

Application of Trichoscopy and Novel Non-Invasive Imaging Techniques in the Diagnosis and Management of Patients with Scalp Psoriasis

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Abstract: Scalp psoriasis affects up to 80% of patients with psoriasis and possesses a significant challenge as a difficult-to-treat area. A comprehensive literature search was conducted in PubMed using relevant keywords to identify recent studies focusing on scalp psoriasis diagnosis and treatment. The diagnosis is mainly based on clinical evaluation and trichoscopy. Other diagnostic tools, such as histopathology, optical coherence tomography, reflectance confocal microscopy (RCM) and line-field confocal optical coherence tomography (LC-OCT) may offer valuable insights in doubtful cases. Topical therapies (glucocorticosteroids, a betamethasone-calcipotriol combination or calcineurin inhibitors) remain the first-line therapy for mild to moderate cases. Patients with severe scalp psoriasis and those who do not respond to topical treatment are candidates for systemic therapy, including targeted therapy (interleukin-17 inhibitors, interleukin-23 inhibitors, tumor necrosis alpha inhibitors) or classic treatment (methotrexate, cyclosporine). Recent studies have demonstrated promising outcomes with novel treatments including Janus kinase (JAK) inhibitors and other new small molecules. This review provides updated information focused on diagnostic methods and targeted treatment of scalp psoriasis with relevance to clinical management of patients.

Keywords: scalp psoriasis, biologic agents, systemic treatment, topical, diascopy, trichoscopy, phototherapy, vitamin d analogs

Introduction

This review aims to comprehensively update and enhance the understanding of scalp psoriasis, from its diagnosis to treatment. It provides a detailed overview of the epidemiology, clinical features, and pathophysiology of scalp psoriasis, which are crucial for making the accurate diagnosis and effective treatment. Furthermore, it highlights available diagnosing tools and the difficulties in distinguishing this condition from other scalp disorders. The review article evaluates the efficacy and safety of both topical and systemic treatments for scalp psoriasis. By assessing the effectiveness and safety profiles of various treatment modalities, including topical corticosteroids, vitamin D analogs, and systemic agents, this review intends to provide valuable insights for healthcare professionals in the management of scalp psoriasis, ultimately leading to improved patient outcomes and quality of life.

Materials and Methods

Search strategy: A comprehensive literature search was conducted in PubMed in February 2024 using the following search terms “psoriasis” AND “scalp” AND “diagnosis” AND “treatment” AND “topical” AND “systemic” AND “trichoscopy” AND “dermoscopy”. The studies were reviewed in the English language. Articles were selected based on their relevance to scalp psoriasis and their contribution to the understanding of its diagnosis and treatment in the last 5 years. This search strategy aimed to identify relevant articles addressing various aspects of scalp psoriasis, including diagnostic techniques, treatment modalities, pathophysiology, and clinical outcomes. We obtained a total of 428 records,



and a total of 75 papers were evaluated in this article. We excluded papers that involved pediatrics patients, non-evidence based methods, other scalp diseases or different types of psoriasis.

Results

Psoriasis is a chronic immune-mediated disease marked by inflammation, affecting approximately 125 million individuals worldwide.¹ It presents a bimodal age pattern in its onset and can involve any part of the body, particularly the skin, nails, scalp, joints, and intertriginous areas.^{2,3} Psoriasis is linked to various comorbid conditions, including metabolic syndrome, inflammatory disease, cardiovascular disorders, type II diabetes, obesity, anxiety, and depression.^{4,5} The main clinical symptoms are erythematous plaques with a silvery-white micaceous scale on the skin's surface that vary in morphology, severity, and distribution.^{6,7} The assessment of psoriasis is commonly conducted through the use of the Psoriasis Area and Severity Index (PASI), which evaluates the severity of lesions and the extent of the affected area to calculate a single score. PASI is commonly displayed as a percentage rate of response.⁸

Pathophysiology

Psoriasis pathophysiology includes primarily tumor necrosis factor alpha (TNF- α), dendritic cells (DCs), antimicrobial peptides (AMPs), interleukin (IL)-17, IL-22, IL-23, T helper (Th)17, interferon gamma (IFN- γ), signal transducer and activator of transcription 3 (STAT-3), and keratinocyte proliferation/differentiation.^{8,9} The stimulation of IL-17 through the IL-23/Th17 pathway is considered the main mechanism in the generation of psoriasis. The signaling pathway of IL-17 and its associated products play a crucial role in the inflammatory process characteristic of the condition. It has been identified as a critical target for the development of various therapeutic interventions for psoriasis.¹⁰

Psoriasis of the Scalp – Anatomical Differences and Clinical Implications

Scalp involvement is particularly common, affecting up to 80% of individuals with psoriasis.² The condition can significantly impact patients' quality of life (QoL) by causing pain, pruritus, bleeding, and embarrassment, resulting in a deterioration in psychosocial functioning. It is generally classified as a difficult-to-treat location and requires particular attention.¹¹ Limited accessibility, the presence of hair, and the intolerable aesthetic effect of topical treatment may lower patients' compliance and contentment.¹²

Scalp skin possesses unique anatomical features designed to protect cranium. It is considered thicker compared to other body locations, and it varies from 3 mm in the forehead up to 8 mm in the occipital region.¹³ It is rich in hair follicles and sebaceous glands compared to other skin. Scalp subcutaneous tissue is rather thin and in cachectic subjects, fat tissue might not be present. Nonetheless, it has a rich network of anastomosing arteries, veins, lymphatics, and sensory nerves.¹³

The scalp is the most prevalent area affected by psoriatic itch.^{14,15} The difficulty of treating psoriasis-related scalp itching is primarily due to a lack of understanding of its pathophysiological mechanism and the inherent challenges involved in applying topical medications to lesions located in this anatomical region. According to the studies, the pruritic pathway is multifaceted, involving essentially the structures of the scalp, such as hair follicles, and encompasses the endocrine, nervous, vascular, and immune systems.¹⁶ Mastocytes located in the dermal sheath of follicles may have a significant impact on the onset of the scalp itch in psoriasis.¹⁷ In addition, a recent prospective study by Nattkemper et al, with scalp biopsies from a cohort of 27 Hispanic patients with psoriasis, indicated the neuroimmune mediators of pruritus. Based on the intensity of the itch, patients were divided into two groups: 13 patients with mild/moderate itch and 14 patients with severe itch. The authors revealed the correlation between pruritus intensity and the expression levels of protease-activated receptor 2 (PAR2), IL-23, transient receptor potential (TRP) channels V3 and M8, and substance P. Furthermore, the occurrence of only IL-23 and TNF- α cytokines in severely itchy scalp lesions has been demonstrated. Histamine+ cells did not significantly differ across psoriatic scalp itch groups. Additionally, cells did not show any correlation with the intensity of the itch. These results highlight a non-histaminergic pathway of the itch in scalp psoriasis, which may explain the ineffective antihistamine treatment for psoriatic severe itch.¹⁴

Scaliness on the scalp is a common discomfort, therefore the differential diagnosis is crucial. Isolated scalp psoriasis with a lack of presence in additional skin locations might be challenging to distinguish from seborrheic dermatitis, due to

their comparable clinicopathological characteristics.^{2,18} The indication of the proper diagnosis may be the color of the findings, as scales in seborrheic dermatitis are yellowish. The coexistence of these two conditions has been noted.¹⁸ Lichen planus may be diagnosed due to violaceous papules, eventually with cicatricial alopecia. The fungal infections located in the scalp area differ from psoriasis with more prominent alopecia and broken hairs.¹⁹

In terms of treatment, scalp psoriasis poses unique challenges compared to other forms of psoriasis due to the difficulty of applying topical treatments to the scalp and the limited efficacy of some systemic therapies. The insufficient response is mainly due to the inadequacy of the galenic formulations for the hairy, follicle-rich skin of the scalp. This area has unique conditions for cutaneous bioavailability and requires a special approach in topical treatment.²⁰ Even though the scalp skin is thicker compared to other body locations, thanks to rich vascular plexus in the subcutaneous tissue, the bioavailability of topical agents is very good. Topical corticosteroids and vitamin D analogs are commonly used as first-line treatments for mild to moderate scalp psoriasis, but their effectiveness may be limited by factors such as poor adherence and inadequate penetration.² Systemic therapies, including methotrexate, cyclosporine, and biologic agents targeting TNF-, interleukin (IL)-17, and IL-23, are reserved for more severe cases of scalp psoriasis but may be associated with systemic side effects and long-term safety concerns.^{2,12}

Clinical Manifestations and Assessment

Lesions are situated behind the hairline's edge or reach the skin's periphery around the ears, forehead, and occipital region.²¹ Several scales are available for evaluating disease severity such as: PASI, Psoriasis Scalp Severity Index (PSSI), Dermatology Life Quality Index (DLQI), Scalp specific Physician's Global Assessment (sc-PGA), Investigator Global Assessment (IGA). Assessing psoriasis severity in difficult-to-treat locations can be challenging, as commonly used severity definitions often rely on the proportion of body surface area involved. Site-specific scoring systems provide a more precise evaluation of disease severity in difficult-to-treat areas. PSSI includes the severity of erythema, skin extension, infiltration, desquamation and is assessed by doctors from 0 to 72 points.²² Sc-PGA measures the severity of the disease using a 6-point scale from clear to very severe.²³ DLQI introduced in 1994, was the first instrument specifically developed to evaluate quality of life in dermatological patients. The questionnaire evaluates six areas of life affected by skin disease: symptoms and emotional impact, everyday activities, leisure time, work or school performance, interpersonal relationships, and treatment.²⁴ Moreover, as pruritus is one of the main symptoms of scalp psoriasis, the scalp itch NRS scale seems to be enormously important. Patients measure the severity of the scalp itching from 0 (no pruritus) to 10 (an extremely intense itching sensation of the scalp).²⁵

Trichoscopy

The diagnosis may be often performed on the basis of clinical evaluation. The typical presentation is presence of erythema, scaling and inflammation. In the active phase of the disease patients may experience mild to moderate itch. Some patients develop psoriatic alopecia.²⁶

Advanced imaging techniques like trichoscopy have emerged as valuable tools in the diagnosis of scalp psoriasis.^{27,28} Trichoscopy is a non-invasive diagnostic method widely used for the *in vivo* assessment of scalp diseases and hair loss. This technique is recognized for its potential to reduce the necessity for biopsies and histopathological evaluation in psoriasis.^{27,29,30} Diagnosing scalp psoriasis may be challenging due to the various clinical patterns.²¹ Trichoscopy is conducted using a handheld dermoscope or digital videodermoscope and allows to evaluate hair shafts, cutaneous microvessels, follicular openings, and the perifollicular epidermis.^{30,31} In scalp psoriasis trichoscopy typically reveals features such as regularly distributed red dots/globules (at low magnification), bushy vessels, twisted loops (at higher magnification), reddish background, and diffuse scaling (Figure 1).^{21,32–35} The quantity of twisted capillary loops and of micro-extravasations corresponds to disease severity.²⁶ Scalp psoriasis has a similar vascular pattern to psoriasis vulgaris, with red globular vessels being present in a large majority of patients. Twisted red loops are present in over 57% of patients with scalp psoriasis.³⁴ Scaling is usually characterized as white, thick, and diffuse or patchy structures and is present more frequently on the scalp than in other locations.²⁸ Kibar et al described signet ring vessels and hidden hair as structures linked to the diagnosis of psoriasis.³⁶ These distinctive features aid in distinguishing scalp psoriasis from other

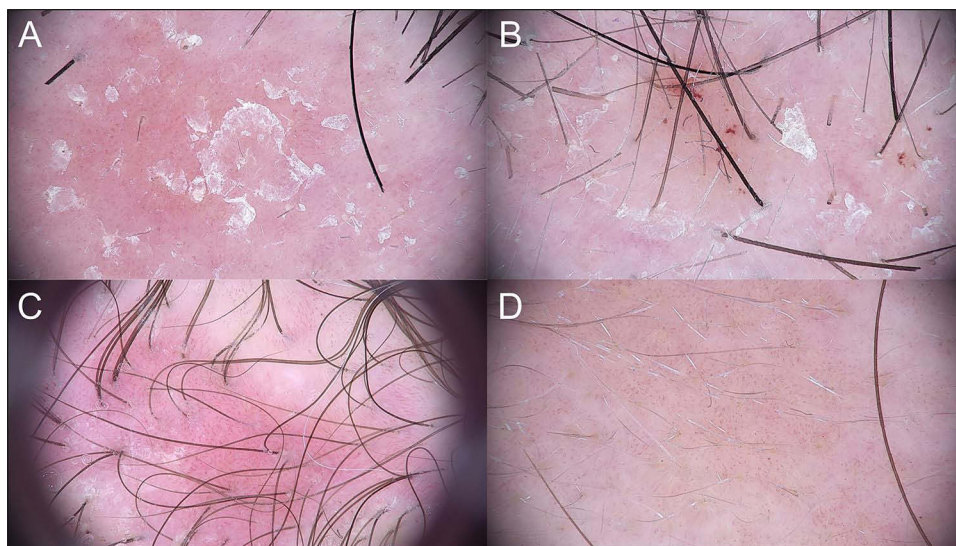


Figure 1 Trichoscopy in patients with scalp psoriasis. Images without immersion (**A** and **B**) show white scales, erythema and pinpoint bleeding (Auspitz sign), after immersion (**C** and **D**) presence of regular dotted vessels can be visualized.

inflammatory scalp conditions (including seborrheic dermatitis) and can provide valuable diagnostic support, particularly in cases where clinical presentation alone is inconclusive.^{27,29}

Diascopy

The research conducted by Kłosowicz et al, examined through firm direct pressure (diascopy) the vascular responses of interfollicular twisted loops in scalp psoriasis (16 cases of biopsy-confirmed scalp psoriasis) with arborizing vessels in healthy individuals and patients with seborrheic dermatitis (37 cases). This comparative analysis was performed with the FotoFinder technology at x40 magnification, particularly focusing on the changes upon the application of pressure. Respectively, the diasopic findings highlighted the blanching effect in arborizing red-line vessels. In contrast, the majority of both twisted and simple loops did not show any blanching. The results of this study may provide a possible assistance in the diagnosis of scalp psoriasis.³⁰

Optical Coherence Tomography

Optical Coherence Tomography (OCT) is an imaging technique with high resolution that captures detailed biological tissue images using light waves. Estarabadi et al, investigated the utility of OCT in diagnosing inflammatory scalp disorders, including scalp psoriasis. Their prospective observational study demonstrated the objective assessment of red loop density using OCT, aiding in the differentiation of psoriasis from seborrheic dermatitis. OCT provided non-invasive insights, reducing the need for invasive procedures like biopsies and offering valuable diagnostic information. En-face OCT imaging of the dermal papillae in scalp psoriasis shows a scattered pattern of dilated spinal vessels. These features differ from control images with normal skin, which are thinner and regularly distributed, or from seborrheic dermatitis with arborizing vessels in a net-like distribution. A cross-sectional image revealed moderately dilated capillary loops and increased epidermal thickness (0.13–0.16 cm).³⁷

Reflectance Confocal Microscopy

Reflectance confocal microscopy (RCM), a non-invasive technique, creates two-dimensional, high-resolution optical sections at different depths of the skin, ranging from the stratum corneum to the papillary dermis.³⁸ RCM of the scalp psoriasis revealed parakeratosis, atypical honeycomb pattern, orthokeratosis, and the presence of the inflammatory cells within the superficial layer. Moreover, at the dermal-epidermal junction, RCM findings were papillomatosis, enlarged dermal papillae with dilated vessels.³⁹

Line-Field Confocal Optical Coherence Tomography

Line-field confocal optical coherence tomography (LC-OCT) is a novel non-invasive imaging technique that integrates the principles of optical coherence tomography and reflectance confocal microscopy with line-field illumination. It enables high-resolution, real-time, cell-resolved visualization of the skin *in vivo* in both vertical and horizontal planes and is considered a “virtual biopsy”.⁴⁰ LC-OCT features of scalp psoriasis are epidermal hyperplasia with parakeratosis, neutrophils in the stratum corneum and papillomatous appearance (Figure 2),⁴¹ which corresponds directly to histopathology. Non-invasive techniques can facilitate earlier diagnosis and faster introduction of specific treatments improving patients clinical responds.

Limitations of Non-Invasive Skin-Imaging Techniques

While histopathology remains the gold standard for the diagnosis of inflammatory skin conditions, the use of non-invasive skin imaging techniques reduce the number of punch biopsies, enable faster diagnosis, and targeted treatment. Trichoscopy is the cheapest and therefore most accessible non-invasive skin imaging method. The previously mentioned features (regularly distributed red dots/globules and silver scales) can help distinguish scalp psoriasis from other dermatoses, ie. seborrheic dermatitis. However, in challenging cases, biopsy might still be required. RCM and LC-OCT allow visualization at the cellular level, revealing features which correspond directly to histopathology (parakeratosis, acanthosis, absence of granular layer, elongation of rete ridges or inflammatory infiltrations). Nonetheless, there are several limitations to those two techniques. First, the depth of the acquired images (up to 250 μm in RCM and 500 μm in LC-OCT) allows visualization of epidermis and upper layers of dermis. Second, severe scaling can cause laser-beam refraction and prevent examination due to artifacts. Finally, there is the limited accessibility and the high cost of the devices.

Treatment

The management of scalp psoriasis requires a complex approach, with treatment options ranging from topical therapies to systemic agents.^{16,42} The treatment aims to clear visible signs of scalp psoriasis, reduce main symptoms (eg. erythema and itching), and sustain long-term remission without the significant adverse effects associated with long-term therapy.²⁶

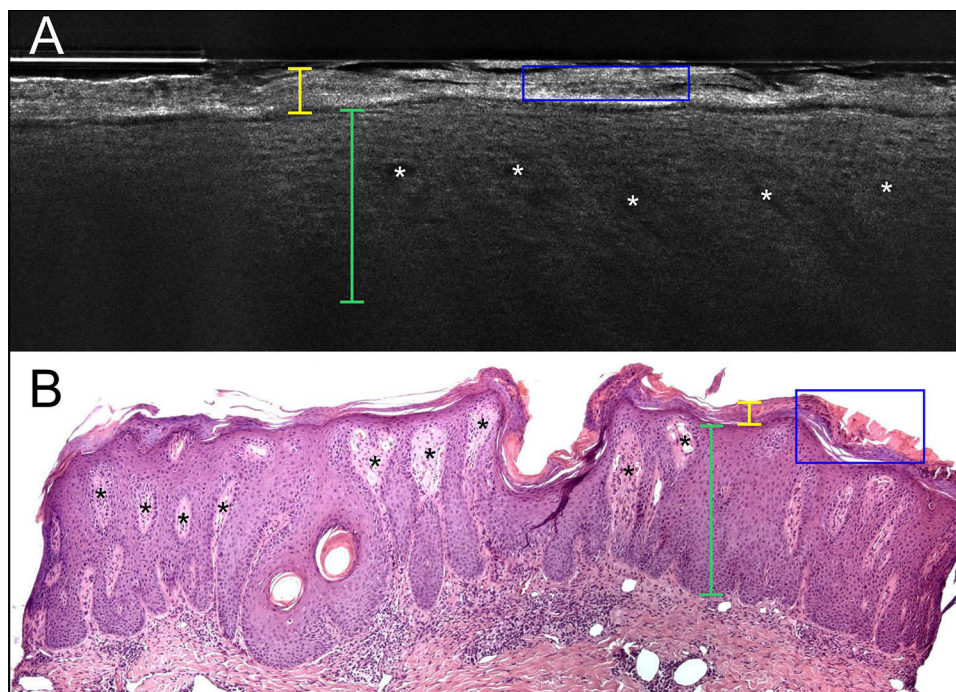


Figure 2 Correlation between LC-OCT images (A) and histopathology sections (B) of scalp psoriasis. Specific characteristics include: parakeratosis (blue rectangle), hyperkeratosis (presented in yellow), acanthosis (presented in green), and dilated blood vessels in elongated dermal papillae (asterixis).

Combination therapy with topical corticosteroids and vitamin D analogs is commonly recommended as first-line treatments for mild to moderate scalp psoriasis, providing symptomatic relief and reducing inflammation (Table 1).⁴³

Moderate to severe scalp psoriasis, as well as cases not responding to topical therapy usually require systemic therapy. This may be treatment that targets IL-17, IL-23 or TNF-. Classic treatment options include methotrexate, cyclosporin and acitretin. Several new agents, including Janus kinase (JAK) inhibitors are under investigation.

Table 1 Summary of Studies on the Treatment of Scalp Psoriasis

Treatment	Study	Comparison	Type of Study	Year	Result
Calcipotriene 0.005% plus Betamethasone Dipropionate 0.064% (Cal/BD)	Patel et al ⁴⁴	BD or Cal foam alone	RCT	2020	Scalp lesions with Cal/BD foam vs. BD or Cal foam (week 4) for redness (80.0% vs. 76.2% vs. 61.4%), scaliness (82.0% vs. 78.2% vs. 67.3%), and thickness (89.0% vs. 80.2% vs. 71.3%).
The gel combining Calcipotriol and Betamethasone Dipropionate	Liu et al ⁴⁵	Calcipotriol scalp solution	RCT	2020	The two-compound gel managed scalp psoriasis effectively over the long term and was well-tolerated
Supramolecular active zinc antidandruff hair conditioner	Yu et al ⁴⁶	Placebo, calcipotriol ointment	RCT	2023	The use of supramolecular active zinc hair conditioner proved beneficial in treating scalp psoriasis, demonstrating strong clinical efficacy in sustaining therapeutic effects
Roflumilast	Kircik et al ⁴⁷	Vehicle	RCT	2023	A larger percentage of patients treated with roflumilast achieved the IGA scalp endpoint (59.1% by week 8) compared to the vehicle group (11.4%) (P < 0.0001). Significant improvements were noted in body IGA, scalp itch scale, and PSSI.
Tapinarof	Robbins et al ⁴⁸	Vehicle	RCT	2018	Treatment success defined by PGA 0 or 1 and a 2-grade improvement at week 12 was statistically significantly higher (at a 0.05 significance level) in the tapinarof groups (65% [1% twice daily], 56% [1% once daily], 46% [0.5% twice daily], and 36% [0.5% once daily]) than in the vehicle groups
Tofacitinib, Peficitinib, Solcitinib, Baricitinib, Abrocitinib, Deucravacitinib,	Zhang et al ⁴⁹	Placebo	Meta-analysis using RTCs	2022	JAK inhibitors showed superior PASI75 response over placebo at both 8 and 12 weeks
Etanercept	Bagel et al ⁵⁰	Placebo	RCT	2012	PSSI improvement (week 12): 86.8% (week 24): 90.6%
Adalimumab	Thaçi et al ⁵¹	None	RCT	2015	PSSI improvement (week 16) 77.2 ± 96.9%
Brodalumab	Seo et al ⁵²	Placebo	RCT	2021	PSSI was greater in the brodalumab group (week 12–22.8 ± 16.2) compared with the placebo group (2.5 ± 9.2)
Ixekizumab	Paller et al ⁵³	Placebo	RCT	2020	Clearance of scalp (week 12- PSSI = 0, P < 0.001)
Secukinumab	Rompoti et al ⁵⁴	Placebo	RCT	2019	Pain (-1.98 vs. 0.61), Scaling (-5.76 vs. -0.95), Itching of scalp (-4.07 vs. -0.04)

(Continued)

Table 1 (Continued).

Treatment	Study	Comparison	Type of Study	Year	Result
Guselkumab	Jo SJ et al ⁵⁵	Placebo/ Adalimumab	RCT	2023	“clear” or “near clear” with guselkumab was superior to adalimumab for scalp psoriasis ss-IGA (week 24 [85.7%] vs [67.3%], P = 0.004),
Apremilast	Voorhees et al ⁸	Placebo	RCT	2020	ScPGA (43.3% vs 13.7%), Scalp Itch NRS (47.1% vs 21.1%), Whole Body Itch NRS (45.5% vs 22.5%). DLQI (−6.7 vs −3.8)

Abbreviations: PSSI, Psoriasis Scalp Severity Index; ScPGA, scalp Physician Global Assessment; DLQI, Dermatology Life Quality Index; NRS, The Numerical Rating Scale; ss-IGA, Scalp-specific Investigator's Global Assessment; RCT, Randomized controlled trial.

Although numerous clinical guidelines address the management of psoriasis, involvement of the scalp is often underrepresented, despite its high prevalence and significant impact on quality of life. The European consensus guideline on scalp psoriasis published by the European Academy of Dermatology and Venereology in 2009, highlights the lack of current, dedicated guidelines. Further research, along with the development and implementation of new guidelines, is necessary to improve the management of scalp psoriasis.⁵⁶

Topical Therapy

Calcipotriol and Betamethasone Combination

The effect of a calcipotriol/betamethasone gel and foam in scalp psoriasis is well documented, and this combination is usually recommended as first line topical therapy.^{44–46} A Cochrane review of topical treatment options in scalp psoriasis confirmed that the two-compound combination is more beneficial over the formulation containing only the corticosteroid and that both therapies were similarly safe in short-term therapy. Differences in the methodology of various short-term studies (4–8 weeks) performed in adult patients with scalp psoriasis limit the possibility of comparing the efficacy of these two formulations. The ointment formulation was not studied in isolated scalp psoriasis in clinical trials. A small case series indicated the possibility of significant efficacy. However, difficulty in washing the ointment out of the hair may be a limiting factor.

A long-term study of a calcipotriol/betamethasone gel in adult patients performed by Saraceno et al⁵⁷ indicated that maintenance therapy with twice-weekly applications versus on-demand treatment was more effective and was associated with a lower rate of relapse. The treatment was considered cosmetically acceptable by 79% of the patients.

Scalp psoriasis in adolescents is a significant therapeutic challenge. An analysis of data from clinical trial was performed to evaluate the efficacy of a foam formulation in scalp psoriasis in adults and adolescents from the age of 12 years. An improvement was observed in PGA classification at week 4 in 73.6% of the adolescents and it was higher compared to that reached in the adults.

There is preference among patients for gel or foam over ointment because of the pharmaceutical properties.⁵⁸

Corticosteroids

Topical corticosteroids are widely prescribed for scalp psoriasis due to their anti-inflammatory properties. They effectively reduce erythema, scaling, and pruritus, promoting symptom relief and improving cosmetic appearance. To accommodate patient preferences and improve compliance, a diverse range of corticosteroid formulations are available, such as solutions, foams, gels, and ointments.⁵⁹ However, long-term use of potent corticosteroids may lead to cutaneous atrophy, telangiectasia, and rebound phenomenon upon discontinuation.^{2,60,61}

Vitamin D Analogues

Calcipotriol and calcitriol are synthetic analogs of vitamin D that inhibit keratinocyte proliferation and modulate immune responses. When applied topically, these agents can effectively reduce inflammation and promote epidermal

differentiation, leading to clinical improvement in scalp psoriasis. Combination therapy with corticosteroids enhances efficacy while minimizing adverse effects associated with prolonged corticosteroid use.⁶¹ Liposomal formulations of corticosteroids and vitamin D analogs have shown improved penetration into the scalp, resulting in better clinical outcomes compared to traditional formulations.⁴

Coal Tar Preparations

Coal tar has been used for centuries in the treatment of psoriasis due to its anti-inflammatory and antiproliferative effects. Topical coal tar preparations, such as shampoos and solutions, can effectively reduce scaling and erythema in scalp psoriasis. However, their characteristic odor, staining potential, and limited cosmetic acceptability may limit patient adherence and satisfaction.^{62,63}

Calcineurin Inhibitors

Tacrolimus and pimecrolimus are calcineurin inhibitors that modulate immune responses by inhibiting T-cell activation and cytokine production. Topical calcineurin inhibitors are particularly useful in sensitive areas such as the face and intertriginous regions, where corticosteroids may be contraindicated or poorly tolerated. Although they are generally well-tolerated, long-term safety concerns, including the potential for skin malignancies, warrant cautious use and regular monitoring.²⁰

Roflumilast

Roflumilast a topical phosphodiesterase type 4 (PDE-4) inhibitor, recently demonstrated promising trials in psoriasis treatment in randomized, double-blind, vehicle controlled phase IIb study.⁴⁷ These findings support the necessity for additional research into topical solutions for managing the scalp psoriasis.^{47,64,65} Recently, the U.S. Food and Drug Administration (FDA) has approved new therapies for psoriasis, including the topical agents tapinarof and roflumilast. Additionally, other potential treatments are currently under investigation, such as orismilast.^{66,67}

Both tapinarof 1% cream and roflumilast 0.3% cream demonstrate efficacy in treating mild-to-moderate plaque psoriasis, with minimal adverse events, and offer improved patient compliance due to their water-based formulations.⁴⁸ Tapinarof is associated with more frequent, though less severe, side effects such as folliculitis and contact dermatitis, compared to urticaria and application site pain observed with roflumilast.⁶⁷

Systemic Therapy

Numerous research papers reveal that a range of systemic agents have a significant role in the reduction of lesions and the improvement of symptoms in cases of moderate to severe psoriasis. These treatments are also recommended and required for individuals who did not respond to earlier topical treatments or light therapy.⁶⁸

Conventional Systemic Agents: methotrexate, cyclosporine, and acitretin are traditional systemic agents used in the treatment of moderate to severe psoriasis, including scalp involvement.^{69–72} These agents modulate immune responses, inhibit keratinocyte proliferation, and promote epidermal differentiation, leading to clinical improvement. However, their use may be limited by potential systemic toxicities, including hepatotoxicity, nephrotoxicity, and teratogenicity, necessitating regular monitoring and dose adjustments.^{73,74} Specific dosing of methotrexate, cyclosporin and acitretin in patients with scalp psoriasis is included in [Table 2](#).

Table 2 Dosing of Methotrexate, Cyclosporine and Acitretine in Patients with Scalp Psoriasis

Medication	Typical Starting Dose	Therapeutic Range
Methotrexate	10–20 mg orally once weekly ⁶⁹	15–25 mg/week (max 25–30 mg/week) ⁶⁹
Cyclosporine	2.5 mg/kg/day, divided into 2 doses ⁷⁰	2.5–5 mg/kg/day ⁷⁰
Acitretin	10–25 mg orally once daily ⁷¹	0.25–1 mg/kg/day (~25–50 mg/day) ⁷²

While methotrexate, cyclosporine and acitretin are well-established treatments for psoriasis, there are no published randomized controlled trials (RCTs) that have specifically assessed their effectiveness for scalp involvement.

Biologic Therapies: Biologic agents targeting specific cytokines involved in psoriasis pathogenesis have revolutionized the treatment landscape for scalp psoriasis. TNF- α inhibitors (Etanercept, Adalimumab, Infliximab), IL-17 inhibitors (Brodalumab, Ixekizumab, Secukinumab), and IL-23 inhibitors (Guselkumab, Risankizumab, Mirikizumab), IL-12/IL-23 Inhibitor (Ustekinumab) have demonstrated remarkable efficacy in clinical trials, providing rapid and sustained clearance of psoriatic lesions, including scalp involvement. These targeted therapies offer improved safety profiles and reduced systemic toxicity compared to conventional systemic agents, making them an attractive option for patients with moderate to severe scalp psoriasis.^{50–55,74,75} Determining the most effective biologic for treating scalp psoriasis is challenging due to variations in outcome measures and the absence of head-to-head comparisons. Due to limited body surface area of the scalp patients with scalp psoriasis can be qualified to biological treatment based on disease severity assessed by scalp specific scoring.

Small Molecules: Apremilast, an oral PDE-4 inhibitor, in the first prospective, randomized, Phase 3, placebo-controlled trial demonstrated sustained efficacy in reducing the severity of moderate-to-severe scalp psoriasis.⁸ According to a recent study by Mrowietz et al, apremilast showed improvement in QoL connected with special areas of the skin (including scalp) and reduction in DLQI.⁷⁶

Selective, oral JAK inhibitors have shown promise in clinical trials, offering a new mechanism of action by targeting intracellular signaling pathways (transducers and activators of transcription) involved in psoriasis pathogenesis. This blocking results in the reduction of inflammation. JAK inhibitors have demonstrated efficacy in minimizing disease activity and improving symptoms, which may enhance patient adherence compared to injectable biologics. However, additional research focusing particularly on the scalp region is necessary to assess the effectiveness of this treatment approach.^{26,77,78}

To evaluate and compare the efficacy and safety profiles of JAK inhibitors in the treatment of psoriasis, a network meta-analysis was conducted, incorporating data from eight eligible randomized controlled trials. The analysis included six JAK inhibitors: tofacitinib, peficitinib, solcitinib, baricitinib, abrocitinib, and deucravacitinib, with a total of 3612 patients diagnosed with moderate-to-severe plaque psoriasis. Overall, JAK inhibitors demonstrated significantly improved PASI75 responses compared to placebo at both 8 and 12 weeks. Comparable trends were observed with respect to PGA responses. Regarding safety outcomes, most JAK inhibitors displayed a safety profile comparable to placebo, with the exceptions of deucravacitinib 6 mg twice daily and 12 mg once daily, which were associated with a higher incidence of adverse events. Tofacitinib 2 mg administered twice daily ranked highest for safety, followed by deucravacitinib 3 mg once daily and tofacitinib 5 mg twice daily.

When considering both efficacy and safety, tofacitinib across all evaluated doses (2 mg, 5 mg, 10 mg, and 15 mg twice daily) outperformed other JAK inhibitors, demonstrating clinical efficacy (in terms of PASI75 and PGA responses) alongside a favorable safety profile. These findings support the therapeutic potential of JAK inhibitors, particularly tofacitinib, as effective treatment options for patients with moderate-to-severe plaque psoriasis.⁴⁹

Phototherapy

Phototherapy by the wavelengths of light can reduce inflammation and decrease abnormal proliferation of the skin in psoriasis. Several studies have evaluated the efficiency of phototherapy (UVA or UVB) in psoriasis treatment. It may be utilized independently or alongside biological treatment for severe cases. This type of treatment has highly developed over the past several decades. Scalp is a limited area due to the presence of hair; therefore, handheld devices support targeted treatment [80,81].

There are some works about the efficacy of light therapy in scalp psoriasis. Rattanakaemakorn et al, in a retrospective study, showed the results of using a 308-nm excimer lamp as a treatment modality of scalp psoriasis. There was a statistically significant decrease observed in both the PSSI and itch scores achieved by this treatment in 10 months. The 308-nm excimer lamp surpassed the conventional phototherapy by a broader range of irradiation, reduced power density, fewer treatment sessions, and shorter therapeutic durations [81].

Conclusion

Scalp psoriasis represents a significant clinical challenge due to its impact on patients' quality of life and the complexity of its management. Scalp is one of the most affected areas in psoriasis. Scalp psoriasis requires scalp-specific diagnostic and therapeutic considerations distinct from generalized plaque psoriasis. Proper techniques including trichoscopy (dermoscopy of the scalp), diascopy, OCT, RCM and LC-OCT are crucial in making an appropriate diagnosis. The treatment of scalp psoriasis requires a comprehensive and individualized approach, considering disease severity, patient preferences, and treatment goals. Topical therapies remain the cornerstone of management for mild to moderate disease, offering localized symptom relief and minimizing systemic exposure. Systemic therapies, including conventional agents and biologics, provide effective disease control for moderate to severe scalp psoriasis, improving both clinical outcomes and patient quality of life. Continued research and clinical advancements are essential to optimize treatment strategies and address the needs of patients with scalp psoriasis. This review summarizes the importance of acquiring insights into scalp psoriasis diagnosis, evaluating treatment effectiveness, and understanding its impact on patient outcomes.

Perspectives

Current data provides limited scalp specific outcome measures with heterogeneity across studies, lack of head-to-head trials for biologics, long-term safety data for newer agents. Further research projects combining use of non-invasive imaging together with treatment outcomes would expand the knowledge on subclinical changes in scalp psoriasis. Prospective randomized clinical trials are needed to understand better change in scalp-specific outcome measures and quality of life in patients suffering from psoriasis predominantly localized in the scalp region.

Disclosure

The authors report no conflicts of interest in this work.

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