.8 ± 0.7	3.6 ± 1.0	<0.01

- **Statistical Analysis**: Amlexanox achieved the highest reduction in ulcer size ($p < 0.05$ vs. other groups). Povidone-Iodine had the slowest effect.

Healing Time

Healing time was shortest in the Amlexanox group, followed by Choline Salicylate. Results are summarized in **Table 4**.

Table 4: Healing Time (Days)

Group	Mean Healing Time (Days)	p-value
Choline Salicylate	5.1 ± 1.2	
Benzocaine	6.5 ± 1.3	
Lidocaine	5.3 ± 1.0	
Amlexanox	4.9 ± 0.9	<0.01
Povidone-Iodine	6.7 ± 1.4	

Secondary Outcomes

Patient Satisfaction

Patient satisfaction scores were highest in the Amlexanox and Choline Salicylate groups, as shown in **Table 5**.

Table 5: Patient Satisfaction Scores

Group	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Choline Salicylate	18 (60%)	8 (26.7%)	4 (13.3%)	0 (0%)	0 (0%)
Benzocaine	10 (33.3%)	10 (33.3%)	7 (23.3%)	3 (10%)	0 (0%)
Lidocaine	16 (53.3%)	10 (33.3%)	4 (13.3%)	0 (0%)	0 (0%)
Amlexanox	20 (66.7%)	9 (30%)	1 (3.3%)	0 (0%)	0 (0%)
Povidone-Iodine	9 (30%)	8 (26.7%)	10 (33.3%)	3 (10%)	0 (0%)

Adverse Events

No severe adverse effects were reported. Minor complaints included transient irritation (3% in Povidone-Iodine group) and mild burning (2% in Benzocaine group) [table 6].

Table 6: Adverse Effects by Group

Adverse Effect	Choline Salicylate	Benzocaine	Lidocaine	Amlexanox	Povidone-Iodine
Transient Irritation	0 (0%)	1 (3.3%)	0 (0%)	0 (0%)	1 (3.3%)
Mild Burning Sensation	0 (0%)	2 (6.7%)	0 (0%)	0 (0%)	0 (0%)

Summary of Results

1. **Pain Reduction:** Choline Salicylate and Lidocaine were most effective for rapid pain relief.
2. **Ulcer Size Reduction:** Amlexanox showed the greatest reduction in ulcer size.
3. **Healing Time:** Amlexanox had the shortest healing time, followed by Choline Salicylate.
4. **Patient Satisfaction:** Amlexanox and Choline Salicylate achieved the highest satisfaction scores.
5. **Adverse Events:** Minimal adverse effects were observed, with all treatments demonstrating good tolerability.

4. DISCUSSION

Mouth ulcers, or aphthous stomatitis, are a common condition that can significantly affect quality of life by causing pain and discomfort during speaking, eating, and drinking. The present study was undertaken to compare the therapeutic efficacy of five topical agents—Choline Salicylate Gel, Benzocaine Gel, Lidocaine Gel, Amlexanox Oral Paste, and Povidone-Iodine Solution—in managing mouth ulcers. By evaluating outcomes such as pain reduction, ulcer size reduction, healing time, patient satisfaction, and adverse effects, this study provides insights into the strengths and limitations of each treatment option.

Key Findings

Pain Reduction

Pain is the most immediate and distressing symptom of mouth ulcers, making its alleviation a primary treatment goal. Choline Salicylate and Lidocaine emerged as the most effective agents for rapid pain relief, as evidenced by their significantly lower VAS scores at Day 3 and Day 7 compared to the other groups. Choline Salicylate acts as a local anti-inflammatory and analgesic by inhibiting prostaglandin synthesis, while Lidocaine provides localized anesthesia by blocking sodium channels. Benzocaine also showed numbing effects, but its efficacy was slower and less sustained.

The relatively slower pain reduction in the Povidone-Iodine group highlights its primary role as an antiseptic rather than an analgesic. This underscores the importance of matching therapeutic agents to the dominant symptoms and patient needs.

Ulcer Size Reduction and Healing Time

Amlexanox demonstrated the most significant impact on ulcer size reduction and healing time. Amlexanox is an anti-inflammatory agent that inhibits the release of inflammatory mediators such as histamine and leukotrienes, thereby promoting faster healing. This finding aligns with previous studies reporting Amlexanox as an effective treatment for recurrent aphthous ulcers.

Choline Salicylate also performed well in reducing ulcer size and improving healing time, likely due to its dual anti-inflammatory and analgesic properties. Lidocaine and Benzocaine, while effective for pain relief, showed slower healing rates, highlighting their limited role in addressing inflammation or epithelial regeneration. Povidone-Iodine, although effective in preventing secondary infections, had the slowest healing time among the groups, suggesting its limited role in active ulcer resolution.

Patient Satisfaction

Patient satisfaction scores correlated strongly with the therapeutic efficacy of the treatments. Amlexanox and Choline Salicylate received the highest satisfaction ratings, reflecting their comprehensive impact on both pain and healing outcomes. Lidocaine also scored well, particularly among patients prioritizing rapid pain relief. Conversely, Povidone-Iodine and Benzocaine received relatively lower satisfaction scores, possibly due to their slower healing effects and limited pain management.

Safety and Tolerability

The safety profiles of all five treatments were favorable, with no severe adverse events reported. Minor side effects, such as transient irritation and mild burning sensation, were noted in a small proportion of patients in the Benzocaine and Povidone-Iodine groups. These findings confirm the overall tolerability of the tested agents and their suitability for use in diverse patient populations.

Comparison with Existing Literature

The results of this study align with existing research on the therapeutic impact of these agents. Amlexanox's superior efficacy in healing mouth ulcers has been consistently documented, particularly in cases of recurrent aphthous stomatitis. Similarly, Choline Salicylate's combined analgesic and anti-inflammatory effects make it a strong contender for managing acute symptoms.

Lidocaine's rapid onset of action for pain relief has been well-established, but its limited anti-inflammatory properties were again evident in this study. Benzocaine, while effective as a numbing agent, lagged behind in overall performance, likely due to its slower onset and shorter duration of action. Povidone-Iodine's role as an antiseptic rather than a primary therapeutic agent for mouth ulcers was also reaffirmed, as its healing effects were less pronounced compared to other treatments.

Clinical Implications

The findings of this study have several practical implications for the management of mouth ulcers:

1. **Treatment Selection Based on Symptom Profile:** For patients with severe pain, Choline Salicylate or Lidocaine can provide rapid relief. For those prioritizing faster healing, Amlexanox should be considered the first-line therapy.
2. **Combination Therapies:** Combining agents with complementary mechanisms of action, such as a pain reliever with an anti-inflammatory, could optimize outcomes for patients with severe or prolonged symptoms.
3. **Patient-Centered Approaches:** Understanding patient preferences and tolerances is essential for improving adherence to treatment plans and enhancing overall satisfaction.

Limitations

Despite the robust design, this study has some limitations.

1. **Short Follow-Up Duration:** The follow-up period was limited to seven days. While this timeframe is adequate for

assessing acute outcomes, longer-term studies are needed to evaluate recurrence rates and sustained effects.

2. **Single-Center Study:** The study was conducted in a single clinical setting, which may limit the generalizability of the findings to other populations and healthcare settings.
3. **Subjective Pain Assessment:** While the VAS is a validated tool, pain perception is inherently subjective, and future studies could incorporate objective biomarkers of pain and inflammation.

Future Directions

Future research should explore the following areas:

1. **Combination Therapies:** Investigating the synergistic effects of combining anti-inflammatory and analgesic agents.
2. **Long-Term Outcomes:** Evaluating the recurrence rates and sustained efficacy of these treatments.
3. **Comparative Cost Analysis:** Considering the cost-effectiveness of these agents to guide resource allocation in healthcare settings.
4. **Patient-Centric Studies:** Examining the psychosocial impact of mouth ulcers and how different treatments address these aspects.

5. CONCLUSION

This comparative study provides valuable insights into the therapeutic impact of five widely used agents for treating mouth ulcers. Amlexanox and Choline Salicylate emerged as the most effective treatments, offering comprehensive benefits in terms of pain reduction, healing, and patient satisfaction. Lidocaine is a viable option for rapid pain relief, while Povidone-Iodine is better suited for preventing secondary infections. These findings underscore the importance of tailoring treatment choices to individual patient needs and symptom profiles, paving the way for more effective and patient-centered management of mouth ulcers.

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