

ROLE OF ALOE VERA IN DENTISTRY: NARRATIVE LITERATURE REVIEW

Narrative Review

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ABSTRACT

Background: Aloe vera (*Aloe barbadensis miller*) is a well-known medicinal plant with diverse pharmacological properties, including antibacterial, antifungal, antiviral, anti-inflammatory, and wound-healing effects. Its use in dentistry has gained significant attention due to the increasing interest in natural and biocompatible alternatives to synthetic agents. Aloe vera gel is rich in essential vitamins, minerals, enzymes, and amino acids that contribute to its therapeutic benefits, making it a promising adjunct in dental care.

Objective: This narrative review aims to explore the applications of Aloe vera in various branches of dentistry, evaluate its clinical efficacy, and discuss limitations in the current body of evidence while suggesting directions for future research.

Main Discussion Points: The review synthesizes literature on Aloe vera's role in oral medicine, periodontology, oral and maxillofacial surgery, prosthodontics, endodontics, pediatric dentistry, and cross-infection control. Clinical findings indicate Aloe vera's effectiveness in treating oral lichen planus, aphthous ulcers, gingivitis, alveolar osteitis, denture-related infections, and as an intracanal medicament. However, variability in formulations, small sample sizes, and inconsistent methodologies across studies limit definitive conclusions. Critical analysis reveals gaps in standardization and long-term efficacy data.

Conclusion: Aloe vera holds significant potential as a natural adjunctive agent in dentistry, with benefits across a range of clinical applications. While preliminary evidence is promising, further high-quality randomized controlled trials are essential to validate its effectiveness and inform standardized clinical guidelines.

Keywords: Aloe vera, Dentistry, Oral Medicine, Periodontology, Natural Therapeutics, Narrative Review.

INTRODUCTION

Aloe vera, a succulent plant widely known for its therapeutic potential, has garnered increasing interest in the field of dentistry due to its diverse pharmacological properties and biocompatibility. Belonging to the Liliaceae family, Aloe vera has been used traditionally across various cultures for its soothing, wound-healing, and anti-inflammatory effects. Among the over 300 species identified, *Aloe barbadensis miller* is the most widely researched for medicinal purposes. The transparent mucilaginous gel derived from the inner leaf contains a rich matrix of bioactive components, including vitamins, minerals, enzymes, polysaccharides, amino acids, and sterols. These constituents have been found to exhibit antimicrobial, anti-inflammatory, antioxidant, and immunomodulatory properties, which are highly relevant to dental care (1,2). The global burden of oral diseases remains a significant public health challenge, affecting nearly 3.5 billion people worldwide. Dental caries and periodontal diseases are among the most prevalent non-communicable diseases globally, with a particularly high prevalence in low- and middle-income countries due to limited access to oral healthcare services. Conventional dental treatments often rely on synthetic pharmaceuticals, which may lead to adverse effects, drug resistance, and hypersensitivity reactions. Therefore, there is a growing demand for alternative or adjunctive natural therapies that are both safe and effective. In this context, Aloe vera has emerged as a promising phytotherapeutic agent in dental applications, including but not limited to gingivitis, periodontitis, oral lichen planus, aphthous ulcers, and post-extraction wound healing (3,4).

Over the past decade, multiple in vitro and in vivo studies have examined the use of Aloe vera in dentistry. Its anti-inflammatory effects are attributed to the suppression of cyclooxygenase pathways and reduction in prostaglandin E2 production. Additionally, Aloe vera enhances fibroblast proliferation and collagen synthesis, accelerating tissue regeneration and healing (5). The antibacterial efficacy of Aloe vera gel has been demonstrated against both gram-positive and gram-negative organisms, including *Streptococcus mutans*, *Lactobacillus acidophilus*, and *Porphyromonas gingivalis* (6), all of which play critical roles in dental plaque formation and periodontal disease progression. Its antiviral and antifungal capabilities further broaden its therapeutic scope, especially in the management of oral candidiasis and herpes simplex virus infections. Despite a growing body of evidence supporting the dental applications of Aloe vera, there remains a lack of consensus regarding its standardized formulations, dosage, and long-term efficacy (7). While several clinical trials have reported promising results in reducing gingival inflammation, plaque scores, and mucosal ulceration, methodological variations and small sample sizes limit the generalizability of findings. Moreover, the precise mechanisms of action underlying Aloe vera's pharmacodynamics in oral tissues have not been fully elucidated. There is also a need to understand potential interactions with conventional dental products such as chlorhexidine and fluoride-based agents, to optimize combination therapies and prevent antagonistic effects (8,9).

Given the limitations in current research and the potential benefits of Aloe vera in dental care, a comprehensive narrative review is warranted to synthesize the existing literature, highlight therapeutic outcomes, and identify gaps that warrant further investigation. This review aims to explore the pharmacological attributes of Aloe vera relevant to dentistry, critically evaluate its clinical efficacy across various oral health conditions, and discuss future directions for its integration into dental practice. Emphasis will be placed on recent studies published in the last five years, focusing on both randomized controlled trials and observational studies that examine the clinical outcomes, safety profiles, and patient-reported benefits of Aloe vera-based formulations (10). The rationale for conducting this review stems from the growing inclination toward herbal and natural treatment modalities in dental care, especially in the context of rising antimicrobial resistance and increased awareness of biocompatibility. By providing a cohesive overview of the therapeutic potential of Aloe vera in dentistry, this review seeks to inform clinicians, researchers, and policy-makers about its practical implications, limitations, and avenues for further research. The goal is not only to validate Aloe vera as a viable adjunct in dental care but also to encourage its standardized incorporation into evidence-based treatment protocols. In doing so, the review contributes to a more holistic and integrative approach to oral healthcare, which aligns with contemporary trends in personalized and minimally invasive dentistry.

Thematic Discussion

The application of Aloe vera in various dental specialties has gained significant attention due to its multifaceted therapeutic properties. With its anti-inflammatory, antimicrobial, and wound-healing attributes, Aloe vera has emerged as a viable adjunctive agent across domains such as oral medicine, periodontology, oral surgery, prosthodontics, and pediatric dentistry. The literature highlights several promising interventions using Aloe vera in both clinical and supportive dental care, although certain inconsistencies in methodology and standardization still prevail. In oral medicine, Aloe vera has demonstrated notable efficacy in the management of chronic mucosal conditions. A randomized controlled trial showed significantly better symptom resolution in patients with oral lichen planus treated with Aloe vera compared to placebo, attributing the effect to its immunomodulatory and anti-inflammatory constituents (11). Similarly, in the management of oral submucous fibrosis, a chronic precancerous condition, the application of Aloe vera gel has shown promising

antifibrotic and symptomatic benefits (12). These results are further supported by a double-blind clinical trial which found that Aloe vera gel application significantly reduced pain and lesion size in patients with recurrent aphthous ulcers, underscoring its potential as a non-steroidal option for mucosal ulcerations (13).

In the domain of oral and maxillofacial surgery, Aloe vera's efficacy extends to both pre- and post-operative care. Studies have supported its role in reducing the incidence of alveolar osteitis following tooth extractions, with its anti-inflammatory and antimicrobial action aiding socket healing (14). Moreover, the mucoprotective effects of Aloe vera have been explored in radiation-induced oral mucositis, with reduced severity and delayed onset of mucositis among patients undergoing head and neck radiotherapy (14). Its application as a postoperative rinse after third molar surgery has also been explored, where Aloe vera mouthwash was shown to significantly reduce postoperative pain and swelling, offering a botanical alternative to conventional pharmacologic rinses (15). Furthermore, Aloe vera was noted to enhance angiogenesis and soft tissue healing following periapical surgery, suggesting a role in promoting local vascularization (16). In periodontology, Aloe vera has demonstrated benefits in managing gingival inflammation and promoting periodontal wound healing. The gel's natural antibacterial and anti-inflammatory properties offer a non-toxic and patient-friendly alternative to chemical agents. In plaque-induced gingivitis, mouth rinses containing Aloe vera have been found effective in reducing gingival index scores, comparable to chlorhexidine but without associated side effects such as staining and taste alteration (17). Additionally, its application following periodontal flap surgery has shown improved soft tissue healing and reduced postoperative discomfort, making it a cost-effective adjunct (18). Aloe vera has also been used as a subgingival gel post-scaling and root planing, where it promotes healing of periodontal pockets by modulating inflammatory responses and fibroblast activity. When used as an antiplaque agent, Aloe vera demonstrated results comparable to chlorhexidine, making it suitable for long-term plaque control with better tolerance (19).

In prosthodontics, particularly in patients wearing removable dentures, Aloe vera has been studied for its antifungal and antimicrobial properties. Its efficacy in reducing *Candida albicans* colonization makes it an ideal candidate for denture stomatitis management. Aloe vera-based denture cleansers offer similar antimicrobial effects to chemical cleansers, without the cytotoxicity commonly associated with chemical agents (20). A study indicated that Aloe vera-based herbal adhesives provided better retention and stability in mandibular dentures, which could significantly enhance patient comfort and satisfaction in complete denture wearers (21). Within operative dentistry and endodontics, Aloe vera has gained attention for its use as an intracanal medicament. A study demonstrated that Aloe vera showed potent antimicrobial activity within root canals and did not interfere with the physical integrity of gutta-percha, making it a safe option for canal disinfection (22). Additionally, Aloe vera has been suggested as a bio-compatible bonding agent enhancer in adhesive restorative procedures due to its influence on the dentin collagen matrix (23). Its ability to preserve periodontal ligament cell viability has also been utilized in tooth avulsion cases, where Aloe vera gel acts as a storage medium prior to replantation, improving the prognosis of avulsed teeth (24). In preventive and pediatric dentistry, the non-abrasive nature of Aloe vera gel makes it an effective alternative to toothpaste, particularly for patients with dentin hypersensitivity or special needs. After minimally invasive caries excavation, Aloe vera gel can be used to disinfect the remaining dentinal surfaces, thereby preventing secondary infections (4). In an observational study, combined Aloe vera with zinc oxide eugenol as an obturating material in pediatric endodontics. The blend not only showed favorable sealing but also promoted periradicular healing in primary molars (25).

Finally, in the context of cross-infection control, Aloe vera's antimicrobial properties are also being evaluated for dental unit waterline (DUWL) disinfection. Chemical disinfectants, although effective, can corrode dental equipment and pose health hazards. Herbal alternatives like Aloe vera offer a safe and eco-friendly solution. Aloe vera was effective in reducing microbial counts in DUWLs, proposing its application as a part of routine infection control protocols (12,20). Despite encouraging findings across various domains, it is important to acknowledge limitations in current research, including small sample sizes, lack of standardized formulations, and variability in concentration and application methods. Furthermore, most available studies have short follow-up durations, limiting long-term efficacy evaluation. Larger multicentric randomized trials with uniform protocols are required to establish definitive clinical guidelines. Until then, Aloe vera remains a promising but adjunctive therapeutic option in dentistry, with scope for integration into holistic and minimally invasive dental care models.

Table 1: Summary of Aloe Vera Applications and Clinical Benefits Across Dental Specialties

Dental Specialty	Clinical Application	Observed Benefits	Reference
Oral Medicine	Oral Lichen Planus	Symptom reduction, lesion healing	(10)
Oral Medicine	Oral Submucous Fibrosis	Anti-fibrotic effect, pain relief	(11)
Oral Medicine	Recurrent Aphthous Ulcers	Reduced lesion size and pain	(12)
Oral & Maxillofacial Surgery	Alveolar Osteitis	Decreased incidence of dry socket	(13)
Oral & Maxillofacial Surgery	Radiation-induced Mucositis	Delay in onset, reduced severity	(14)
Oral & Maxillofacial Surgery	Post-Third Molar Surgery	Decreased postoperative pain and swelling	(15)
Oral & Maxillofacial Surgery	Periapical Surgery	Enhanced angiogenesis, wound healing	(16)
Periodontology	Gingivitis & Plaque Control	Reduced inflammation, comparable to chlorhexidine	(17)
Periodontology	Post-Periodontal Flap Surgery	Improved healing, cost-effective	(16)
Periodontology	Periodontal Pocket Healing	Enhanced healing after scaling and root planing	(19)
Prosthodontics	Denture Stomatitis	Antifungal, anti-Candida properties	(21)
Prosthodontics	Denture Cleanser & Adhesive	Effective cleansing with improved denture retention	(22,23)
Operative & Endodontics	Intracanal Medicament	Antimicrobial, gutta-percha compatible	(24)
Operative & Endodontics	Composite Bonding & Tooth Avulsion	Enhanced bonding; viable storage medium	(22,25)
Pediatric Dentistry	Caries Disinfection & Obturating Material	Safe disinfection, periradicular healing	(12)
Cross-Infection Control	Dental Unit Waterline Disinfection	Microbial load reduction with eco-friendly properties	(18)

Critical Analysis and Limitations

Despite the encouraging findings regarding the therapeutic applications of *Aloe vera* in dentistry, the existing body of literature presents several critical limitations that must be acknowledged. A major concern lies in the overall quality and consistency of study designs. Many of the available investigations, though promising in outcomes, are based on small sample sizes that limit the statistical power and robustness of their conclusions. Several studies lacked control groups or were non-randomized, introducing potential for overestimation of treatment effects. The scarcity of large-scale, multicenter randomized controlled trials (RCTs) significantly impairs the credibility and reliability of many claims, particularly in areas such as mucosal lesion healing or endodontic disinfection, where standardization is crucial for therapeutic reproducibility (10–17). Methodological biases are also evident across the reviewed literature. Selection bias is a recurrent limitation, as most studies tend to recruit homogenous populations, often excluding patients with comorbidities, extensive oral pathology, or diverse ethnic backgrounds. This narrow selection may skew results and hinders the external validity of findings. Furthermore, performance bias due to lack of proper blinding—both of participants and outcome assessors—is common. For instance, many trials evaluating Aloe vera-based mouth rinses fail to use indistinguishable placebo preparations, which could influence participants' subjective reporting of symptoms such as pain or burning sensation (12,15).

Another issue concerns the potential for publication bias. Positive findings showing Aloe vera's effectiveness are more likely to be published, whereas studies yielding null or negative results may remain unpublished. This selective reporting inflates perceived efficacy and creates an overrepresentation of successful interventions in the literature. Without access to full datasets or unpublished trials, it becomes challenging to perform objective meta-analyses or evidence grading (19,20). The variability in measurement outcomes also restricts direct comparisons between studies. Researchers have used a wide range of outcome measures—ranging from plaque index scores and ulcer diameter to subjective pain scales and histological evaluations. This heterogeneity makes it difficult to synthesize data across studies or reach unified conclusions regarding the optimal dosage, frequency, and mode of Aloe vera administration. For example,

differences in formulation (gel vs. extract vs. rinse), concentration, and duration of use may lead to significantly different outcomes, yet these variables are often underreported or inconsistently applied (13,18).

The generalizability of findings remains another concern. A considerable portion of the current literature has been conducted in specific geographic regions, such as South Asia and the Middle East, where traditional or herbal medicine holds cultural prominence. Consequently, the patient populations studied may already exhibit a predisposition toward accepting or responding favorably to plant-based treatments. Moreover, the lack of studies involving pediatric, geriatric, and immunocompromised populations limits the applicability of Aloe vera interventions across the full spectrum of dental patients. Most available data focus on adult participants with mild-to-moderate oral pathologies, and thus, extrapolating results to complex clinical scenarios may not be appropriate (11,22,23). In summary, while Aloe vera continues to demonstrate therapeutic promise in various dental disciplines, its integration into mainstream clinical practice must be approached with caution. Addressing methodological weaknesses, standardizing formulations and outcome measures, and expanding the diversity of studied populations are essential next steps. Only through rigorous, transparent, and large-scale clinical research can Aloe vera's role in evidence-based dentistry be fully realized.

Implications and Future Directions

The growing body of evidence supporting the use of *Aloe vera* in dentistry offers several meaningful implications for clinical practice. As an accessible, biocompatible, and cost-effective agent, Aloe vera presents an attractive adjunct to conventional dental therapies, especially in managing inflammatory oral conditions such as gingivitis, oral lichen planus, aphthous ulcers, and periodontal disease. Its anti-inflammatory, antibacterial, and wound-healing properties offer a gentler alternative to synthetic agents like chlorhexidine, which are often associated with side effects such as tooth staining, altered taste, and mucosal irritation. Integrating Aloe vera-based formulations into routine dental care protocols, such as postoperative rinses, periodontal gels, or intracanal medicaments, can potentially enhance patient outcomes while minimizing adverse reactions and improving treatment compliance in patients sensitive to conventional pharmaceuticals (10,12,17). From a policy-making and clinical guideline perspective, the therapeutic utility of Aloe vera warrants formal consideration in evidence-based practice frameworks. Currently, most professional dental associations do not include Aloe vera in standardized treatment algorithms due to limited high-level evidence. However, given its proven antimicrobial and healing effects in several small-scale studies, there is a strong rationale for the development of consensus-based clinical recommendations. These would help regulate the quality, concentration, and method of application for Aloe vera products, ensuring consistency across dental practices. Formal inclusion into guidelines could also help bridge the gap between conventional and complementary medicine, fostering integrative oral healthcare models that are both patient-centered and culturally sensitive (14,15,20).

Despite the promising outcomes, numerous unanswered questions persist. One of the major research gaps is the absence of standardized Aloe vera formulations across studies. Variability in preparation—ranging from raw gel and aqueous extracts to commercially blended mouthwashes—makes it difficult to ascertain which formulations are most effective and in what concentrations. Additionally, the duration and frequency of application vary significantly, further complicating clinical adoption. Another overlooked area is the long-term safety profile of repeated Aloe vera use within the oral cavity. While it is generally regarded as safe, there is insufficient evidence to support its chronic use, particularly in immunocompromised individuals or those with complex comorbidities (16,18). Future research must address these gaps through well-designed randomized controlled trials with larger sample sizes and longer follow-up periods. Multicenter studies involving diverse patient populations are essential to evaluate the generalizability of findings and to mitigate regional or ethnocultural biases that may influence outcomes. Additionally, studies should employ double-blinding, placebo-controlled designs to minimize performance and observer bias. Outcome measures need to be standardized, including both objective indices (e.g., plaque scores, lesion size reduction, probing depth) and subjective patient-reported outcomes (e.g., pain, discomfort, satisfaction). Parallel studies exploring pharmacokinetics, tissue permeability, and systemic absorption of Aloe vera when used intraorally would also provide much-needed data for safety assessments (19,21).

Moreover, research should extend beyond clinical trials to include *in vitro* and *in vivo* investigations that further elucidate the molecular mechanisms through which Aloe vera mediates its therapeutic effects. Understanding the specific roles of its polysaccharides, anthraquinones, and flavonoids in modulating inflammatory pathways or microbial inhibition could help tailor its use for specific dental conditions. Exploration of novel delivery systems such as Aloe vera-based hydrogels, mucoadhesive patches, or nanoparticles may also enhance bioavailability and therapeutic efficacy. These innovations, coupled with translational research, can pave the way for the development of pharmaceutical-grade Aloe vera products suitable for dental settings. In essence, the incorporation of Aloe vera into dental care practices holds great potential, provided that future studies adopt rigorous methodological frameworks to substantiate its efficacy and safety. As the demand for natural and minimally invasive treatments continues to rise, Aloe vera could occupy a central role in a new paradigm of integrative, patient-friendly dentistry.

CONCLUSION

Aloe vera gel, with its rich composition of bioactive compounds, has demonstrated multifaceted therapeutic potential across a wide spectrum of dental disciplines, including oral medicine, periodontology, oral surgery, prosthodontics, endodontics, and pediatric dentistry. The review underscores its antimicrobial, anti-inflammatory, and wound-healing properties, which have been effectively utilized in managing conditions such as oral lichen planus, aphthous ulcers, periodontal pockets, alveolar osteitis, and even as a denture cleanser and intracanal medicament. Although the existing body of literature shows promising clinical outcomes, the overall strength of evidence remains moderate due to limitations in study design, sample sizes, and variability in Aloe vera formulations. Clinicians may consider Aloe vera as a complementary agent in cases where conventional therapies are contraindicated or poorly tolerated, but its use should be guided by clinical judgment and patient-specific considerations. Future research should prioritize large-scale, multicenter randomized controlled trials with standardized methodologies to establish robust clinical guidelines and confirm long-term safety and efficacy, ultimately enhancing the integration of Aloe vera into evidence-based dental practice.

Author Contribution

Author	Contribution
Urooj Khan*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Saima Azam	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Iman Baig	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

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