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Review Article

Expert opinion on management of *Pityriasis capitis* (dandruff) and related scalp conditions in clinical practice

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ABSTRACT

Dandruff and related scalp conditions, including seborrhoeic dermatitis (SD), scalp psoriasis, folliculitis, pityriasis versicolor (PV) and acne vulgaris (AV), are common globally. Dandruff, caused by Malassezia fungi, leads to excessive scalp skin shedding, whereas SD can vary in severity. Scalp psoriasis presents with chronic inflammation and scaly plaques. PV is a benign fungal infection that affects the trunk and neck, whereas AV primarily impacts the face and can also appear on the body. Both acne and dandruff are associated with imbalances in the skin and gut microbiome and altered immune responses. Treatments range from topical antifungals and anti-inflammatories to systemic therapies. The key active ingredients such as Selenium sulphide (SS), Zinc pyrithione (ZPT), Coal tar, Salicylic acid, Ketoconazole, Ciclopirox and Clobetasol are commonly employed in antidandruff formulations. Comparative studies suggest SS has a superior anti-dandruff effect compared with ZPT and coal tar. SS is effective against fungal infections, cost-efficient and has minimal side effects. In chronic and recurrent conditions, the use of SS in maintenance therapy can significantly lower treatment costs. This makes it a practical choice for long-term management. The current study presents the consensus statements derived from focused group discussions held across various regions of India between March and September 2023 concerning clinical strategies for the management of dandruff and related dermatological conditions.

Keywords: Dandruff, Hair products, Pharmacotherapy, Seborrhoeic dermatitis, Scalp psoriasis, Tinea versicolor

INTRODUCTION

Dandruff and associated dermatological conditions exert a detrimental effect on seborrhoeic regions, eliciting psychological distress, reduced self-esteem and social discomfort. These encompass pityriasis capitis (PC), *Seborrhoeic dermatitis* (SD), scalp psoriasis, folliculitis, *Pityriasis versicolor* (PV) and acne vulgaris (AV) and are characterised by multifactorial aetiology that necessitates further elucidation, despite their pervasive prevalence.[1,2] Therapeutic interventions primarily target the regulation of sebum production, mitigation of Malassezia spp. colonisation on the skin and the management of inflammatory processes.[3] Topical medicated shampoos such as Selenium sulphide (SS), Ketoconazole, Ciclopirox and Pramiconazole are commonly used for managing mild-to-moderate scalp SD in adults, whereas severe or refractory cases may necessitate systemic antifungal medications such as Itraconazole administered in conjunction with UVB phototherapy.[3-5] SS offers anti-inflammatory properties, which may provide additional benefits when used with medicated shampoos.[6] Medicated shampoos are often known to lack aesthetic attributes, which may impact patient compliance and treatment outcomes. A comprehensive therapeutic approach involving both pharmacological interventions

and appropriate aesthetic considerations is essential for addressing dandruff, SD and related conditions effectively.[7] Additionally, in light of the emerging resistance to Ketoconazole, it is imperative to investigate new therapeutic agents that offer a multipronged approach to management. In recent times, various novel treatment strategies have been explored to enhance outcomes in cases of dandruff and SD.[5] The current consensus combines expert opinions on managing dandruff and related scalp conditions, outlining their causes and tailored treatment strategies while acknowledging therapeutic limitations and patient needs.

Scope of the manuscript

The manuscript aims to provide a comprehensive understanding of dandruff (PC) and related scalp dermatological conditions, including SD, scalp psoriasis, folliculitis, PV and AV. It explores clinical perspectives, diagnostic challenges and effective management strategies for these conditions. Furthermore, it examines the influence of hair care practices and products such as shampoos, conditioners and treatment options on dandruff control and overall scalp health. Additionally, the manuscript addresses the impact of cosmetics and hair procedures on dandruff and related conditions.

OVERVIEW OF FREQUENTLY ENCOUNTERED DANDRUFF AND OVERARCHING DERMATOLOGICAL DISORDERS IN CLINICAL PRACTICE

Pityriasis capitis (dandruff)

Dandruff affects people across all genders and ethnicities. An imbalance in the bacterial and fungal populations, particularly the Malassezia species, plays a pivotal role in its development. Various factors such as immunological traits, emotional stress, nutritional status, genetics, environmental influences and hair care practices contribute to its onset.[8] Dandruff ranges from mild to severe, causing itching and flaking on the scalp without inflammation.[1]

Seborrhoeic dermatitis

SD affects seborrhoeic areas such as the scalp, face and chest, causing flaking, scaling, inflammation, itching and redness. SD, along with dandruff, impacts around half of the global population.Its pathogenesis involves a complex interplay of intrinsic and environmental factors, including sebum production, fungal colonisation of the skin surface, individual susceptibility and their interactions.[1] SD affects approximately 3% of the population.[1]

Pityriasis versicolor

PV (tinea versicolor) is a common, benign fungal infection affecting the trunk, neck and limbs. It leads to hyperpigmented (common in lighter skin) or hypopigmented (seen in darker skin) patches, accompanied by fine scaling. PV is caused by the same fungus responsible for dandruff and both conditions can occur together, although this is rare.[9,10]

Other scalp-related disorders

Folliculitis is the inflammation of hair follicles, resulting in pustules and dandruff.[11] Scalp psoriasis may manifest alone or in conjunction with other forms of psoriasis, exhibiting persistent cycles of remissions and exacerbations.[12] Acne can coexist with dandruff due to shared aetiologies such as inflammation, sebum production and microbial dysbiosis.[13,14]

CHALLENGES ENCOUNTERED IN THE TREATMENT OF DANDRUFF AND SCALP DISORDERS

The main hurdle in managing dandruff lies in its high rates of recurrence and relapse. Existing treatments often carry notable side effects and scientific evidence suggests that the current management strategies mainly focus on providing symptomatic relief, leaving underlying causes largely unaddressed.[9]

SD also impacts psychosocial well-being and overall quality of life.[15] Dandruff in SD may cause self-consciousness, embarrassment and itching, impacting individuals beyond medical concerns and leading to social and psychological challenges.[5] Diagnosing and treating SD in immunocompromised individuals is challenging, leading to more severe symptoms and a poorer prognosis.[16]

Additionally, the lack of optimal efficacy and safety of numerous existing therapies, especially topical treatments and the lack of robust evidence emphasises the need for more extensive research.[17]

DIAGNOSIS AND TREATMENT OF PITYRIASIS CAPITIS (DANDRUFF)

Diagnosis

PC (also known as dandruff) can be diagnosed by a skilful clinical examination of hair and scalp.[18] It is presented as fine white or grey scaling of the scalp.[19] Typically, diagnosis involves a thorough history-taking and physical examination. However, in rare cases where a more comprehensive differential diagnosis is needed, a skin biopsy may be required.[1] Differential diagnosis of PC includes atopic dermatitis, impetigo and tinea capitis.[20,21]

Treatment

The current treatment approaches for PC includes antifungal agents such as ZPT and Imidazoles, along with anti-keratolytic agents, such as coal tar, SS and salicylic

acid, commonly used to manage symptoms. As per the study by Suchimiatri et al, no significant differences in mycological efficacy or side effects between SS 1.8% shampoo and Ketoconazole 2% shampoo in treating PV were observed.[21,22] Additionally, anti-inflammatory agents such as corticosteroids, anti-sebum agents such as vitamin A derivatives Isotretinoin; anti-androgens such as Cyproterone acetate and immunomodulatory agents such as Pimecrolimus and Tacrolimus may be employed for treating dandruff.[9] Ketoconazole, Fluocinolone and phototherapy are also prescribed for dandruff management.[1,23]

Treatment with different topical antifungal agents such as Imidazole derivatives, ZPT (1-hydroxy-2-pyridinethiones and zinc salts), sulphur, piroctone olamine and derivatives of undecylenic acid aims to decrease the Malassezia overgrowth and regulate sebaceous gland activity (Table 1).[9]

Table 1: Current topical agents for dandruff treatment.[6]

Class	Medications	Mechanism
Azoles	Ketoconazole	Inhibition of fungal cell wall synthesis
	Fluconazole	
	Clotrimazole	
	Sertaconazole	
	Bifonazole	
	Miconazole	
Allylamine	Terbinafine (systemic)	Interferes with the synthesis of Ergosterol by inhibiting squalene 2,3-epoxidase
Benzylamine	Butenafine	
Organosulphur	Zinc pyrithione	Increases cellular copper and interferes with iron-sulphur proteins
Hydroxypyridones	Ciclopirox Olamine	Inhibition of metal-dependent enzymes
Molecules targeting multiple pathways	Selenium sulphide	Cytostatic and keratolytic activity, antimitotic action decreases turnover of epidermal; also possess antibacterial, anti-seborrhoeic and mild antifungal properties
	Coal tar	Disperses scales and diminishes epidermal multiplication and dermal penetrates
	Zinc pyrithione	Inhibits yeast growth through copper influx and inactivation of iron-sulphur proteins
	Immunomodulators	Inhibit calcineurin and prevent cytokine production and exhibit anti-inflammatory effects (Tacrolimus)
Anti-inflammatory agents	Corticosteroids	Penetrate the stratum corneum with a limited increase in the sebum level in the sebum
Anti-sebum agents	Isotretinoin	Reduces sebum production and stabilises keratinisation
Anti-sebum agents	Isotretinoin	Reduces the ability of mast cells to release chemicals that promote inflammation
	Pimecrolimus	

Source: Adapted from Sheth U, Dande P. Pityriasis capitis: Causes, pathophysiology, current modalities and future approach. J Cosmet Dermatol 2021;20(1):35-47.

MOLECULES TARGETING MULTIPLE PATHWAYS

Seborrhoeic dermatitis

Seborrhoeic dermatitis (SS) is sometimes referred to as selenium disulfide in certain studies. Agents inducing keratinocyte apoptosis are considered in dandruff treatment. SS could serve as an effective medicated shampoo for treating dandruff and SD. It exerts cytostatic effects by reducing the production of corneocytes and keratinocytes, which are responsible for dandruff formation. Barve et al, compared SS 2.5% with other keratolytic agents, concluding that SS selectively targets hyperproliferative keratinocytes with superior cytostatic and therapeutic effects. SS 2.5% exhibited the highest cytostatic and keratolytic activities, confirming its safety profile compared to all the other shampoos.[21]

A study by Danby et al, in 246 patients with moderate-to-severe dandruff compared the effectiveness and safety of Ketoconazole 2% shampoo with SS 2.5% shampoo and placebo and concluded that moderate-to-severe dandruff can be effectively treated by both SS 2.5% and Ketoconazole 2% shampoos.[21] In another study by Van Cutsem et al, Ketoconazole, ZPT and SS were evaluated in terms of fungistatic and fungicidal activities against yeast, Pityrosporum, which is attributed to causing SD and dandruff. The concentration required for growth inhibition ranged from 0.001 to 1 µg/ml for Ketoconazole and higher for ZPT and SS.[24] A recent study led by Godse et al, investigated the safety, effectiveness and

properties of SS 2.5% shampoo for treating dandruff, marking the first of its kind among the Indian population. Significant reductions in mean total dandruff score were observed from baseline (11.5) to week 1 (7.17), week 2 (4.93) and week 4 (2.5) (p=0.001) with SS 2.5% shampoo. All participants reported decreased dandruff and a satisfactory fragrance of the SS 2.5% shampoo by week 4. The study reported SS 2.5% shampoo effectively addresses dandruff and resolves symptoms such as itching, oiliness and greasiness, demonstrating a positive safety profile among patients in India.[5] A placebo-controlled randomised trial by Salmanpoor et al, compared the efficacy of three shampoos containing SS 1%, Liquorice 7% and placebo in managing dandruff in a cohort of 72 participants. SS 1% exhibited the most pronounced reduction in dandruff severity versus Liquorice and placebo shampoos.[6] However, another study by Rapaport et al, evaluated the anti-dandruff efficacy of four shampoos in 199 patients. SS 1% showed a significant reduction in total dandruff scores (both loose and adherent) more effectively than other shampoos. SS demonstrated a notably quicker rate of improvement than any of the other tested preparations, with results showing statistical significance ($p<0.05$).

The findings of this study align with those of the study by Kligman et al, which also reported that SS 2.5% was more effective than other shampoos based on corneocyte counts used to measure anti-dandruff activity. The mean dandruff scores at the end of the study are summarised in Table 2.[25] One of the primary mechanisms by which SS exerts its antifungal activity is through the generation of reactive oxygen species that can damage microbial cells.[26]

Table 2: Mean dandruff scores at the end of the study.[24]

Stage of study/component of shampoo used	Mean study score
Prestudy	19.5
Selenium sulphide	16.2
ZPT[a]-brand 1	14.6
ZPT[a]-brand 2	13.5
Coal tar extract and allantoin	13.1

[a]ZPT: Zinc pyrithione.

Zinc pyrithione

Zinc pyrithione (ZPT) also plays an important role in reducing flaking by decreasing the Malassezia growth on the scalp. A study by Reeder et al, reported that the incubation of ZPT with M. globosa resulted in copper imbalance, indicating that the source of the efficacy against the fungi linked to PC is increased intracellular copper.[27]

Immunomodulators

Immunomodulators such as Tacrolimus and Pimecrolimus have demonstrated efficacy in treating PC by inhibiting calcineurin. By preventing cytokine production, both medications exhibit anti-inflammatory effects. A pilot study by Braza et al, reported that topical Tacrolimus 0.1% ointment is efficient in the short-term treatment of SD.[9,28]

Coal tar

Coal tar reduces cell growth and Malassezia, but can be odorous, staining and messy.[9] As per the study by Saleshwarkar et al, combination shampoo containing polytar (1%) and ZPT (1%) provides a safe and efficient treatment option for dandruff and its related symptoms.[29]

Herbal treatment approaches

For those preferring natural remedies, herbal treatments including plant-based ingredients such as vitamins, essential oils, enzymes and amino acids provide anti-dandruff benefits. Common options include aloe vera, neem and amla.[9] Alternative approaches such as the application of tea tree oil have also been documented.[1]

MOLECULES TARGETING A SINGLE PATHWAY

Antifungal agents

Azoles

Azoles are commonly used antifungals for dandruff treatment, but prolonged use can lead to fungal resistance. Emerging resistance to azoles, including in Malassezia species, is concerning. Park et al, showed higher minimal inhibitory concentrations for Ketoconazole in two M. restricta strains (KCTC 27529 and KCTC 27550), indicating resistance. This resistance may result from prolonged azole use, incomplete treatments or genetic mutations.[30]

Non-azoles

Other topical antifungal agents are allylamines (Terbinafine), benzylamines (Butenafine) and hydroxypyridones (Ciclopirox). However, Terbinafine and Butenafine are not commonly used.[30]

Corticosteroids

Anti-inflammatory agents such as corticosteroids treat dry skin and inflammation by penetrating the stratum corneum without high serum absorption. Topical treatments such as lithium salts, calcineurin inhibitors (Tacrolimus and Pimecrolimus) and steroids (Hydrocortisone and Betamethasone) can help improve symptoms of SD.[31] Corticosteroids effectively alleviate itching and treat SD and dandruff by reducing Pityrosporum yeasts. Yet, their efficacy comes with a high risk of relapse and prolonged use may result in adverse effects such as skin thinning, delayed wound healing, purpura and perioral dermatitis.[32]

Consensus statements

In rare cases of dandruff where a more comprehensive differential diagnosis is needed, a skin biopsy may be required. SS 2.5% offers prolonged benefits in treating dandruff, combining cytostatic, keratolytic and anti-inflammatory effects. It effectively removes scalp oil and build-up due to its anti-proliferative and keratolytic properties. Ketoconazole can also effectively address moderate-to-severe dandruff, albeit necessitating higher doses compared to SS. SS treatment lasts 3–6 months, with lesions often resolving in 2–6 weeks. For best results, apply the shampoo to the scalp, leave it on for 5 minutes and rinse it out 2–3 times per week for the first 2 weeks. In recalcitrant cases of dandruff, SS can be combined with the primary medicated shampoo, applied 2–3 times a week, depending on severity. Steroid-based shampoos can be used in the case of erythema. Ivermectin and Metronidazole are utilized to address immune dysbiosis-induced inflammation by targeting and mitigating inflammatory responses. Oral therapy is deemed unnecessary unless for concurrent infection or proven deficiency, with multivitamins possibly serving as adjuncts. SS 1% can be used for maintenance therapy alongside salicylic acid shampoo for dandruff management.

DIAGNOSIS AND TREATMENT OF SEBORRHOEIC DERMATITIS

Diagnosis

Clinical diagnosis relies largely on medical history and clinical examination findings of patients. Several disorders, such as psoriasis, atopic and contact dermatitis and erythrasma, share features with seborrhoeic dermatitis (SD), making differential diagnosis challenging. Moreover, distinguishing SD from rosacea can be difficult due to overlapping symptoms. In children, tinea capitis and SD are frequently misdiagnosed. Differential diagnosis in adult SD, particularly with conditions such as psoriasis, eczema and Darier disease, requires careful consideration.[15]

Treatment

SD may respond well to several treatment approaches (Table 3).[33] The most popular therapies work by inhibiting the colonisation of skin yeast, reducing erythema and pruritus, removing the crusts and scales and reducing inflammation. These treatments include corticosteroids, immunomodulators, keratolytics and antifungal medications. Some of these modalities, however, include more than one feature, such as the keratolytic qualities of coal tar preparations, zinc and selenium preparations and the anti-inflammatory qualities present in many antifungal drugs.[33]

Table 3: Treatment options for management of scalp and beard SD.[33]

Mild-to-moderate SD[a]		
Drugs	**Dose**	**Status in therapy**
Selenium sulphide	2.5% twice a week for a month, then 1% once or twice a week for symptom control	First-line
Ketoconazole	2% twice weekly, then once or twice a week for symptom control	First-line
Zinc pyrithione, coal tar or salicylic acid	-	Second-line
Topical keratolytic or mineral/olive oil	-	Additional therapy
Severe SD[a]		
	Review diagnosis, consider specialist referral, HIV[b] testing	First-line

[a]SD: Seborrheic dermatitis; bHIV: Human immunodeficiency virus

DRUGS TARGETING MULTIPLE PATHWAYS

Selenium sulphide

Selenium sulphide (SS) has been formulated in some over-the-counter (OTC) shampoos, with a twice-weekly regimen showing successful results in treating SD. SS (aqueous/oil suspensions) exhibit antimicrobial properties against various types of fungi and bacteria. Unlike some dermatological agents that have a fungistatic effect, SeS2 inhibits fungal growth, possibly by disrupting sulphur metabolism within fungal cells.[34] A study by Massiot et al, suggest SS shampoo maintain scalp microbiota and manages clinical symptoms associated with dandruff and SD, following a first course of Ketoconazole therapy. Results confirm SS enhances scalp microbiota and improves clinical symptoms of SD and dandruff (−0.8; p=0.0002 for adherent flakes and −0.7; p=0.0081 for non-adherent flakes) at day 84 after Ketoconazole treatment. Furthermore, maintenance treatment with SS shampoo may significantly enhance SS symptoms. This study confirms the additional benefits of SS shampoo in maintaining scalp health and alleviating symptoms of SD and dandruff following initial Ketoconazole treatment.[35] Daily application of SS shampoo 1%–0.5% to the scalp for 2 weeks, followed by weekly maintenance is recommended.[3] In a study by Barbosa et al, conducted in 64 patients, the effectiveness and quality of life impact of

1% SS and 2% Ketoconazole shampoo achieved a significantly greater reduction in scalp severity scores (−71%) by day 28 compared to Ketoconazole ($p<0.001$) with improvement in quality of life. The findings suggest that SS 1% shampoo is a reliable and well-tolerated alternative to Ketoconazole for patients with moderate-to-severe scalp SD.[36]

Hydroxypyridones

Ciclopirox shampoo 1%–1.5% is recommended to be used 2–3 times a week until clearance is obtained, after which it should be used every week for prophylaxis.[37] A study by Unholzer et al, showed Ciclopirox olamine had higher treatment success (73.9% vs. 53.6%) and better clinical sign reduction in SD than the vehicle. It is also better tolerated than Ketoconazole.[38]

Zinc pyrithione

Most OTC anti-dandruff shampoos containing ZPT, is thought to have antibacterial and fungistatic effects and is available in 1% (shampoo) and 2% (cream) concentrations. A study by Marks et al, observed a significant decrease in the number of Periodic acid–Schiff-positive microorganisms in the areas treated with shampoo containing ZPT 1%.[39]

Immunomodulators

Both Pimecrolimus and Tacrolimus inhibit calcineurin, making them valuable in treating SD and have demonstrated efficacy in randomized trials and do not share the side effect profile of corticosteroids.[40] A study by Warshaw et al, demonstrated that Pimecrolimus cream 1% is an effective and well-tolerated treatment for moderate-to-severe facial SD.[41]

Coal tar

Coal tar has fungistatic properties similar to Ketoconazole but carries safety concerns (exfoliative dermatitis, keratoacanthomas, pigmentation changes, skin atrophy, contact dermatitis and psoriasis flare-ups).[33] A clinical trial in India showed that a shampoo containing Polytar and ZPT is both safe and highly effective in treating dandruff and its symptoms.[31]

Phototherapy

Although no randomized studies confirm its effectiveness, phototherapy is considered effective for severe SD. Side effects include burning and itching.[42]

DRUGS TARGETING SINGLE PATHWAYS

Antifungal agents

Azoles

Ketoconazole, Itraconazole and Bifonazole are key elements in anti-seborrhoeic therapy. Ketoconazole has been studied in over 10 randomised trials for scalp dermatitis. OTC formulations such as foams and gels are widely available, with a 4-week regimen of 200 mg/day often recommended.[43] Ketoconazole has also been used intermittently with success when used regularly to induce remission of the condition and works well when used in conjunction with zinc and selenium.[44] A comparative study on Ciclopirox 1.5% and Ketoconazole 2.0% suggested that both demonstrated comparable efficacy in treating scalp SD.[45]

Non-azoles

Benzylamines (Butenafine) and allylamines (Terbinafine) are antifungals that inhibit squalene epoxidase, essential for fungal cell membrane synthesis. Terbinafine also penetrates sebum and is available in an oral form.[46] Butenafine is effective for up to 72 hours after application, possesses antifungal and anti-inflammatory properties and reduces UVB-induced erythema.[47]

Topical corticosteroids

SD treatment is commonly associated with corticosteroids (Hydrocortisone and Beclomethasone) but they cause side effects like folliculitis, hypertrichosis and skin atrophy. As a result, there is a shift towards using more tolerable antifungal treatments.[48] Nevertheless, corticosteroid treatment may still be beneficial, particularly in immunocompromised individuals. Interestingly, there is no proven link between increased Malassezia growth and immunosuppressive dermatitis in HIV infection.[49]

Antibiotics

The study by Prasad et al, suggest that applying Metronidazole twice daily for 8 weeks in a gel formulation is efficacious but many be associated with a rare kind of contact sensitisation with repeated use.[50]

Consensus statements

Several disorders, such as psoriasis, atopic and contact dermatitis and erythrasma, share features with SD, making differential diagnosis challenging. Patients with SD visited the clinic more frequently compared to those with dandruff since it is a more severe form of the same condition. For people in South India, due to the humid climate and oiling practices, dandruff and SD are common. Based on the severity of symptoms, salicylic acid combined with SS can serve as an effective standalone treatment for SD. Coal tar and SS combination is particularly effective in treating in severe SD and psoriasis. A twice-weekly regimen of SS effectively treats SD, starting with daily application for 2 weeks followed by weekly maintenance, using shampoos containing 1%–0.5% SS. An initial wash with a normal shampoo without active ingredients, followed by

application of the SS shampoo enhances the keratolytic effects and leads to better resolution of scaling.

DIAGNOSIS AND TREATMENT OF PITYRIASIS VERSICOLOR

Diagnosis

Diagnosis of PV is clinical, relying on characteristic features (multiple hypo- or hyperpigmented, finely scaling macules/patches, coalescing centrally, evoked scale sign). However, the diverse presentations of the condition can be challenging for inexperienced clinicians. Examination with a Wood's lamp, at 365 nm, may reveal gold-yellow, yellowish-green or coppery-orange fluorescence in affected areas, although fluorescence is not always present and may extend beyond clinically visible lesions, indicating fungal spread.[10] PV may exist with dandruff and as per the study by Gothamy et al, these cases should be examined for the presence of M. furfur.[51]

Treatment

Treatment options for PV encompass topical antifungals such as azoles, Terbinafine, Naftifine and Butenafine. Additionally, non-specific topical agents such as SS, ZPT, propylene glycol, Whitfield ointment and combinations such as sulphur plus salicylic acid or benzoyl peroxide are utilised. Oral antifungal medications such as Itraconazole and Fluconazole may also be prescribed for comprehensive management.[10] As per the study by Gothamy et al, the presence of dandruff, especially when accompanied by PV caused by M. furfur, can significantly impact the prognosis and progression of the condition while identifying the organism holds key implications to understand cause and its outcome.[51]

The recurrence can be minimised partially by maintaining good personal hygiene. The prophylactic therapy for PV includes topical Ketoconazole 2% and Clotrimazole 1%. The SS 2.5% shampoo can also be applied for 10 minutes once/month to reduce recurrence rate. Oral antifungal agents such as Itraconazole can be prescribed when prophylaxis with topical antifungal is not adequate.[10]

Drugs targeting multiple pathways

Selenium sulphide

SS is a non-specific topical antifungal agent, available in different formulations with strength ranging from 1% to 2.5% concentrations. It has a success rate comparable to topical Ketoconazole and Bifonazole for treating PV and is cost-effective, readily accessible and user-friendly.[10] A double-blind randomised controlled trial by Surachmiati et al, evaluated the antifungal efficacy and safety of SS 1.8% versus Ketoconazole 2% shampoo for the management of PV and concluded that both have similar mycological efficacy and side effects for the management of PV.[22]

The study by Hernanz et al, randomised 20 PV patients to oral Itraconazole (200 mg OD for 5 days) group and SS 2.5% shampoo (applied OD for 7 days) group. Both treatments showed similar efficacy (16/20 vs. 17/20 healed). SS 2.25% shampoo was applied once daily for 7 days on the lesions of adults with a good lather formation, followed by keeping it for 10 minutes and a thorough rinse.[52]

DRUGS TARGETING SINGLE PATHWAYS

Antifungal agents

Azoles

Ketoconazole foam exhibits a significantly enhanced ability to penetrate transcutaneous tissue, approximately six times greater than that of lotions. The efficacy and safety of Ketoconazole foam are comparable to topical Ketoconazole cream 2%. Oral antifungals such as Ketoconazole, Itraconazole and Fluconazole have demonstrated outstanding efficacy. Additionally, newer oral triazole antifungal agents, such as Pramiconazole, administered in multiple doses (a single dose of 200 mg or 400 mg or 200 mg/day for 2 or 3 days), have shown remarkable effectiveness.[53]

Consensus statements

Examination with a Wood lamp, emitting filtered ultraviolet light at 365 nm, may reveal gold-yellow, yellowish-green or coppery-orange fluorescence in affected areas. Fluconazole, Itraconazole, Eberconazole and SS are currently used treatment options. SS is recommended periodically in combination with Fluconazole or Itraconazole, either weekly or monthly. Oral Itraconazole therapy for 2 weeks may be required along with the application of a topical agent if lesions are present on the body. Both SS 2.5% and, in some cases, a 1% formulation are utilised as standalone therapies for treating PV of the scalp. SS is advised to be applied 10 minutes before bath on the affected areas, followed by Ketoconazole or Eberconazole cream application. If the lesions are extensive, the treatment should be combined with Ketoconazole or Itraconazole tablets. For the treatment of hypopigmentation in PV, prophylactic therapy is required with Ketoconazole shampoo 2% and SS 1% for 4 weeks. SS 1% is a preferred agent and patients are advised to initiate prophylactic treatment twice a month during summer and rainy seasons following completion of the PV treatment course

Other treatment options

This includes laser and photodynamic therapies, including narrow-band UV-B phototherapy. Beeswax, honey, essential oils, plant-based products and creams

releasing nitric oxide are topically used worldwide; however, no scientific study support their usage.[10]

DIAGNOSIS AND TREATMENT OF OTHER SCALP-RELATED DISORDERS

Diagnosis

Scalp psoriasis often goes undiagnosed causing flaking and itching. Clinical presentations of scalp psoriasis rely on visual examination rather than pathology. Trichoscopy can help differentiate scalp psoriasis from SD.[54] Malassezia folliculitis can be misdiagnosed as acne due to its similar clinical features and site of occurrence.[55] Additionally, both Malassezia folliculitis and AV may coexist and last for a prolonged period, despite traditional acne treatments, as observed in two retrospective studies where Malassezia folliculitis coexisted with AV in >75% and 25% of patients, respectively. Malassezia folliculitis worsened post-antibiotic usage.[55,56]

Treatment

Emollients and corticosteroids are common topical treatments for psoriasis, along with vitamin D analogues (such as Calcipotriene), calcineurin inhibitors, Tazarotene, Bexarotene gel, Dithranol, sulphur, ZPT and coal tar.[57] Although flakes in psoriasis and dandruff may appear similar, their impact can be distressing. Shampoos containing coal tar, ZPT or SS can alleviate flaking for both conditions.[1] The preferred formulations in some studies have highlighted the use of 2%–10% coal tar solution and 0.05% Clobetasol propionate to treat scalp psoriasis. Clobetasol propionate 0.05% has been effective for scalp psoriasis. Salicylic acid 5%–10% has shown a potent keratolytic effect.[58] Topical calcineurin inhibitors commonly used include Tacrolimus (0.03% and 0.1% ointment) and Pimecrolimus (1% cream).57 The AV treatment depends on severity and type, often combining topical agents such as benzoyl peroxide, antibiotics and retinoids. Systemic options include oral antibiotics, hormonal therapy and Isotretinoin. Physical treatments such as lesion removal and phototherapy may also help. Treatment should be personalised based on the patient's condition and response.[59]

Consensus statements

Scalp psoriasis and Malassezia folliculitis are often underdiagnosed. The combination of coal tar and salicylic acid is the best for local wash. Use of oral therapy is also recommended with Methotrexate in recalcitrant conditions.Oral therapy should always be combined with local application therapy to offer better results in full-body and scalp psoriasis (oral antibiotics for 7 days along with topical preparations and, if required, Methotrexate can be prescribed). SS 1% and salicylic acid 3% are effective treatments for psoriasis, attributed to the keratolytic properties of salicylic acid, which helps in the removal of scales and the reduction of inflammation.

SS can be effective in the management of acne coexisting with dandruff as per the experts. In patients with a sensitive scalp, anti-dandruff shampoo can be combined with SS, steroids or low-strength salicylic acid. Good results were obtained by the topical application of Bifonazole once a day in the morning along with Benzoyl peroxide in the evening and resulted in complete eradication of lesions in 3 weeks to 1 month. It is an effective drug, though not well marketed. Using SS shampoo once every 15 days can help prevent recurrence.

EXPERT CONSENSUS ON DANDRUFF AND RELATED CONDITIONS CAUSED BY TOPICAL HAIR COSMETICS AND PROCEDURES

How do hair products cause dandruff?

Several studies have proven the association between hair care practice and dandruff incidence. Use of shampoo for less than 5 times/week was associated with higher dandruff risk.[60] Maintaining the right pH of the hair product is important for treating dandruff and overarching dermatological disorders. Alkaline pH can cause a higher negative electrical charge of the hair fibre surface, causing increased friction between the fibres and cuticle damage and fibre breakage. A lower pH in shampoos reduces frizz by generating less negative static electricity on the fibre surface, thereby minimising hair breakage.[61]

Impact of hair procedures on scalp health and dandruff

Studies have revealed that straighteners and dyes may cause allergic or irritant dermatitis, chemical burns, scarring alopecia and increased hair breakage. Even frequent shampooing could result in damaging the structures at the hair surface. Hair care products contain ingredients that can have various detrimental effects on the hair, also ultimately damaging the hair structure.62

However, to improve shampoo and conditioner formulations, it is important to carefully study various factors such as the thickness of the product when applied, its water content and its effects on hair texture or smoothness (Table 4).[63]

Consensus statements

Patient education is important in hair and scalp care post-transplant because patients assume that washing hair post-transplant will damage the hair follicles. This unawareness can lead to dandruff. Using a shampoo or conditioner separately is advised; their combination does not prove to be effective. Over-conditioning may exacerbate dandruff, whereas shampoos with glycolic acid can offer gentle scalp exfoliation. When using SS, it is crucial to rinse it off thoroughly or take a bath for at least 2–5 minutes; in case of PV, it should be left on for 2–5 minutes before rinsing.

Table 4: Therapeutic shampoos used in dermatology.[63]

Shampoo formulations		Mechanism(s) of action			
Active ingredient(s)	**Strength (%)**	**Keratolytic**	**Antiproliferative cytostatic**	**Antimicrobial**	**Anti-inflammatory**
Molecules targeting multiple pathways					
Selenium sulphide	1	+	++	+++	
Zinc pyrithione	1	+	++	++	
Coal tar preparations	0.5	+	+++	+	++
Molecules targeting single pathways					
Ketoconazole	1			+++	++
Ciclopirox	2			+++	++
Clobetasol propionate	0.05		+++		+++
Fluocinolone acetonide	0.01		+++		+++

Source: Adapted from Wolverton SE, Wu JJ. Therapeutic shampoos. In: Emerson AN, Brodell RT (eds). Comprehensive Dermatologic Drug Therapy. USA: Elsevier Health Sciences; 2019. p. 576.

CONCLUSION

The management of dandruff and related disorders requires a multifaceted approach. Several treatment options are available to manage these conditions, such as PC, PV, SD and acne. Some of the effective anti-dandruff agents include salicylic acid and sulphur, ZPT, SS, coal tar, Ketoconazole and Ciclopirox. SS is indicated for the treatment of dandruff, SD of the scalp and tinea capitis due to its antibacterial, anti-seborrheic and mild antifungal properties, which may enhance its effectiveness. It also exhibits cytostatic activity on the epidermis and follicular epithelium, leading to a reduction in corneocyte production and, consequently, decreased flaking.

The use of medicated shampoos containing antifungal, anti-inflammatory, cytostatic and keratolytic agents can effectively control mild-to-moderate cases. In more severe cases, topical corticosteroids and other specialised treatments may be necessary. Additionally, lifestyle factors such as diet, stress management and proper hair care practices play a significant role in maintaining scalp health. Continued research into the underlying mechanisms of scalp conditions is warranted to enhance our understanding of their pathogenesis further and to develop more targeted and efficacious therapeutic strategies.

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