



## REVIEW ARTICLE

## THE USE OF PLANT POLYPHENOLS IN THE TREATMENT OF ORAL LICHEN PLANUS: A NARRATIVE REVIEW

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Oral lichen planus (OLP) is a chronic inflammatory disorder of the oral mucosa mediated by T-cell immune responses and recognized by the World Health Organization as a potentially malignant condition. The disease often causes persistent pain, burning sensations, and discomfort during eating and speaking, which can markedly reduce patients' quality of life. Although topical and systemic corticosteroids remain the cornerstone of treatment, their prolonged use may result in local and systemic adverse effects, prompting interest in safer and more sustainable therapeutic approaches.

This narrative review examines the available evidence on the use of plant-derived polyphenols in the management of OLP. Relevant publications published between 2010 and 2026 were identified through searches of PubMed, Scopus, and e-LIBRARY using combinations of the terms "oral lichen planus," "polyphenols," "antioxidants," and "treatment." Clinical studies, systematic reviews, and meta-analyses evaluating topical or systemic plant-based interventions were considered. A growing body of research indicates that several polyphenol-rich natural products, including curcumin, pomegranate extracts, green tea catechins, chamomile, Aloe vera, and Ocimum sanctum (Tulsi), may provide clinical benefits in patients with OLP. Their therapeutic effects are largely attributed to antioxidant, anti-inflammatory, immunomodulatory, and tissue-healing activities. Among the investigated agents, curcumin and Aloe vera have been studied most extensively and have shown results comparable to topical corticosteroids in a number of clinical trials. Nevertheless, differences in study design, treatment protocols, dosage forms, sample sizes, and follow-up periods make direct comparisons difficult and limit the strength of current conclusions. Overall, plant-derived polyphenols appear to be promising adjunctive therapies for oral lichen planus and may offer useful alternatives for selected patients. However, the existing evidence is not yet sufficient to support their routine use as first-line treatment. Further well-designed randomized controlled trials with standardized formulations and longer follow-up periods are needed to better define their efficacy, safety, and place in clinical practice.

**Keywords:** oral lichen planus; polyphenols; phytotherapy; antioxidants; oral mucosa; curcumin.

## INTRODUCTION

Oral lichen planus (OLP) is a chronic inflammatory disease of the oral mucosa characterized by an immune-mediated reaction directed against epithelial basal cells. Although the oral cavity is the most frequently affected

site, lesions may also occur on the skin and genital mucosa. The condition is relatively common, with reported prevalence rates ranging from 0.1% to 4% worldwide, and is observed predominantly in middle-aged and older adults, particularly women<sup>1,2</sup>. In some

patients, oral lesions may be accompanied by extraoral manifestations involving the skin or genital mucous membranes, reflecting the systemic nature of the disease process<sup>3</sup>. The clinical importance of OLP extends beyond its chronic and often symptomatic course. The World Health Organization currently recognizes oral lichen planus as a potentially malignant oral disorder because of its documented, albeit relatively low, risk of progression to oral squamous cell carcinoma<sup>4</sup>. For this reason, affected patients require not only appropriate treatment but also long-term clinical follow-up and careful surveillance. Oral lichen planus presents in several clinical forms, including reticular, plaque-like, atrophic, erosive, and bullous variants<sup>5</sup>. The reticular form is the most common and is usually identified by the presence of characteristic white interlacing striae, known as Wickham's striae. In contrast, erosive and atrophic lesions are frequently associated with pain, burning sensations, sensitivity to spicy foods, and difficulties with eating and speaking, often resulting in a considerable decline in quality of life<sup>6</sup>. Despite decades of investigation, the exact mechanisms responsible for the development of OLP have not been fully clarified. Current evidence indicates that cellular immune dysfunction plays a central role in disease pathogenesis. Cytotoxic T lymphocytes are believed to trigger apoptosis of basal keratinocytes, leading to chronic inflammation and tissue damage within the oral epithelium<sup>7</sup>. In recent years, increasing attention has been paid to the role of oxidative stress as an additional factor contributing to disease initiation and progression<sup>8,9</sup>. Oxidative stress develops when the production of reactive oxygen and nitrogen species exceeds the capacity of endogenous antioxidant defense systems, resulting in cellular injury and disruption of normal tissue homeostasis<sup>10</sup>. Several studies have demonstrated elevated levels of oxidative stress biomarkers together with reduced antioxidant capacity in both saliva and serum samples obtained from patients with OLP<sup>11-14</sup>. Furthermore, inflammatory cell infiltration within oral lesions may promote excessive generation of reactive oxygen species, thereby sustaining tissue injury and perpetuating chronic inflammation<sup>13</sup>. In a systematic review and meta-analysis, Wang et al. confirmed that patients with OLP consistently exhibit increased oxidative stress and impaired antioxidant defenses, supporting the hypothesis that oxidative imbalance is involved in disease pathogenesis<sup>14</sup>. These observations have stimulated interest in therapeutic approaches aimed at restoring redox balance and reducing oxidative tissue damage. Current management of OLP is focused primarily on controlling symptoms, reducing inflammation, promoting healing of oral lesions, and improving patient comfort. Topical corticosteroids remain the treatment of choice for symptomatic disease

and continue to be regarded as the clinical gold standard<sup>15-17</sup>. However, long-term corticosteroid therapy may be associated with several adverse effects, including oral candidiasis, mucosal thinning, xerostomia, and, in some cases, systemic complications. As a result, there is growing interest in identifying safer treatment options that can be used for prolonged periods without compromising efficacy. Natural products have attracted increasing attention in recent years as potential adjuncts or alternatives to conventional therapies. Among these, plant-derived polyphenols are of particular interest because they possess a broad range of biological activities, including antioxidant, anti-inflammatory, immunomodulatory, antimicrobial, and tissue-repair properties<sup>18,19</sup>. These naturally occurring compounds are abundant in fruits, vegetables, medicinal herbs, tea, and many other plant sources. Their ability to modulate inflammatory pathways and neutralize reactive oxygen species provides a strong biological rationale for their use in chronic inflammatory disorders such as OLP. A variety of polyphenol-rich preparations, including curcumin, pomegranate extracts, green tea catechins, chamomile, Aloe vera, and *Ocimum sanctum* (Tulsi), have been evaluated in clinical studies involving patients with oral lichen planus. Although many of these investigations have reported improvements in symptoms and clinical lesion severity, the available evidence remains heterogeneous, and definitive conclusions regarding their therapeutic value have not yet been established. Therefore, the purpose of this narrative review is to provide an updated overview of the current evidence regarding the use of plant-derived polyphenols in the management of oral lichen planus, with particular emphasis on their biological mechanisms of action, clinical effectiveness, safety profiles, and potential role as adjunctive or alternative therapeutic agents.

### MATERIALS AND METHODS

This narrative review was conducted to evaluate the current evidence regarding the use of plant-derived polyphenols in the treatment of oral lichen planus (OLP). A comprehensive literature search was performed using the electronic databases PubMed, Scopus, and eLIBRARY. Publications published between January 2010 and January 2026 were considered eligible for inclusion. The search strategy combined the following keywords and Medical Subject Headings (MeSH) terms: "oral lichen planus," "oral mucosa," "polyphenols," "antioxidants," "phytotherapy," "herbal medicine," "curcumin," "Aloe vera," "green tea," "pomegranate," "chamomile," "Ocimum sanctum," and "treatment."

*The inclusion criteria were as follows:*

1. Original clinical studies, randomized controlled trials, observational studies, systematic reviews, and meta-

analyses;

2. Studies investigating topical or systemic administration of plant-derived products containing polyphenolic compounds;

3. Studies evaluating clinical outcomes in patients diagnosed with oral lichen planus;

### ***The exclusion criteria included:***

1. Animal studies and in vitro investigations;

2. Case reports and conference abstracts without sufficient clinical data;

3. Studies focusing on cutaneous lichen planus without oral involvement;

4. Publications lacking relevant clinical outcome measures;

Titles and abstracts retrieved from the databases were independently screened for relevance. Full-text articles meeting the inclusion criteria were subsequently evaluated. Particular attention was given to study design, sample size, intervention characteristics, duration of treatment, clinical outcomes, safety profile, and reported adverse effects. The selected studies were analyzed descriptively due to substantial heterogeneity in study design, treatment protocols, dosage regimens, outcome assessment methods, and follow-up periods. Therefore, a quantitative meta-analysis was not performed. The available evidence was synthesized narratively, focusing on the mechanisms of action, therapeutic efficacy, safety, and clinical applicability of plant-derived polyphenols in the management of oral lichen planus. The review specifically examined the evidence regarding curcumin, pomegranate (*Punica granatum*) extracts, green tea catechins, chamomile (*Matricaria chamomilla*), Aloe vera, and *Ocimum sanctum* (Tulsi), as these agents were the most frequently investigated plant-derived products in the identified literature.

## **RESULTS**

The reviewed literature demonstrates growing interest in plant-derived polyphenols as adjunctive therapeutic agents for oral lichen planus. Although the quality of evidence varies considerably among studies, most investigations reported improvements in clinical symptoms, lesion severity, or patient-reported outcomes following treatment with polyphenol-rich preparations. Among all investigated compounds, curcumin has received the greatest scientific attention. Multiple randomized clinical trials, systematic reviews, and meta-analyses have consistently shown reductions in pain, burning sensation, and lesion severity in patients treated with topical or systemic curcumin preparations. Several studies reported outcomes comparable to those achieved with topical corticosteroids, while adverse effects were generally mild and infrequent.

Pomegranate-derived preparations have also produced encouraging clinical results. Topical formulations prepared from pomegranate peel or seed extracts were associated with improvements in symptomatic lesions and oral health-related quality of life. In some comparative studies, the clinical response was similar to that observed with topical corticosteroid therapy, suggesting potential value as an adjunctive treatment option. Evidence regarding green tea polyphenols remains more limited. Available studies indicate that catechins, particularly epigallocatechin-3-gallate (EGCG), may reduce oxidative stress and inflammatory activity within oral lesions. Preliminary clinical findings suggest improvement in symptoms and lesion characteristics; however, the small number of controlled studies prevents definitive conclusions regarding efficacy. Chamomile-based preparations have demonstrated beneficial anti-inflammatory effects in patients with symptomatic OLP. Although corticosteroids generally produced a more rapid response during the initial phase of treatment, some studies reported comparable clinical outcomes after several weeks of therapy. These findings suggest that chamomile may be useful in patients seeking non-steroidal treatment approaches. Aloe vera represents one of the most extensively studied herbal interventions for OLP. Clinical trials and systematic reviews have reported significant reductions in pain and lesion severity together with improved mucosal healing. Importantly, several investigations found therapeutic results comparable to those obtained with topical corticosteroids, while treatment-related adverse events were uncommon. Fewer studies have evaluated *Ocimum sanctum* (Tulsi) and other Ayurvedic formulations. Available data indicate potential benefits in reducing pain, burning sensation, and lesion severity; however, the evidence base remains relatively small. Comparative studies suggest that clinical improvements may be less pronounced than those observed with curcumin, although beneficial effects have nevertheless been reported. Despite these promising findings, several limitations were identified across the reviewed literature. Many studies involved small sample sizes, short follow-up periods, and considerable variation in formulations, dosage regimens, and outcome assessment methods. Such heterogeneity makes direct comparison between studies difficult and limits the strength of current recommendations. Overall, the strongest clinical evidence currently supports the use of curcumin and Aloe vera, whereas pomegranate extracts, chamomile, green tea polyphenols, and Tulsi appear promising but require further investigation in larger, well-designed randomized controlled trials. **Table 1** summarizes the principal plant-derived polyphenols, their proposed mechanisms of action, and reported clinical effects.

**Table 1. Biological Activities and Reported Clinical Effects of Plant-Derived Polyphenols Used in the Management of Oral Lichen Planus**

Plant-derived agent	Major bioactive compounds	Proposed mechanisms of action	Reported clinical effects	Key references
Curcumin ( <i>Curcuma longa</i> )	Curcuminoids	Inhibition of NF-κB signaling, suppression of pro-inflammatory cytokines, antioxidant activity, and immunomodulation	Reduction in pain scores, burning sensation, and clinical lesion severity; improvement in overall clinical outcomes	[23–27]
Pomegranate ( <i>Punica granatum</i> )	Ellagitannins, punicalagins, flavonoids	Antioxidant activity, modulation of inflammatory pathways, and promotion of tissue repair	Improvement in lesion healing, symptom severity, and oral health-related quality of life	[29–31]
Greentea ( <i>Camellia sinensis</i> )	Catechins, particularly epigallocatechin-3-gallate (EGCG)	Free radical scavenging, anti-inflammatory activity, and inhibition of oxidative cellular damage	Reduction in symptom intensity and improvement in clinical lesion characteristics	[34–36]
Chamomile ( <i>Matricaria chamomilla</i> )	Flavonoids, terpenoids, coumarins	Anti-inflammatory, antioxidant, antimicrobial, and soothing effects	Reduction in pain, erythema, and inflammatory manifestations	[39–41]
Aloe vera	Polyphenols, vitamins, sterols, polysaccharides	Anti-inflammatory and antioxidant activity; stimulation of epithelial regeneration and wound healing	Enhanced mucosal healing and reduction in pain and discomfort	[44–48]
Ocimum sanctum (Tulsi)	Eugenol, rosmarinic acid, flavonoids	Antioxidant and immunomodulatory effects; inhibition of inflammatory mediators	Reduction in pain and burning sensation with improvement in overall clinical symptoms	[49,50]

**Table 2** presents the available clinical evidence, treatment protocols, and levels of evidence for the investigated interventions.

**Table 2. Comparative Clinical Characteristics of Plant-Derived Preparations Used in Oral Lichen Planus**

Intervention	Pharmaceutical form	Dosage and treatment regimen	Comparison with conventional therapy
<b>Curcumin</b> ( <i>Curcuma longa</i> )	Gel, mucoadhesive paste, oral capsules	Topical concentrations ranging from 1–5%, applied 2–6 times daily; oral administration up to 80 mg/day	Therapeutic efficacy comparable to topical corticosteroids in several clinical studies [23–27]
<b>Pomegranate</b> ( <i>Punica granatum</i> )	Topical gel	Applied 4–5 times daily for 4 weeks	Clinical outcomes comparable to topical triamcinolone acetonide [29–31]
<b>Green tea</b> ( <i>Camellia sinensis</i> )	Oral tablets, buccal formulations	300–450 mg/day	Limited clinical evidence; further controlled studies are required [34–

Intervention	Pharmaceutical form	Dosage and treatment regimen	Comparison with conventional therapy
<b>Chamomile</b> ( <i>Matricaria chamomilla</i> )	Gel, topical cream	2% formulation applied for approximately 4 weeks	36] Clinical efficacy comparable to corticosteroid therapy after 4 weeks of treatment [38–41]
<b>Aloe vera</b>	Topical gel	Preparations containing up to 97% <i>Aloe vera</i> extract	Clinical effectiveness comparable to topical corticosteroids with a favorable safety profile [44–48]
<b>Polyherbal Ayurvedic formulation</b>	Topical gel	Applied for approximately 10 days	Demonstrated superior outcomes compared with placebo [49]
<b>Tulsi</b> ( <i>Ocimum sanctum</i> )	Topical ointment	Applied twice daily for up to 3 months	Clinical improvement observed, although efficacy appeared lower than that of curcumin in comparative studies [50]

## DISCUSSION

Oral lichen planus (OLP) is a chronic immune-mediated inflammatory disorder with a well-recognized potential for malignant transformation and therefore often requires long-term clinical management<sup>1,3,4,6</sup>. In recent years, increasing attention has been directed toward plant-derived polyphenols as potential therapeutic agents due to their anti-inflammatory, antioxidant, immunomodulatory, and tissue-regenerative properties<sup>18,47</sup>. These bioactive compounds may target multiple pathogenic pathways involved in OLP while simultaneously reducing the adverse effects commonly associated with conventional pharmacotherapy. A growing body of evidence indicates that oxidative stress plays a central role in the pathogenesis of OLP. Patients with OLP frequently demonstrate elevated levels of reactive oxygen species (ROS) alongside a reduction in endogenous antioxidant defense mechanisms, which collectively contribute to epithelial damage, persistent inflammation, and disease progression<sup>8,11,14</sup>. Accordingly, therapeutic strategies aimed at modulating oxidative stress appear to be a rational and promising approach. Within this context, plant-derived polyphenols are particularly noteworthy due to their ability to neutralize free radicals, regulate inflammatory signaling pathways, and promote tissue repair. Among the various natural compounds investigated, curcumin has received the most extensive scientific attention. Clinical studies and systematic reviews have reported that both topical and systemic formulations of curcumin can significantly reduce pain intensity, burning sensation, and lesion severity in patients with OLP<sup>20,21,26</sup>.

In several studies, curcumin demonstrated clinical efficacy comparable to that of corticosteroids, particularly during longer follow-up periods<sup>23,27</sup>. The therapeutic effects of curcumin are mainly attributed to its inhibitory action on pro-inflammatory mediators, including cyclooxygenase and lipoxygenase pathways, as well as its ability to modulate cytokine expression and inflammatory cascades<sup>22</sup>. These findings suggest that curcumin may represent a valuable adjunctive or even alternative therapeutic option, especially in patients who are intolerant to corticosteroid therapy or require prolonged treatment.

Pomegranate (*Punica granatum*)-derived preparations have also shown promising therapeutic potential.

Clinical investigations have demonstrated that topical gels containing pomegranate seed or peel extracts can lead to significant improvement in symptoms and overall quality of life in patients with OLP<sup>29,30</sup>.

The beneficial effects of pomegranate are primarily attributed to its high concentration of polyphenolic compounds, particularly flavonoids and tannins, which possess strong antioxidant and anti-inflammatory properties<sup>28</sup>. Importantly, several studies have reported outcomes comparable to those achieved with topical corticosteroids such as triamcinolone, supporting its possible role in clinical practice.

Green tea polyphenols, especially epigallocatechin gallate (EGCG), have also attracted considerable attention due to their potent antioxidant, anti-inflammatory, and anticarcinogenic properties<sup>32,34</sup>. Preliminary clinical studies have reported reductions in lesion size and symptom severity following green tea-based interventions. However, the current evidence remains limited due to small sample sizes, short observation periods, and methodological heterogeneity. Additionally, the low bioavailability of EGCG represents a significant limitation for its clinical application<sup>33</sup>. Therefore, further well-designed clinical trials are necessary to clarify its therapeutic efficacy and optimal delivery systems in OLP management.

Chamomile has long been used in traditional medicine for inflammatory oral conditions due to its anti-inflammatory, antimicrobial, and antioxidant properties. Clinical studies have demonstrated that chamomile-based preparations can reduce pain and improve clinical symptoms in patients with OLP<sup>37,39,41</sup>. Although corticosteroids may provide faster symptomatic relief in the early stages of treatment, several studies have reported comparable long-term outcomes between chamomile and corticosteroid therapy. These findings suggest that chamomile may serve as a safe complementary therapeutic option for selected patients.

Aloe vera is another extensively studied natural agent with well-documented anti-inflammatory, antioxidant, antimicrobial, and wound-healing effects. Clinical trials and systematic reviews have shown significant improvements in pain, lesion size, and overall clinical appearance in patients treated with Aloe vera preparations<sup>44,45,46</sup>. Notably, several studies have reported that its effectiveness may be comparable to topical corticosteroids while offering a more favorable safety profile<sup>48</sup>. This makes Aloe vera an attractive option for long-term management of chronic OLP. In addition, recent research has explored the therapeutic potential of combined herbal formulations. Ayurvedic preparations containing turmeric, calendula, and Tulsi have demonstrated superior outcomes compared with placebo in patients with erosive OLP<sup>49</sup>. Tulsi (*Ocimum sanctum*) itself possesses strong antioxidant and immunomodulatory properties that may contribute to

symptom improvement. Nevertheless, comparative studies suggest that turmeric-based formulations may provide greater reductions in pain and burning sensation than Tulsi alone<sup>50</sup>.

Overall, the evidence reviewed in this study indicates that several plant-derived polyphenols exhibit therapeutic efficacy that may approach that of conventional corticosteroid therapy in the management of OLP symptoms. Their favorable safety profiles, lower incidence of adverse effects, and potential affordability make them attractive adjunctive or alternative options to standard treatment. However, the current literature is characterized by substantial heterogeneity in study design, sample size, treatment duration, formulation types, and outcome assessment methods, which limits direct comparison across studies and prevents definitive clinical recommendations<sup>19,43</sup>.

Future research should focus on large-scale, multicenter randomized controlled trials with standardized protocols, longer follow-up periods, and uniform outcome measures. Particular attention should be given to optimal dosing strategies, delivery systems, treatment duration, and pharmacodynamic mechanisms. Moreover, further studies are needed to explore whether plant-derived polyphenols may play a role in preventing malignant transformation of OLP lesions, which remains a critical clinical concern<sup>4</sup>.

Overall, plant-derived polyphenols represent a promising and biologically plausible therapeutic approach for OLP. While they cannot yet replace conventional therapies, they may serve as effective adjunctive or alternative options, particularly in patients requiring long-term management or those experiencing adverse effects from corticosteroid therapy.

### CONCLUSION

Current evidence suggests that plant-derived polyphenols possess significant anti-inflammatory, antioxidant, immunomodulatory, and regenerative properties that may be beneficial in the management of oral lichen planus. Natural compounds such as curcumin, Aloe vera, pomegranate extracts, chamomile, green tea catechins, and Tulsi have demonstrated encouraging clinical outcomes, including reductions in pain intensity, burning sensation, lesion severity, and overall improvement in patients' quality of life<sup>23,30,44,49</sup>. Among the investigated agents, curcumin and Aloe vera currently have the strongest clinical evidence base. Both have demonstrated therapeutic efficacy comparable to topical corticosteroids in multiple studies while potentially offering a superior safety profile<sup>23,45</sup>.

Nevertheless, the overall evidence remains limited due to small sample sizes, variability in study designs, heterogeneity in formulations and dosing regimens, and insufficient long-term follow-up data. Therefore, plant-derived polyphenols should currently be considered promising adjunctive or complementary therapeutic approaches rather than definitive replacements for conventional corticosteroid-based therapy. Well-designed multicenter randomized controlled trials with standardized methodologies are essential to determine optimal formulations, dosing regimens, long-term safety, and their potential role in preventing disease progression and malignant transformation in oral lichen planus.

## DECLARATIONS

### Ethical Approval

Ethical approval was not required as this is a narrative review of published literature.

### Conflict of Interest

The author declare no conflict of interest.

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