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CONGRESS HIGHLIGHTS

LATEST RESEARCH & KNOWLEDGE

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Contents

- State of the art in hair disorder diagnosis and treatment 2
- Long-term remission achievable in alopecia areata 8
- Novel shampoo restores microbiome ratio of a healthy scalp in patients with seborrheic dermatitis 11

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STATE OF THE ART IN HAIR DISORDER DIAGNOSIS AND TREATMENT

Hair disorders significantly affect individuals' quality of life, influencing self-esteem and psychological well-being. Recent advancements in hair follicle biology, diagnostic imaging, and therapeutic interventions have revolutionised the management of various alopecias. At the EADV Congress 2024, several experts built on the foundational knowledge of hair follicle biology and its microenvironment into the diagnostic field with trichoscopy and advanced imaging techniques. Furthermore, they discussed how these tools are indispensable for accurately diagnosing conditions like telogen effluvium, androgenetic alopecia in females and males, and scarring alopecias.

Hair follicle microenvironment

Prof. Dr. Ralf Paus (University of Miami School of Medicine, FL, USA) initiated the first of 2 symposiums by explaining how hair follicle biology is profoundly influenced by its surrounding microenvironment, including the immune system, vascular networks, neural inputs, adipocytes, and various stem cell populations. These elements interact with hair follicles to regulate growth, cycling, and regeneration. Of particular interest is the role of senescent cells, which secrete factors like osteopontin, activating epithelial stem cells and promoting hair follicle enlargement, challenging the negative view typically associated with senescence. Hair follicles influence and are influenced by molecular gradients in the skin, which include growth factors, cytokines, lipids, and reactive oxygen species, all of which play a role in follicular health [1]. Moreover, hair follicles produce neurohormones such as melatonin, TRH, and endocannabinoids, impacting follicular growth and survival [2-4].

Recent research highlights the intricate relationship between hair follicles and their microbiome, which may influence immune function and follicle growth [5]. Moreover, the follicle's interaction with structures like the dermal white adipose

tissue, plays a crucial role in maintaining hair in the anagen phase by promoting angiogenesis and secreting growth factors like VEGF-A [6,7]. Hair follicles function as a detox system, absorbing systemic toxins and depositing them in the hair shaft, which is later shed [8]. Clinicians should consider not only follicular biology but also how to modulate its microenvironment to extend the anagen phase, addressing underlying factors like vascularization, immune response, and signaling gradients.

Understanding the complex interactions within the hair follicle microenvironment lays the foundation for diagnosing and managing hair disorders. To visualise these intricate structures and assess pathological changes, advanced imaging techniques like trichoscopy have become invaluable tools for clinicians.

Trichoscopy and imaging techniques

"Trichoscopy, a non-invasive diagnostic tool established by Polish dermatologists almost 20 years ago, allows clinicians to examine the surface of the scalp and hair shafts at magnifications of up to 200x," Dr Marta Sar-Pomian (Medical university of Warsaw, Poland) explained [9]. While it provides valuable insights into common hair and scalp disorders, its limitations include an inability to reveal cellular details, necessitating histopathology in more complex cases. Newer imaging methods, such as Reflectance Confocal Microscopy (RCM) and Line-field Confocal Optical Coherence Tomography (LC-OCT), have emerged to bridge the gap between trichoscopy and histopathology. RCM provides detailed, non-invasive images of the epidermis and papillary dermis, though its depth is limited [10]. In contrast, LC-OCT, introduced in 2018, offers both vertical and horizontal cross-sections of the scalp, providing 3D imaging that allows for a more comprehensive view of hair follicle disorders [11]. These advanced techniques help in diagnosing conditions like Discoid Lupus Erythematosus, folliculitis decalvans, lichen planopilaris, frontal fibrosing alopecia, and alopecia areata by visualising features such as black and yellow dots, inflammatory cells, pigment incontinence, and fibrosis [11-17]. Combining trichoscopy with RCM and LC-OCT can offer deeper insights, especially in challenging cases, and the potential integration of artificial

intelligence in these methods could revolutionise future diagnostic and monitoring practices. With these diagnostic modalities, clinicians can better evaluate conditions like telogen effluvium, a common cause of diffuse hair shedding influenced by disruptions in the hair growth cycle.

Workup for telogen effluvium

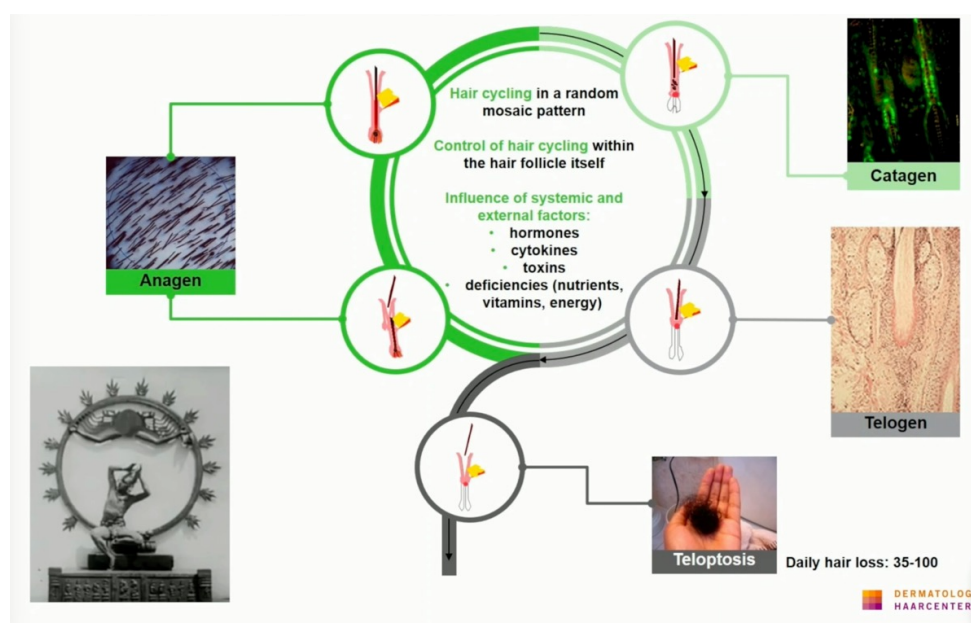
Telogen effluvium (TE) is a common cause of diffuse hair shedding caused by a disruption in the normal hair cycle that triggers excessive shedding of telogen-phase hairs. Hair typically cycles through asynchronous phases - anagen (growth), catagen (transition), and telogen (resting) - under the influence of systemic and external factors like hormones, stress, nutritional deficiencies, and illness (see Figure 1). "Normally, hair goes through the hair cycle in an asynchronous manner, independent of neighbouring hair follicles. Thus, hairs that are shed daily are shed in small amounts. In cases of synchronization of hairs, all hairs go into telogen and are then shed, which causes a shedding of a large number of hairs," Prof. Dimitrios Ioannides (Aristotle University Medical School, Greece) highlighted. In TE, large numbers of hair follicles synchronise into the telogen phase, leading to significant hair loss a few months after a triggering event, such as fever, surgery, or stress. There are 4 main types of TE based on different mechanisms: immediate anagen release, delayed

anagen release, short telogen release, and delayed telogen release. For instance, post-febrile TE occurs when a fever leads to synchronised telogen hair shedding about 3 months after the illness. Postpartum TE follows a similar pattern, with delayed shedding after a prolonged anagen phase during pregnancy. Additionally, seasonal shedding is a recognised phenomenon, where hair loss peaks during spring and late summer [18].

A comprehensive workup for TE includes a thorough medical and drug history, scalp examination, and laboratory tests to rule out underlying conditions such as thyroid dysfunction or iron deficiency. In most cases, TE resolves spontaneously once the triggering factor is addressed, and hair regrowth typically occurs within a few months. While there is no specific treatment to stop the shedding, supportive care includes a balanced diet rich in protein, vitamins, and minerals such as zinc and biotin, which can promote healthy hair regrowth. Awareness of seasonal fluctuations in hair shedding is crucial for assessing hair loss and ensuring appropriate patient counselling.

While telogen effluvium represents a transient shedding phase, androgenetic alopecia presents a progressive pattern of hair loss, particularly impactful in women due to its psychosocial effects.

Figure 1: Cycle of hair growth.



Taken from Prof. Dimitrios Ioannides' presentation

Female androgenetic alopecia

Female androgenetic alopecia (FAGA) is the most common hair disorder in women, significantly impacting quality of life due to hair thinning in the central and frontal regions, while typically preserving the frontal hairline [19]. The role of sexual hormones in FAGA is still debated, with family history emerging as a key factor, especially maternal inheritance [19]. Recent studies suggest that nutritional deficiencies, particularly in micronutrients, may contribute to FAGA, although vitamin D supplementation has not shown definitive benefits [20]. Genetic studies highlight differences between male and female androgenetic alopecia, with distinct genes, such as GJC1, playing a role in females [21]. Trichoscopy remains a key diagnostic tool, revealing patterns like hair miniaturisation and reduced follicle numbers, with new imaging techniques like ultrasonography showing promise [22,23]. Treatment primarily relies on minoxidil (topical and oral), with antiandrogens such as finasteride and spironolactone used in certain cases, often in combination [24-29]. Other emerging therapies include mesotherapy with dutasteride and experimental use of botulinum toxin A [30-32]. Hair transplantation and scalp tattooing are viable options in advanced cases [33]. "We must not forget that these females are heavily impacted in their quality of life. Depression and fear of going out are typical, and so we must try to give them the best treatment options, as for safety and for effectiveness," Prof. Bianca Maria Piraccini (IRCCS Azienda Ospedaliero-Universitaria di Bologna, Italy) concluded [34].

Similarly, male androgenetic alopecia is prevalent and has been the focus of numerous therapeutic advancements aimed at halting or reversing hair loss.

Male androgenetic alopecia

"Hair loss can be more difficult for men because they start losing their hair by the age of 25, significantly affecting their quality of life. However, we believe that the future holds new treatments, as research in this area is booming, with ongoing clinical trials and advancements in therapies like minoxidil, antiandrogens, and platelet-rich plasma (PRP) [35]," Prof. Dimitrios Ioannides (Aristotle University Medical School, Greece) stated at the beginning of his talk. Treatment options have advanced in recent years, with promising develop-

ments on the horizon. Oral minoxidil (2.5 to 5 mg/day) remains a cornerstone of therapy, alongside mesotherapy with 5% topical minoxidil for patients who are reluctant to take oral medication [36]. Oral dutasteride (0.5 mg, 3 to 7 times weekly) is another effective treatment, showing improvements, especially in the frontal and vertex areas, even at lower doses [37]. Mesotherapy with platelet-rich plasma (PRP) is used as an adjuvant therapy in cases where patients exhibit low response or poor adherence to other treatments [38].

Recent research highlights additional treatment options, such as microneedling, botulinum toxin, low-level laser therapy, and exosomes. Microneedling, particularly when combined with minoxidil or PRP, has been shown to enhance therapeutic outcomes [39]. While botulinum toxin has shown potential by improving blood flow and reducing dihydrotestosterone levels, its effectiveness remains controversial [41]. Low-level laser therapy is FDA-approved and widely available, with patients advised to use it 3 times per week for optimal results [40]. Exosomes, though still under investigation, have emerged as a potential future treatment to prolong hair follicle life and stimulate hair growth [42].

Furthermore, small interfering RNAs are being explored as an innovative approach to inhibit androgen receptor expression, with promising early results comparable to finasteride [43]. While prostaglandin analogues once held potential, optimism has waned despite a recent meta-analysis suggesting some efficacy [44]. Botanicals and nutraceuticals, including zinc gluconate and amino acid formulations, are also gaining popularity, although clinical evidence supporting their use remains limited. As research continues, these emerging therapies offer new hope for more effective and personalised approaches to treating male androgenetic alopecia.

Beyond genetic factors, hair loss can also result from infectious agents affecting the scalp, necessitating accurate diagnosis and targeted treatment strategies.

Infectious alopecia

Infectious alopecias are a group of hair loss conditions caused by fungal, bacterial, and viral infections affecting the scalp. Common infections include tinea capitis, a fungal dermatophytosis that

leads to patchy hair loss with broken hairs and can range from non-inflammatory to severe inflammatory forms [45,46]. Bacterial infections, such as folliculitis, typically caused by *Staphylococcus aureus*, can result in localised hair loss, with chronic cases potentially leading to scarring [45]. Viral infections like herpes zoster (shingles) can cause hair loss due to inflammation and scarring of the affected area. Secondary bacterial infections are also common in pre-existing scalp conditions like psoriasis or in self-inflicted disorders such as trichotillomania.

“Diagnosis of infectious alopecias can be challenging due to the similarity in appearance to other hair loss conditions, but trichoscopy plays a critical role,” Prof. Nino Lortkipanidze (David Tvildiani Medical University, Georgia) added. This non-invasive imaging technique reveals specific patterns such as corkscrew hairs and broken hairs in tinea capitis, tufted hairs in folliculitis decalvans, and exclamation mark hairs in alopecia areata. Early and accurate diagnosis is important for effective treatment and to prevent permanent hair loss, highlighting the importance of integrating clinical examination with trichoscopy and, when necessary, culture or histopathology.

In some cases, infections or inflammatory processes can lead to permanent follicular damage, culminating in scarring alopecias that pose significant therapeutic challenges.

Scarring alopecia

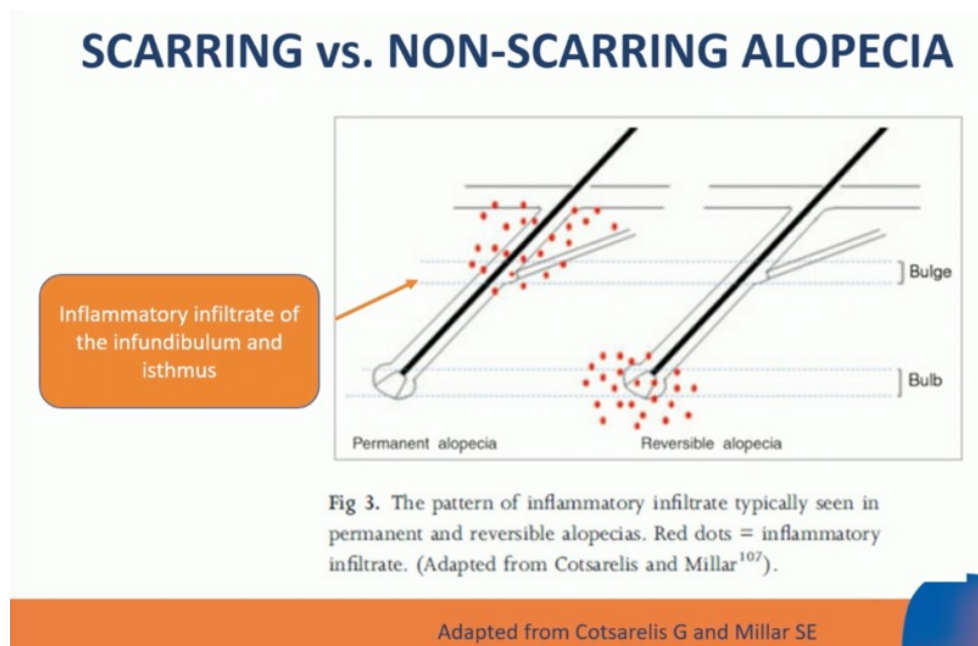
As explained by Prof. Alexander Katoulis (National and Kapodistrian University of Athens, Greece), scarring alopecia, or cicatricial alopecia, is a group of rare hair disorders characterised by permanent destruction of hair follicles and replacement with fibrous tissue, leading to irreversible hair loss. It is divided into primary scarring alopecia, caused by inflammatory conditions targeting the hair follicles, and secondary scarring alopecia, resulting from trauma, infections, or neoplasms. A key distinguishing feature between scarring and non-scarring alopecia is the location of the inflammatory infiltrate: in scarring alopecia, inflammation targets the upper part of the hair follicle, leading to permanent damage, while non-scarring alopecia affects the lower, regenerable part of the follicle.

Primary scarring alopecias can be classified based on the type of inflammatory cells involved: lymphocytic, neutrophilic, or mixed [47]. These conditions account for about 3-7% of all alopecia cases, with significant psychosocial impacts due to their poor prognosis and limited treatment options [48]. The pathophysiology is complex and includes genetic predisposition, loss of immune privilege, hormonal influences, and environmental factors like infections and allergens. Diagnosis relies on clinical examination, trichoscopy, and histopathological analysis, with biopsies serving as the gold standard.

Treatment focuses on slowing disease progression and managing symptoms. Lymphocytic scarring alopecias are often treated with corticosteroids, hydroxychloroquine, and immunosuppressants like cyclosporine. For neutrophilic types, antibiotics like doxycycline and isotretinoin are common, with biologics like anti-TNF- α agents used in resistant cases [49]. In some instances, surgical options like hair transplantation or scalp reduction may be considered after a period of disease stability. Advances in trichoscopy and emerging therapies, such as JAK inhibitors, hold promise for improving outcomes in these challenging cases [50].

For patients with irreversible hair loss due to scarring or other alopecias, hair transplantation is a viable solution to restore hair and improve quality of life.

Figure 2: Difference between scarring and non-scarring alopecia.



Taken from Prof. Alexander Katoulis' presentation

Hair transplantation

Hair transplantation is a rapidly evolving field that offers effective solutions for treating hair loss, particularly in cases of androgenetic alopecia and certain types of scarring alopecia. The 2 primary techniques - Follicular Unit Transplantation (FUT) and Follicular Unit Extraction (FUE) - allow for the redistribution of hair from stable donor areas to balding or thinning regions. FUT involves removing a strip of scalp and dissecting it into follicular units, while FUE extracts individual follicles, leaving minimal scarring.

Ideal candidates include men with Norwood-Hamilton stage II to VI hair loss, women with Ludwig stage I to II, and individuals with stable scarring alopecia from conditions like radiotherapy or discoid lupus. The surgery requires detailed planning, including hairline design and careful donor area assessment to ensure natural-looking results that will age well with the patient.

Postoperative care is important, with transplanted hairs typically shedding before regrowth begins within 4 to 12 months. Medical therapies, such as finasteride or minoxidil, are essential for preventing further hair loss and ensuring the longevity of the results. Despite the rise of unregulated clinics performing hair transplants, patients should seek experienced, certified surgeons to avoid compli-

cations and poor outcomes. "When performed correctly, hair transplantation can significantly improve the quality of life for individuals suffering from hair loss," Dr. Nina Otberg (Hair transplant center, Germany) concluded.

Conclusion

Advances in the understanding of the hair follicle environment and breakthroughs in both diagnostics and treatment have greatly improved hair disorder management. Techniques such as trichoscopy, RCM, and LC-OCT allow for earlier and more precise diagnoses. Additionally, treatments like minoxidil, mesotherapy, PRP, low-level laser therapy, and new therapies like exosomes and siRNAs are transforming the approach to hair disorder treatments. Refinements in hair transplantation techniques also continue to deliver transformative outcomes for patients suffering from irreversible hair loss.

Despite these advances, challenges such as the need for regulated training in hair restoration, the psychological impact of hair disorders, and the prevalence of unregulated clinics remain. These issues call for ongoing education and advocacy. Furthermore, while new treatments show promise, more research is needed to refine these options and ensure they are accessible to all.

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Hair Disorders (D2T07.1)

Prof. Dr. Ralf Paus- Hair follicle microenvironment (D2T07.1A)

Dr. Marta Sar-Pomian - Trichoscopy and imaging techniques (D2T07.1B)

Prof. Bianca Maria Piraccini - Female androgenetic alopecia (D2T07.1C)

Prof. Dimitrios Ioannides - Male androgenetic alopecia (D2T07.1D)

Hair Disorders (D2T07.2)

Prof. Ralph Trüeb - Workup for telogen effluvium (D2T07.2A)

Prof. Dr. Alexander Katoulis - Scarring alopecia (D2T07.2B)

Prof. Nino Lortkipanidze - Infectious alopecia (D2T07.2C)

Dr. Nina Otberg - Hair transplantation (D2T07.2D)

LONG-TERM REMISSION ACHIEVABLE IN ALOPECIA AREATA

During a symposium held at EADV 2024, 4 experts reviewed the pathophysiology of alopecia areata and described treatment options for the disease overall, as well as for special populations such as paediatric patients and patients with late-onset disease.

Dysregulation of the JAK-STAT pathway

Alopecia areata is characterised by premature induction of the catagen phase of hair development through immune cell attack of the anagen hair follicles. The stem cells of the hair follicle are not impacted by this process, so the hair follicle can regenerate and cycle. The JAK-STAT pathway is implicated in this process. "Hair follicle attack by CD8+ T cells and natural killer G2D+ cells is accompanied by a significant IFN- γ response and upregulation of γ -chain cytokines, including IL-2, IL-7, IL-15, and IL-21, which activates the JAK-STAT pathway. That's why, when one uses a JAK inhibitor, this can mitigate the problem," said Prof. Jerry Shapiro (New York University Langone, NY, USA).

Viruses such as Epstein-Barr virus or hepatitis B and C have been implicated as triggers for alopecia areata, as well as SARS-CoV2 infection and vaccination. Other potential causes are environmental factors or UV light exposure. Oxidative stress can also be a factor that triggers alopecia areata through excessive production of reactive oxygen species and a subsequent immune cascade.

The scalp microbiome is dysregulated in alopecia areata. "A higher proportion of Corynebacterium actinobacteria and firmicutes are present on the scalp of patients with alopecia areata," said Prof. Shapiro. This suggests that postbiotics (bioactive peptides, metabolites, and vitamins) can be a potential treatment option, but efficacy needs to be determined in clinical trials.

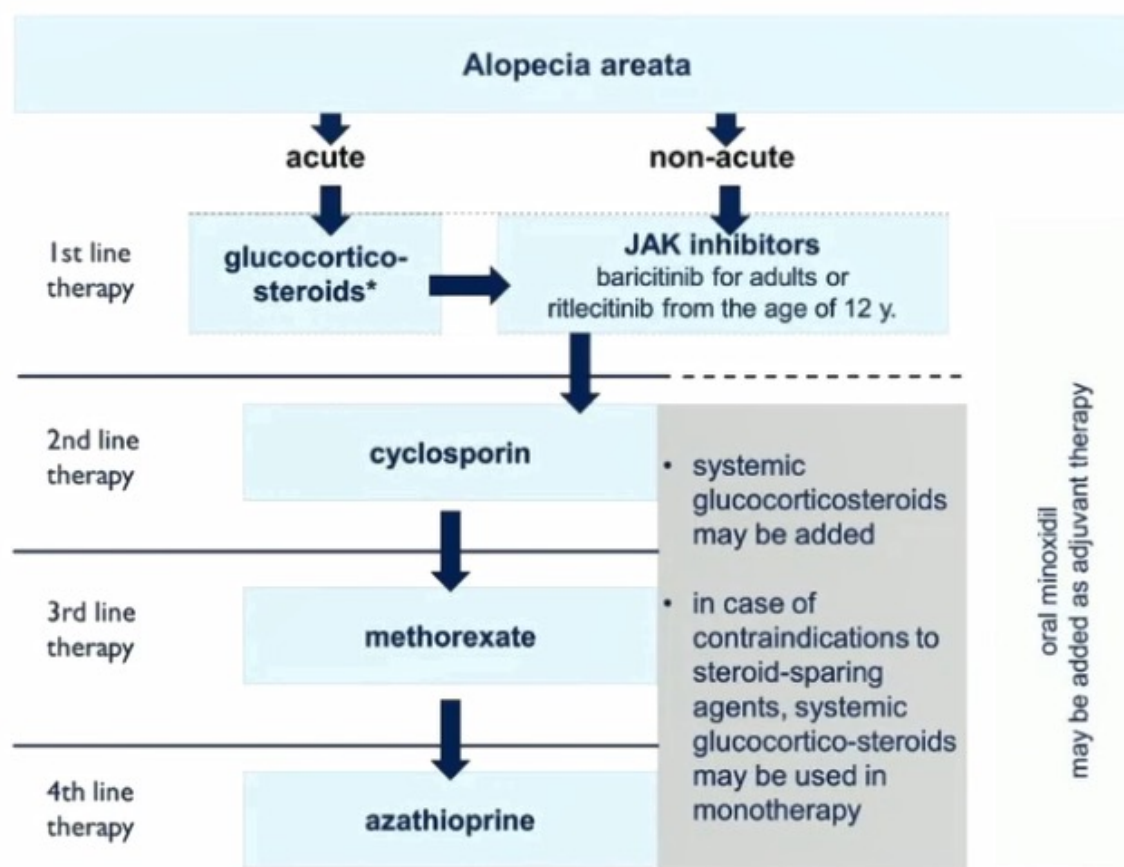
First-line therapy: corticosteroids or JAK inhibitors

A treatment algorithm for alopecia areata was recently published as a consensus statement of European experts (see Figure) [2]. "The main factor which contributes to our treatment decision is disease severity," said Prof. Lidia Rudnicka (Medical University of Warsaw, Poland), and this is "because we have data mainly for disease severity." The main disease measure is the Severity of Alopecia Tool (SALT) score, which measures the percentage of hair loss.

When should systemic therapy be initiated? "We all have a different point of view, but according to the European Expert Consensus we should consider starting therapy when patients have a SALT score of 20 or more, which is disturbing enough to make their lives difficult [1]," said Prof. Rudnicka. The first choice of therapy should be glucocorticosteroids for acute alopecia areata and JAK inhibitors for non-acute disease (see Figure). JAK inhibitors are the treatment of choice since they are the only approved treatment options in the European Union and many parts of the world. In terms of overall efficacy, baricitinib and ritlecitinib lead to SALT scores below 20 in up to 40% of patients by week 36 of therapy, however with a slow onset of response [2,3]. An important item to consider is that among patients who achieve a response, continuation of treatment up to 2 years with baricitinib or ritlecitinib will lead to a maintenance of response and no relapse in 90–93% of cases [4,5]. "This is unlike glucocorticosteroids, maybe even unlike cyclosporin," stated Prof. Rudnicka.

As far as other therapies go, the JAK inhibitor tofacitinib has shown efficacy in case series and is a potential treatment option [6], but it is not approved yet so can only be used off-label. The combination of JAK inhibitors with oral corticosteroids is another treatment choice in certain patients, but "this combination is both off-label and not well documented," said Prof. Rudnicka. "There is a mild suggestion for this combination in the Expert Consensus, but this is not a recommendation [1]." Finally, cyclosporin and methotrexate, both with and without systemic corticosteroids, are also treatment possibilities [6,7]. However, care should be taken with cyclosporin, methotrexate, and azathioprine, in case comorbidities are present which serve as a contraindication to treatment.

Figure 1: Treatment algorithm for alopecia areata.



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Treating paediatric alopecia areata

In paediatric alopecia areata, “patients will have a good prognosis if 1) the disease is patchy, 2) there is no nail involvement, 3) it starts late, 4) the duration is less than 1 year, 5) there are no relatives with the disease, 6) there is no association with atopy, 7) and it is not associated with autoimmune disorders,” said Prof. Ramon Grimalt (International University of Catalonia, Spain). Based on these prognostic factors, “physicians have to decide if they will treat it or not; if there’s a good prognosis, you don’t need to be aggressive with treatments,” he added.

Prof. Grimalt mentioned several available treatment options. “What works really well are immunosuppressants, though in children we have to think of the cost-benefit before starting.” Another option is topical immunosensitisation with diphencyprone, which has been described in 108

children in a retrospective study [8]. In total, 13% of participating children had complete hair regrowth after 6 months of treatment with a further 25% partial hair regrowth. Regarding safety, 21% of children developed marked sensitisation reactions and 54% reported any treatment-emergent adverse event [8]. Psoralen and ultraviolet A phototherapy are also options, but, in Prof. Grimalt’s opinion, they are limited by unilateral responses as well as the fact that hair growth impedes further therapy. Other treatment options can include methotrexate with/without systemic corticosteroids, which has shown hair regrowth over 50% of the scalp in 67.7% of participants in a study including children older than 15 years [9]. Intralesional triamcinolone acetonide has shown preliminary efficacy in a pilot study [10]. Topical JAK inhibitors can also be considered, but results have been mixed. In a case series of 6 paediatric participants, tofacitinib 2% or ruxolitinib 1% led to treatment response in 4 out of 6 participants [11], while in a study of 10 adult participants, tofacitinib 2% led

to significant scalp hair regrowth in only 1 participant and partial regrowth in 2 participants [12]. Finally, hydroxychloroquine has shown efficacy in improving alopecia scores in 5 out of 9 paediatric patients described in a retrospective study, where gastrointestinal intolerance and headache were the most common adverse events [13].

Late-onset alopecia

Late-onset alopecia areata develops after the age of 50 and is characterised by multifocal disease (<25% of scalp involvement) in most patients, with only 10% of patients suffering from diffuse alopecia areata and 7% with alopecia universalis [14].

How can late-onset alopecia areata be described on trichoscopy? "The main features of alopecia areata include exclamation mark hair, which is a sign of activity of alopecia areata, then black dots, tapered hair, Pohl-Pinkus constrictions, regrowing hairs, yellow dots, and vellus hairs," described Prof. Monika Arenbergerova (Charles University, Czech Republic). However, late-onset disease tends to be slightly different. "There are no clear signs of active disease in trichoscopy, so what we usually miss are exclamation mark hairs, black dots, and yellow dots," said Prof. Arenbergerova.

Late-onset alopecia areata is also associated with a set of comorbidities. Older patients typically present with hypertension, diabetes, and thyroid disease, and this is in contrast to early-onset alopecia areata who typically develop atopy [15]. These comorbidities, especially hypertension and diabetes, are important when choosing a treatment strategy, together with the generally good prognosis of late-onset alopecia areata. "Usually I start with topical corticosteroids or intralesional

corticosteroids," stated Prof. Arenbergerova.

Baricitinib and ritlecitinib have both shown efficacy in older adults with alopecia areata [2,3]. The BRAVE-AA1 (n=654) and BRAVE-AA2 (n=546) trials enrolled participants with severe alopecia areata, including men aged <60 years and women aged <70 years, and showed improved efficacy of baricitinib 2 mg versus placebo following 52 weeks of treatment [2]. "But what is important here is that baricitinib 2 mg can be used for patients with a higher risk of thromboembolism, major adverse cardiovascular events, or neoplasia, and for those who are older than 65 years," said Prof. Arenbergerova. The ALLEGRO phase 2b/3 trial assessed various doses of ritlecitinib versus placebo in 718 adolescents (<12 years) and adults (including older adults) with severe alopecia areata, showing improvement in alopecia scores with ritlecitinib [3].

Take-home messages

The pathophysiology of alopecia areata is driven by dysregulation of the JAK-STAT pathway. JAK inhibitors such as baricitinib and ritlecitinib have shown positive results in clinical trials and are the only currently approved therapies for alopecia areata. Other recommended first-line treatment options are glucocorticosteroids, which are used either topically or as intralesional injections, while cyclosporin and methotrexate are to be used in subsequent lines of therapy. Ritlecitinib is the only approved treatment in paediatric alopecia areata, and only in adolescents (≥12 years old), while late-onset alopecia areata is an atypical subtype characterised by less severe disease, but where the presence of comorbidities is important when choosing therapy.

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NOVEL SHAMPOO RESTORES MICROBIOME RATIO OF A HEALTHY SCALP IN PATIENTS WITH SEBORRHEIC DERMATITIS

A study in patients with seborrheic dermatitis showed that a shampoo with the key ingredient selenium disulfide reduced not only Malassezia numbers, but also other pathogenic microbiotas like Staphylococcus sp. Efficacy is comparable across all hair types.

Seborrheic dermatitis is a chronic, inflammatory skin disorder, characterised by erythematous, scaly, and pruritic lesions [1]. Regions that are predominantly affected are rich in sebaceous glands such as the scalp, face, chest, and back. The disease involves a combination of genetic, environmental, and microbial factors. Scalp seborrheic dermatitis has a particularly negative impact on quality of life. "Patients always complain of itching and there can be redness and inflammation of the skull," explained Prof. Bianca Maria Piraccini (Department of Medical and Surgical Sciences, University of Bologna, Italy). As it is a chronic, recurrent condition, patients will never get rid of the disease. "It might improve, but tends to recur, especially during the summer season," Prof. Piraccini noted.

The pathogenesis of scalp seborrheic dermatitis is multifactorial and still poorly understood. However, there are environmental triggers such as low temperature and humidity. It is a common dermatological condition that affects people of all age groups and ethnic backgrounds, approximately 1 up to 5% of the general population [2]. Especially young patients or young male adults are affected. Other predisposing factors are individuals with neurological disorders and immunodeficiency, in-

cluding HIV/AIDS [3,4]. Moreover, nutritional deficits and psychological distress can contribute to the disease [4]. Seborrheic dermatitis and dandruff are a continuous spectrum of the same disease. Dandruff is a mild form of seborrheic dermatitis without visible inflammation with a prevalence of up to 50% in the general population [5].

At the cell level, seborrheic dermatitis is characterised by dysbiosis associated with a reduced T-cell response, increased presence of unsaturated fatty acids on the skin surface, antimicrobial peptides, disruption of cutaneous neurotransmitters, abnormal shedding of keratinocytes, epidermal barrier disturbances associated with genetic factors, and disruption of the cutaneous microbiota [6].

As Prof. Piraccini explained, *Malassezia* yeast species certainly play a role in the pathogenesis of the disease. *Malassezia* is able to metabolize and oxidize sebum derived lipids such as triglycerides, squalene, and fatty acids into inflammatory compounds [7]. However, alteration of the cutaneous microbiome seems to be of similar importance [1]. "The role of *Malassezia* is not debatable, but we don't think about *Malassezia* alone in the pathogenesis of seborrheic dermatitis. We also think about an altered microbiome of the scalp," Prof. Piraccini said.

Emerging role of the skin microbiome

The skin microbiome plays a key role in protection against skin pathogens and immune response modulation. Therefore, the scalp microbiome interacts with host keratinocytes and the innate immune system leading to a stimulated secretion of antimicrobial peptides, free fatty acids, cytokine and chemokines, which is beneficial for the host [8]. As Prof. Piraccini pointed out, microbiota on the scalp is especially found at the infundibulum of the hair follicle.

At present, scalp seborrheic dermatitis is primarily treated by using a topical antifungal shampoo. "Especially women are not likely to apply creams or solution on the scalp and so there is low compliance to treatment and patients feel not satisfied by them," Prof. Piraccini said. Especially young women are distressed. Therefore, shampoo is the preferable vehicle for treatment. But is treating with anti-fungal agents like ketoconazole enough?

Antifungal agents like ketoconazole have shown to be able to reduce *Malassezia* numbers, but this treatment has a couple of limitations [9]: Beside reduction of *Malassezia*, they cannot address other microbiome alterations seen in seborrheic dermatitis and dandruff like a reduction in the *Cutibacterium/Staphylococcus* ratio or a reduction of *Propionibacterium acnes* [10]. Moreover, when treatment is stopped, there is an increased level of skin flaking, so recurrence is common [11]. Looking beyond the conventional *Malassezia*-centric view of seborrheic dermatitis pathogenesis is therefore expected to enable the development of better therapeutic interventions for the management of recurrent disease [1].

Influence of SeS2 shampoo on the microbiome in all hair types

The objective of the Dercos DS shampoo (active ingredients 1% selenium disulfide (SeS2) and 1% salicylic acid) inclusivity study was to shed light on this issue and evaluate the efficacy of the shampoo in microbiome rebalance and assess microbiome diversity. In this study, 92 participants with different hair- and scalp types were included [12]. To investigate the mode of action of this shampoo, dandruff severity, subjective efficacy perception, microbial balance, microbiota diversity, and sebum lipids were assessed. At baseline, subjects of all hair types were randomly assigned for 4 weeks to either the SeS2 or the vehicle shampoo. Both

should be applied 3 times per week for the whole treatment period of 28 days.

In this study, not only the fungi in the scalp, but also bacteria were assessed by Q-PCR quantification analysis, namely the load of 2 bacteria species, *Cutibacterium* genera and *Staphylococcus* genera. In addition, evolution of the load of *Malassezia* genera was assessed. Moreover, information about the diversity of the different genus was documented.

Interestingly, at day 0, there was no significant difference between hair and scalp type in terms of Q-PCR for *Malassezia*, *Cutibacterium* and *Staphylococcus* species. At day 28, use of the SeS2 shampoo led to a significant reduction of scaling ($P \leq 0.01$) and to a significant reduction of *Malassezia* and *Staphylococcus* spp. counts in both lesional and non-lesional zones (see Figure).

“Our shampoo restores the microbiome of a healthy scalp for all hair and scalp types,” Dr Natalia Kovytkina (Vichy Laboratoires, Paris, France) summarized these study results.

In conclusion, SeS2 shampoo is a cosmetic reliable and well-tolerated alternative care to ketoconazole shampoo in the management of patients of all hair types with moderate to severe scalp seborrheic dermatitis. This shampoo rebalances scalp microbiome equilibrium and sebum composition and leads to a significant reduction of scaling [12].

Figure 1: Within a month a shampoo containing selenium disulfide significantly lowers *Malassezia* *Staphylococcus* sp., thereby restoring the microbiome ratio of a healthy scalp

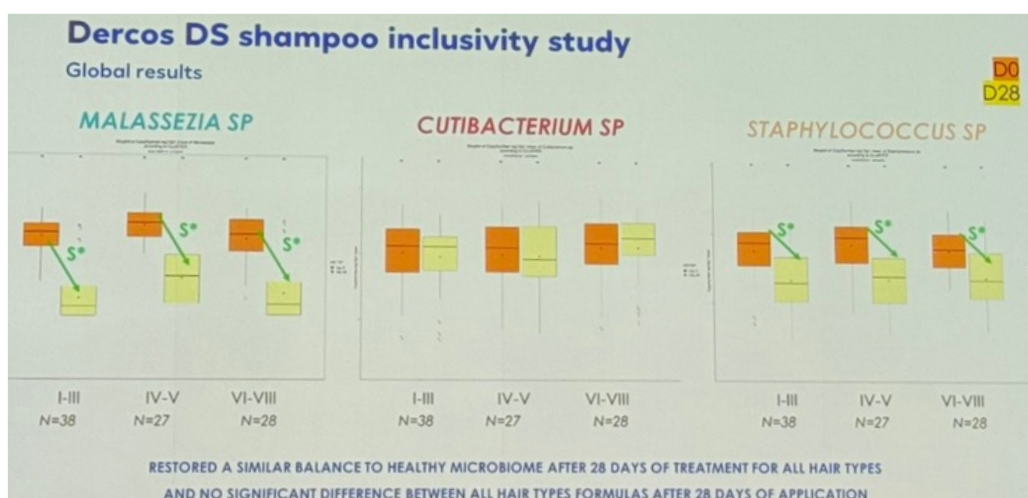


Figure 2: Within a month a shampoo containing selenium disulfide restores the microbiome ratio of a healthy scalp for all hair types.



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L'Oréal Dermatological Beauty Satellite Symposium
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