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Lichen Planus: Modern Diagnostic Techniques and Therapeutic Strategies

Keywords: lichen planus; oral lichen planus; oral lichen planus treatment; photobiomodulation; photodynamic therapy; laser therapy; biological therapy; secukinumab; probiotics; mycophenolate mofetil; clobetasol; corticosteroids; ozonized water

Abstract

Oral lichen planus (OLP) is a chronic immune-mediated inflammatory disease characterized by a relapsing course, pain, and a substantial impact on patients' quality of life. The aim of this study was to present the current state of knowledge on the diagnosis and contemporary treatment methods of OLP, with particular emphasis on emerging therapeutic strategies. The manuscript was prepared as a narrative review of the literature. The analysis was conducted primarily using the PubMed database and included publications from 2019-2025 concerning the treatment of lichen planus. Thirteen studies evaluating the efficacy and safety of topical therapies, photobiomodulation, photodynamic therapy, laser therapy, biological treatment, probiotic therapy, and other adjunctive approaches were included in the final analysis. The findings indicate that topical corticosteroids remain the first-line treatment, effectively reducing symptom severity and improving patients' quality of life. Promising results have also been reported for photodynamic therapy, photobiomodulation, and laser therapy, which may constitute valuable alternatives or adjuncts to standard treatment. Increasing importance is being attributed to therapies targeting the IL-17/IL-23 pathway, particularly in patients with treatment-resistant forms of the disease. Beneficial effects

have also been observed for probiotic therapy, topical mycophenolate mofetil, lycopene, and ozone therapy. Despite advances in the treatment of OLP, high-quality studies with long-term follow-up remain lacking. Further multicenter clinical trials are required to assess the long-term efficacy and safety of novel therapeutic modalities and to develop optimal treatment strategies.

Introduction

Lichen planus (LP) is a chronic inflammatory disease of the skin and mucous membranes, classified among immune-mediated dermatoses. Lesions may involve the skin, oral mucosa, genital mucosa, nails, and scalp. Oral lichen planus (OLP) is of particular clinical importance because it is often characterized by a chronic, relapsing course, persistent pain, and the need for long-term patient follow-up (Rotaru et al. 2020; Gururaj et al. 2021; Manchanda et al. 2024).

OLP most commonly affects adults, particularly middle-aged individuals, and many studies report a higher frequency of diagnosis in women. Lesions are located mainly on the buccal mucosa, usually bilaterally and symmetrically, but they may also involve the tongue, gingiva, palate, and vermilion border. Because of the chronicity of symptoms, discomfort during eating, burning sensation, pain, and difficulties in maintaining oral hygiene, the disease may substantially impair patients' quality of life (Gururaj et al. 2021; Kengtong et al. 2023; Manchanda et al. 2024; Moreira et al. 2024).

The etiopathogenesis of lichen planus has not been fully elucidated; however, current evidence indicates an important role of T-cell-mediated cellular immune responses. The disease process is associated with damage to basal-layer keratinocytes, a band-like inflammatory infiltrate, and activation of numerous immunological mediators. Oxidative stress, genetic predisposition, impaired immunoregulation, and infectious, metabolic, psychological, and environmental factors are also considered to contribute to its pathogenesis. Cytokine pathways, including the IL-17/IL-23 axis, are increasingly being investigated as mechanisms that may sustain chronic inflammation (Solimani et al. 2019; Żychowska et al. 2020; Didona et al. 2022; Manchanda et al. 2024).

The clinical presentation of OLP is heterogeneous. The reticular, papular, plaque-like, atrophic, erosive, and bullous forms are classically described. The reticular form is often asymptomatic or causes only mild discomfort, whereas atrophic and erosive forms are more frequently associated with pain, burning sensation, hypersensitivity to spicy and acidic foods, and intermittent bleeding. A characteristic clinical feature is the presence of whitish, lace-like streaks known as Wickham striae, although their presence alone is not always sufficient for an unequivocal diagnosis (Rotaru et al. 2020; Gururaj et al. 2021; Manchanda et al. 2024).

The diagnosis of OLP requires correlation between clinical and histopathological findings. Microscopically, typical features include degeneration of the basal epithelial layer, apoptotic bodies, and a band-like lymphocytic infiltrate in the upper lamina propria. Differential diagnosis

primarily includes lichenoid lesions associated with drugs or dental materials, leukoplakia, proliferative verrucous leukoplakia, lupus erythematosus, vesiculobullous diseases, and dysplastic lesions. For this reason, biopsy and histopathological assessment are particularly important in atypical, unilateral, erosive, ulcerative, or treatment-resistant cases (Rotaru et al. 2020; Moreira et al. 2024).

An important clinical aspect of OLP is its association with the risk of malignant transformation. Although the risk of oral squamous cell carcinoma in patients with OLP is considered relatively low, it is not negligible and should be taken into account when planning follow-up. Interpretation of the available data is complicated by differences in diagnostic criteria, inconsistent separation of classic OLP from lichenoid lesions, and the possible coexistence of dysplasia. Regular clinical monitoring, documentation of lesions, and repeat biopsy when the clinical appearance changes are therefore important components of management (González-Moles et al. 2019; Li et al. 2023; González-Moles and Ramos-García 2024).

Treatment of lichen planus is most often symptomatic and should be tailored to lesion location, symptom severity, disease activity, and the patient's response to previous management. In asymptomatic patients, observation, elimination of irritating factors, and education regarding oral hygiene may be sufficient. In symptomatic cases, anti-inflammatory and immunomodulatory treatment is used, and the choice of therapy should take into account efficacy, safety, risk of recurrence, and feasibility of long-term use (Didona et al. 2022; Georgaki et al. 2022; Kengtong et al. 2023; Cinotti et al. 2025).

The complex etiology, chronic course, variable clinical presentation, and lack of a single fully effective treatment make lichen planus an important diagnostic and therapeutic challenge. The aim of this study is to present current information on modern diagnostic techniques and therapeutic strategies used in lichen planus, with particular emphasis on oral lichen planus.

Methodology

This study was prepared as a narrative review of the literature on contemporary methods for the treatment of lichen planus, with particular emphasis on oral lichen planus (OLP). The aim of the review was to analyze current therapeutic options and to assess potential directions for the development of new therapies based on immunological mechanisms involved in the pathogenesis of the disease.

The literature review was conducted primarily using the PubMed database. The literature search was performed with keywords and their combinations, including: "lichen planus", "oral lichen planus", "treatment", "oral lichen planus treatment", "photobiomodulation", "photodynamic

therapy", "laser therapy", "biological therapy", "secukinumab", "probiotics", "mycophenolate mofetil", "clobetasol", "corticosteroids", "ozonized water", and "IL-17".

The search identified publications published between 2019 and 2025 concerning the treatment of lichen planus. After analysis of titles, abstracts, and full texts, 13 articles were included in the final review. Publications directly addressing the efficacy, safety, and mechanisms of action of contemporary therapeutic methods used in the treatment of lichen planus, with particular emphasis on oral lichen planus, were included. Studies concerning the immunological mechanisms of the disease were also considered if their findings were relevant to the development of new therapies.

Publications not available in full text, articles not directly related to the treatment of lichen planus, and studies whose scope did not correspond to the aim of this review were excluded from further analysis. Publications that did not provide relevant information on contemporary therapeutic methods or focused on issues beyond the scope of the study were also excluded.

The articles included in the review were primarily clinical studies evaluating the efficacy and safety of topical therapies, photobiomodulation, photodynamic therapy, biological treatment, probiotic therapy, and other modern therapeutic methods used in patients with lichen planus.

Because of the narrative nature of this review, no formal assessment of the methodological quality of individual studies and no meta-analysis of the results were performed. The analysis was qualitative and focused on presenting the current state of knowledge regarding the efficacy, safety, and developmental perspectives of modern treatment methods for lichen planus.

Results

Thirteen publications published between 2019 and 2025 were included in the review, comprising randomized clinical trials, observational studies, retrospective studies, and papers analyzing immunological mechanisms associated with the pathogenesis of lichen planus (Table 1). Most studies concerned oral lichen planus (OLP), whereas the analyzed interventions included topical corticosteroids, photodynamic therapy, photobiomodulation, laser therapy, biological treatment, probiotic therapy, mycophenolate mofetil, lycopene, and ozone therapy. The analyzed studies were assessed in terms of clinical efficacy, effects on pain, patients' quality of life, and the safety of the applied therapies.

Table 1. Characteristics and key findings of studies included in the literature review

Author, year	Study type / therapy	Key findings
Kengtong et al., 2023	Topical corticosteroids in OLP	Significant reduction in pain and clinical lesion severity, with improved patients' quality of life.
Georgaki et al., 2022	Dexamethasone vs cyclosporine	Both therapies were effective; however, dexamethasone showed greater clinical efficacy.
Zborowski et al., 2025	Photodynamic therapy (PDT) vs clobetasol	PDT provided greater reduction in lesion area, a higher remission rate, and improved quality of life.
Mohamed et al., 2024	Photobiomodulation (PBM) vs corticosteroids	Both methods effectively reduced pain and improved the clinical appearance of lesions; no significant differences between groups were found.
Tarasenko et al., 2021	Er:YAG and Nd:YAG laser therapy	Greater pain reduction, faster healing, and decreased pro-inflammatory cytokine concentrations compared with surgical treatment.
Solimani et al., 2019	Biological treatment (secukinumab, ustekinumab, guselkumab)	Clinical improvement of lesions and decreased IL-17A expression and inflammatory infiltrate.
Żychowska et al., 2020	Study of immunological mechanisms	Increased IL-17 levels were demonstrated in the serum and tissues of patients with lichen planus.
Kamal et al., 2025	Probiotics + clobetasol	Greater reduction in pain and lesion extent than with steroid treatment alone.
Samiee et al., 2020	2% mucoadhesive mycophenolate mofetil	Significant reduction in pain, burning sensation, and lesion size with good treatment tolerance.
Eita et al., 2021	Lycopene vs corticosteroids	Efficacy comparable to corticosteroids and a favorable safety profile.
Rodriguez-Galvez et al., 2025	Assessment of oxidative stress markers	All analyzed therapies improved salivary antioxidant parameters and patients' clinical status.
Veneri et al., 2020	Ozonized water + corticosteroids	Greater reduction in pain and lesion extent and fewer recurrences than in the control group.
Moreira et al., 2024	Clinicopathological analysis of OLP	OLP occurred more frequently in women; bilateral and symmetrical lesions had high diagnostic value.

Treatment with topical corticosteroids

Kengtong et al. showed that one month of topical corticosteroid therapy led to a significant reduction in pain and in the severity of clinical lesions assessed using the Thongprasom scale. Treatment was also associated with a significant improvement in patients' quality of life,

particularly in relation to eating, oral hygiene, and psychological well-being (Kengtong et al., 2023).

Georgaki et al. evaluated the efficacy of dexamethasone and cyclosporine in the treatment of OLP. Both approaches resulted in clinical improvement and reduction of pain; however, dexamethasone showed greater therapeutic efficacy, although it was more frequently associated with oral candidiasis (Georgaki et al., 2022).

Photodynamic therapy, photobiomodulation, and laser therapy

Zborowski et al. compared photodynamic therapy (PDT) with topical clobetasol. Both methods effectively reduced disease symptoms; however, after three months of follow-up, a higher rate of complete remission was reported in the PDT group. Photodynamic therapy also provided a greater reduction in lesion area and improvement in patients' quality of life (Zborowski et al., 2025).

Mohamed et al. demonstrated that both photobiomodulation (PBM) and corticosteroid treatment led to a significant reduction in pain and improvement in the clinical appearance of lesions. In addition, both groups showed a decrease in oxidative stress markers, with no significant differences between the compared therapeutic methods (Mohamed et al., 2024).

Tarasenko et al. evaluated the efficacy of Er and Nd lasers compared with surgical treatment. Laser therapy resulted in greater pain reduction, faster healing, and decreased concentrations of pro-inflammatory cytokines, such as IL-1 β , IL-6, and IFN- γ . The most favorable outcomes were obtained with the Er laser (Tarasenko et al., 2021).

Biological treatment and immunological mechanisms

Solimani et al. showed that blockade of the IL-17/IL-23 pathway with biological agents may be an effective therapeutic option in patients with treatment-resistant forms of lichen planus. Clinical improvement was accompanied by a decrease in lymphocytic infiltrate and reduced IL-17A expression in tissues affected by the disease process (Solimani et al., 2019).

The importance of the IL-17 pathway in disease pathogenesis was confirmed by Żychowska et al., who demonstrated increased serum IL-17 levels and elevated expression of this cytokine in lesions from patients with lichen planus (Żychowska et al., 2020).

Alternative and adjunctive treatment methods

Kamal et al. demonstrated that probiotics used as an adjunct to clobetasol treatment led to a greater reduction in pain and lesion extent than steroid therapy alone. Treatment was well tolerated and caused no adverse effects (Kamal et al., 2025).

Samiee et al. evaluated the efficacy of 2% mucoadhesive mycophenolate mofetil in patients with erosive OLP. The therapy caused a significant reduction in pain, burning sensation, and lesion size, and the observed adverse effects were mild (Samiee et al., 2020).

Eita et al. showed that lycopene provided efficacy comparable to oral corticosteroids in terms of clinical improvement and pain reduction. In addition, its use was associated with a beneficial effect on oxidative stress markers and a more favorable safety profile (Eita et al., 2021).

Rodriguez-Galvez et al. showed that all analyzed therapeutic methods led to clinical improvement and favorable changes in salivary antioxidant markers, such as SOD, GSH, and CUPRAC. However, no significant differences were found between the individual therapies (Rodriguez-Galvez et al., 2025).

Veneri et al. demonstrated that ozonized water used as an adjunct to topical corticosteroid treatment resulted in a greater reduction in pain and lesion extent than standard treatment. In addition, a trend toward less frequent recurrences and fungal infections was observed (Veneri et al., 2020).

Clinical characteristics and diagnostic aspects

Moreira et al. conducted a clinicopathological analysis of patients with OLP. The disease was shown to occur more frequently in middle-aged women, and the most common lesion site was the buccal mucosa. A characteristic reticular pattern was observed in all patients. Moreover, the presence of bilateral and symmetrical lesions was significantly associated with the diagnosis of OLP, emphasizing their diagnostic value in differentiating this entity from other lichenoid lesions (Moreira et al., 2024).

Discussion

Lichen planus (LP), and particularly one of its forms, OLP, remains an important clinical problem because of its chronic course, frequent recurrences, and significant impact on patients' quality of life. Analysis of the current literature indicates that substantial progress has been made in recent years in both the diagnosis and treatment of this disease; however, no therapy capable of ensuring sustained remission has yet been developed.

In diagnostics, the contemporary approach is based on the integration of clinical, histopathological, and immunological data. Popa et al. (Popa et al. 2024) emphasize the importance of an interdisciplinary diagnostic approach, particularly in erosive OLP, which requires differentiation from vesiculobullous diseases, drug-induced reactions, and dysplastic lesions. The authors also point to the growing role of inflammatory biomarkers and imaging techniques that support monitoring of disease activity. Similar observations were reported by Agha-Hosseini et al. (Agha-Hosseini et al. 2023), who demonstrated the key importance of interleukin-17 in the pathogenesis

of OLP. Increased IL-17 expression in lesions suggests the potential use of this cytokine both as a marker of disease activity and as a therapeutic target.

Despite the dynamic development of new treatment methods, glucocorticosteroids remain the gold standard for symptomatic therapy. The Cochrane systematic review by Lodi et al. (Lodi et al. 2020) confirmed the efficacy of topical corticosteroids in reducing pain and improving the clinical appearance of lesions. These findings were confirmed by Serafini et al. (Serafini et al. 2023), who showed that topical preparations, particularly clobetasol propionate and fluocinonide, remain the most commonly recommended first-line drugs. At the same time, the authors note the limited quality of some available studies and the lack of unequivocal evidence allowing one preparation to be identified as clearly the most effective.

Limitations of corticosteroid therapy, including adverse effects and frequent recurrences after treatment discontinuation, have contributed to the search for alternative therapeutic methods. Vadivel et al. (Vadivel et al. 2020) showed that calcineurin inhibitors, retinoids, aloe vera preparations, curcumin, and other natural agents may provide clinical benefits in selected patients. Curcumin is of particular interest, as its anti-inflammatory potential has been confirmed in the latest meta-analysis by Al-Maweri et al. (Al-Maweri et al. 2025). The authors demonstrated that the efficacy of curcumin in reducing clinical symptoms may be comparable to that of corticosteroids, while offering a more favorable safety profile. It should be emphasized, however, that most available studies include small patient groups.

In recent years, increasing attention has been paid to regenerative therapies. A systematic review of clinical trials conducted by Niemczyk et al. (Niemczyk et al. 2025) indicates that platelet-rich plasma (PRP) and injectable platelet-rich fibrin (i-PRF) may effectively reduce pain and improve healing of mucosal lesions. The mechanism of action of these methods is associated with the release of numerous growth factors and modulation of inflammatory processes. Although the results obtained are promising, the authors emphasize the need for studies with longer follow-up and larger numbers of participants.

Substantial progress is also being observed in targeted therapies. Rosset et al. (Rosset et al. 2025) presented a comprehensive review of the use of monoclonal antibodies and small molecules in the treatment of lichen planus. Particularly promising results have been obtained for inhibitors of the JAK/STAT pathway and drugs blocking cytokines involved in Th1- and Th17-type responses. The authors indicate that biological therapies may represent a breakthrough in the treatment of cases resistant to conventional therapy, especially in patients with severe mucosal forms. At the same time, they draw attention to the limited number of randomized studies and the lack of long-term safety data for these therapies.

The findings presented by Sandhu et al. (Sandhu et al. 2022) further indicate that therapeutic efficacy should be analyzed not only in terms of clinical effects but also in terms of treatment costs. The authors showed that many modern therapeutic methods generate substantial costs despite a

limited amount of evidence confirming their superiority over standard therapy. Therefore, the choice of treatment strategy should take into account both clinical efficacy and economic aspects.

The Cochrane reviews by Cheng et al. (Cheng et al. 2012) and Lodi et al. (Lodi et al. 2020) emphasize that despite the growing number of studies on OLP treatment, high-quality multicenter clinical trials with uniform efficacy assessment criteria are still lacking. Considerable heterogeneity of study populations, differences in therapeutic protocols, and short follow-up periods hinder comparison of individual study results and the formulation of clear clinical recommendations.

In summary, the contemporary approach to lichen planus is evolving from purely symptomatic therapy toward treatment based on an understanding of the immunological mechanisms of the disease. Corticosteroids remain the foundation of treatment; however, the development of biological therapies, regenerative methods, and agents with immunomodulatory effects opens new therapeutic perspectives. Further studies should focus on identifying prognostic biomarkers, assessing the long-term safety of new therapies, and developing treatment standards tailored to individual disease phenotypes.

Conclusions

Oral lichen planus remains a chronic inflammatory disease with a complex immunological pathogenesis, and its treatment continues to represent a significant clinical challenge. Current data indicate that topical corticosteroids remain the first-line therapy, effectively reducing symptoms and improving patients' quality of life. At the same time, limitations associated with long-term steroid use justify the search for new therapeutic strategies.

An increasing body of evidence supports the efficacy of light-based methods, such as photodynamic therapy, photobiomodulation, and laser therapy. These methods show a favorable safety profile and may constitute a valuable alternative or adjunct to standard treatment, particularly in patients with recurrent or treatment-resistant disease.

Growing knowledge of the immunological mechanisms involved in the pathogenesis of lichen planus indicates a key role of the IL-17/IL-23 axis, creating prospects for the development of targeted therapies. Preliminary results of biological treatment suggest that drugs modulating these pathways may be useful in patients who do not respond to conventional therapy.

Promising results have also been observed for adjunctive therapies, such as probiotic therapy, topical mycophenolate mofetil, lycopene, and ozone therapy. Although these methods require further validation, they may become part of personalized therapeutic management in the future.

Despite the dynamic development of new treatment methods, the available scientific evidence is still limited by small study groups and short follow-up periods. Further high-quality multicenter

clinical trials are necessary to determine the long-term efficacy and safety of new therapies and to develop optimal treatment strategies for patients with lichen planus.

Disclosure

Author Contributions:

Conceptualization: WP

Methodology: WP

Formal analysis: AJ

Investigation: KK

Data curation: KB

Writing – original draft preparation: WP, AJ, WZ, GC, KK

Writing – review and editing: KG, KB, WC, GC, KK

Supervision: GC

Project administration: AJ

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Declaration of the use of generative AI and AI-assisted technologies in the writing process.

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) exclusively for language editing, grammar correction, and translation support. Following the use of this tool, the

authors carefully reviewed and edited the manuscript and take full responsibility for the final content of the publication

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