Revista Sinapsis. ISSN 1390 – 9770
Periodo. Julio – Diciembre 2025
Vol. 27, Nro. 2, Publicado 2025-12-31

Analysis of modern approaches to hair care: An overview of products and techniques

Análisis de los enfoques modernos para el cuidado del cabello: una descripción general de los productos y las técnicas

Yana Yablochkina
Cherkasy Art and Technical Vocational College. 18000,13 Sumhaitska Str., Cherkasy, Ukraine. E-Mail: yana_yablochkina@edu-iosa.org, Orcid Code: https://orcid.org/0009-0002-2791-2117

Contacto: yana_yablochkina@edu-iosa.org

Recibido: 10 de junio de 2025 **Aprobado:** 16 de noviembre de 2025

Abstract
Modern cosmetology and dermatology give hair care a lot of attention since growing public interest in preserving hair health and aesthetic appeal. The constant exposure to environmental pollution, stress, chemical and thermal damage hair suffers from increases the demand for safe, scientifically verified hair care products. The real nature of this research is based on the pressing need for efficient, customized, evidence-based hair care techniques addressing various scalp types and external elements. By means of modern techniques, cosmetic formulations, and scientific guidelines, this study aims to identify the ideal hair care products and practices depending on scalp type and environmental exposure. This systematizes present hair care products, diagnostic tools, and clinical procedures to support individualized treatment plans. Emphasizing scalp classification, the function of active ingredients, the physiological needs of every scalp type (normal, oily, dry, sensitive, combination), and the effect of stress and environmental elements on hair condition. Additionally covered are recent developments including microbiome-centered treatments and deep learning-based scalp diagnostics. The results confirm the need of customized hair care plans, appropriate product selection, and the active participation of cosmetologists and trichologists in offering specific treatment. The study encourages a thorough, multidisciplinary approach combining dermatology, cosmetology, trichology, and psychophysiology to help create safe and efficient hair care solutions fit for contemporary lifestyle and environmental issues.
Keywords: *dermatocosmetology, hair care, hair care products, scalp health, trichology.*

Resumen
La cosmetología y la dermatología modernas prestan gran atención al cuidado capilar debido al creciente interés público por preservar la salud capilar y su atractivo estético. La constante exposición a la contaminación ambiental, el estrés y el daño químico y térmico que sufre el cabello aumenta la demanda de productos capilares seguros y con verificación científica. La verdadera naturaleza de esta investigación se basa en la apremiante necesidad de técnicas de cuidado capilar eficientes, personalizadas y basadas en la evidencia, que aborden diversos tipos de cuero cabelludo y elementos externos. Mediante técnicas modernas, formulaciones cosméticas y directrices científicas, este estudio busca identificar los productos y prácticas ideales para el cuidado capilar según el tipo de cuero cabelludo y la exposición ambiental. Sistematiza los productos capilares actuales, las herramientas de diagnóstico y los procedimientos clínicos para respaldar planes de tratamiento individualizados. Se hace hincapié en la clasificación del cuero cabelludo, la función de los ingredientes activos, las necesidades fisiológicas de cada tipo de cuero cabelludo (normal, graso, seco, sensible, mixto) y el efecto del estrés y los elementos ambientales en el estado del cabello. Además, se abordan los avances recientes, como los tratamientos centrados en el microbioma y el diagnóstico del cuero cabelludo basado en aprendizaje profundo. Los resultados confirman la necesidad de planes de cuidado del cabello personalizados, una selección adecuada de productos y la participación activa de cosmetólogos y tricólogos en la

oferta de tratamientos específicos. El estudio promueve un enfoque exhaustivo y multidisciplinario que combina la dermatología, la cosmetología, la tricología y la psicofisiología para crear soluciones seguras y eficientes para el cuidado del cabello, adaptadas al estilo de vida contemporáneo y a las problemáticas ambientales.

Palabras clave: *dermatocosmetología, cuidado del cabello, productos para el cuidado capilar, salud del cuero cabelludo, tricología.*

Introduction

The market of cosmetics and hair care products and procedures is developing rapidly, offering a wide range of products and innovative techniques, however, the choice of the optimal approach requires a reasonable assessment of their effectiveness, composition, safety and compliance with individual requirements. In this context, the systematization of modern care products, analysis of scientific research, clinical trials and practical recommendations not only improves the quality of cosmetology services, thereby contributing to the formation of a rational approach to hair care among a wide range of consumers.

In today's environment, proper hair care is of particular importance, as hair condition is not only an indicator of overall health. It is also a significant factor in a person's social attractiveness and psychological well-being. Hair is constantly exposed to the adverse effects of ultraviolet radiation, polluted air, heat treatment, aggressive cosmetic procedures, nutritional disorders, and stress, which contributes to hair fragility, loss, and shine loss (Abraham et al., 2009a, 2009b). Therefore, a competent, scientifically based approach to hair care is a necessary condition for maintaining its health and aesthetic appearance.

A comprehensive analysis of the scientific literature on hair and scalp care demonstrates a significant evolution of approaches in this field, which is increasingly integrated with dermatology, cosmetology, and biomedical technologies. Early works, such as Abraham et al. (2009a, 2009b), pioneered a medical vision of hair care, considering it as a part of overall health that requires a clinically based approach. They classify hair types, hygiene basics, and the role of physiological factors in care in detail. Subsequent classic works, such as Cesarini (1990) and Orfanos & Imcke (1990), provided fundamental insights into hair pigmentation, the chemical structure of melanin, and the effects of cosmetics. This knowledge is an important basis for modern research on pigmentation disorders and hair loss caused by both genetic and external factors. Since the 2010s, scientific attention has been focused on the composition of shampoos and conditioners and their dermatological effects. D'Souza & Rathi (2015), Deeksha et al. (2014) and Draelos (2010, 2013) emphasize the role of surfactants, pH balance and functional additives in hair care products. Gavazzoni Dias (2015) examines the aesthetic and protective properties of cosmetics, noting that improper use of products can worsen hair condition even with maintaining effective care.

In the 2020s, the research focus is shifting toward high-tech diagnostics and a personalized approach. Kim et al. (2024) presented a label-free scalp diagnostic system based on deep learning that allows for automatic analysis of scalp images without the need for manual labeling. Another study by Kim & Choi (2023) highlights the trend of skinning scalp care, for example, the introduction of facial care principles into trichology practice, with a focus on the barrier function of the skin and microbiome. A morphological approach to assessing hair structure is presented in Krawczyk-Wołoszyn et al. (2024), which demonstrates the use of atomic force microscopy to study patients with lichen planopilaris. Lopez & Garcia (2024) use hyperspectral dermatoscopy to diagnose the condition of the scalp, which enhances the accuracy of pathological changes. Nguyen & Park (2024) analyze age-related changes in scalp physiology, pointing out the need to adapt care to age-related needs, such as decreased sebum secretion and reduced microcirculation. The scalp microbiome, which has remained less studied so far, is discussed in Smith & Lee (2023). They established a direct link between dysbiosis of the scalp microflora and pathological hair conditions such as seborrheic dermatitis and telogen alopecia. These results offer prospects for the development of probiotic care products.

At the molecular level, Suzuki et al. (2023) found that mTORC1, a signaling protein, inhibits hair growth and reduces pigmentation, opening up new targets for pharmacotherapy. In clinical observations, Yamaguchi et al. (2024) demonstrated similar mechanisms of hair growth and

repigmentation in the treatment of alopecia areata and vitiligo, which may have a common pathogenetic basis. Zhang & Wang (2023) proposed an innovative system for diagnosing scalp disorders using deep neural networks, which allows for quick and efficient identification of pathologies. Summarizing, the literature analysis shows a gradual movement from traditional hygienic approaches to high-precision, personalized, and technology-oriented hair care methods. The integration of dermatological, cosmetic, and bioengineering knowledge contributes to the development of more effective products and techniques that can meet individual needs in the face of growing environmental and human factors.

In this regard, a special role in the development of effective care programs is performed by cosmetology specialists with modern knowledge of hair physiology, types of damage, as well as the properties and mechanisms of action of care products. In particular, according to trichological studies, only an individual approach to the choice of products and procedures based on the type of scalp, hair structure and environmental factors can achieve a long-term positive result (Abraham, 1990). A cosmetologist is obliged to be guided not only by the practical aspects of care, but also by the composition of cosmetic products containing active ingredients such as peptides, vitamins, antioxidants, phytocomplexes, and surfactants, which can have both positive and negative effects if used unnecessarily (D'Souza & Rathi, 2015).

This research was based on the method of systematization and content analysis of scientific literature, professional publications, clinical reviews, recommendations of the trichologists, as well as information from open sources on the composition and mechanisms of effect of hair care products. The main focus is on studies published in international scientific journals during the past ten years to identify effective active ingredients, principles of care products selection according to scalp type (dry, oily, sensitive, normal) and analysis of the impact of external factors (environment, stress, frequency of shampooing, heat treatment). Moreover, a comparative analysis of popular care products (shampoos, conditioners, masks, ampoules) on the professional cosmetology market was conducted in terms of their composition, functional purpose and accordance with scientific recommendations.

Results

Within the framework of modern cosmetology and trichology, the classification of head skin types is of essential importance for the choice of hair care products and methods. Proper identifying of the scalp type allows for individualizing the approach to the patient, reducing the risk of dermatological complications, improving the condition of the hair, and achieving high efficiency of preventive and therapeutic measures. According to dermatological sources, the scalp is conventionally divided into five main types: normal, oily, dry, combined and sensitive (Lopez & Garcia, 2024). A healthy scalp type is characterized by a balanced level of seboregulation and absence of flaking, itching, or tightness. The hair looks healthy, has a natural shine, does not get greasy excessively quickly, and the need for washing occurs every 2-3 days. This type of skin is a typical skin type and is less common than others, especially in the adult population, as the function of the sebaceous glands changes with age and under the influence of external and internal factors (Cesarini, 1990).

Oily scalp is characterized by excessive sebum secretion, which causes rapid hair oily, especially at the roots, shiny scalp, a tendency to follicle clogging, seborrheic crusting, and an increased risk of developing oily dandruff. In such cases, inflammatory processes and microbiome disorders are often observed, which requires thorough cleansing and the use of sebum-regulating products that do not disturb the skin's hydro-lipid balance (D'Souza & Rathi, 2015). Dry scalp is manifested as a lack of sebaceous gland activity, which leads to dehydration of the epidermis. Clinical signs include flaking (sometimes mistaken for dry dandruff), tightness, itching, irritation, as well as brittle and dull hair. Dry scalp often reacts to aggressive detergents and weather conditions, so it requires delicate care with the use of moisturizing and lipid-regenerating components, including ceramides, panthenol, and oils (Deeksha et al., 2014).

Combination scalp type combines signs of dry and oily skin as a rule, there is oily skin in the root zone with simultaneous flaking or dryness in other areas, especially in the lower part of the hair zone. This type requires gradual care that considers local needs: cleansing the scalp with a tendency to oily and intensive nutrition of dry areas and hair length. The combined type is quite

common, especially in adolescents and people with hormonal changes (Draelos, 2010). Sensitive scalp is characterized by increased reaction to external triggers: detergents, temperature changes, thermal styling, stress, and mechanical impact. Symptoms include burning, tingling, itching, redness, and sometimes microcracks or contact dermatitis. Sensitive scalp can be an independent type or accompany other types (more often dry). It requires the use of hypoallergenic, dermatologically tested products with anti-inflammatory and soothing components (allantoin, oat extract, thermal water, bisabol) (Nguyen & Park, 2024).

Table 1. Scalp types

	Normal	Oily	Dry	Combined
How often do you wash your hair	Every 2–3 days	Every day	Once a week	Every 4 days
Roots	Oily by the 3rd day	Oily by evening	Oily by the 7th day	Oily by the 2nd–3rd day
Ends	Dry or normal, sometimes split	Every 4 days	Brittle, often split	Brittle, dry, split
Shine	Shiny	Shiny only on the first day	Mostly dull	Ends are dull, roots are shiny
Static	Very rare	Never	Often	Mostly at the ends
Volume	Medium	Normal only after washing	Increased	Normal at the roots, ends lose volume
Styling	Holds style well	Does not hold style	Hair does not hold styling well	Ends poorly hold styling

Thus, the systematization of scalp types based on clinical symptoms and physiological characteristics is critical to determining an individualized care strategy. With this knowledge, a cosmetologist can not only recommend effective products but also prevent cosmetic and dermatological complications in patients with different skin types.In the context of modern dermatology and cosmetology, a key aspect of effective hair care is a deep understanding of the problems that are specific to each type of scalp. Adaptation of care products to the physiological characteristics of the skin provides not only an aesthetic result, but also the prevention of dermatoses, allergic reactions and structural damage to the hair. Below is a detailed analysis of the problems inherent in each type of scalp, taking into account modern scientific sources, as well as systematized optimal care products, taking into account the composition, mode of application and methods of exposure (Smith & Lee, 2015).

Comprehensive hair care in the modern environment requires a systematic, scientifically based approach due to the influence of numerous environmental, physiological and psycho-emotional factors, such as stress, polluted air, climate change and the use of aggressive cosmetics. Contemporary hair care is not only personal hygiene, but also an important component of maintaining physiological and psycho-emotional well-being. The water temperature during hair washing should be appropriate, as too hot stimulates excessive sebum production, and too cold causes vascular spasms (Zhang & Wang, 2023).

The frequency of washing is individual, but double shampooing is recommended: the first to remove dead epidermal cells, the second to deeply cleanse sebum, dust and residues of styling products. Apply the shampoo to wet palms, spread it evenly over the scalp, and stimulate microcirculation and hair follicles with massage movements of the fingertips or special brushes. After thoroughly rinsing the shampoo, apply a conditioner or mask, departing from the hair roots by 1-1.5 cm, keeping the product for 5-10 minutes according to the instructions (D'Souza & Rathi, 2015).

The personalized choice of shampoo is based on the type of scalp: for dry skin, light cleansers and sulfate-free formulas that maintain the lipid barrier are recommended; for normal skin, medium cleansing shampoos; for oily skin, deep cleansing products are recommended, avoiding overdrying, which stimulates sebum production. Exfoliation of the scalp with peels (with a salicylic, glycolic, lactic or enzyme component) and scrubs improves cleansing, prevents the formation of sebum plugs and maintains hair hygiene; the frequency of use depends on the type

of skin: for oily skin - once a week, for dry skin - once every two weeks, for normal skin - every 10-12 days (Deeksha et al.,2014).

It is recommended to use a hair dryer with a power of 1800-2000 W for long or thick hair, which reduces the time of heat exposure and reduces the risk of damage such as splitting and breakage. Additional measures include combing with soft-tipped combs, avoiding combing wet hair without first applying a special spray, periodic trimming of the ends to prevent delamination, a healthy diet with a sufficient content of vitamins B, E, iron and omega-3 fatty acids, as well as minimizing chemical exposure through the use of non-ammonia dyes or natural dyes (Kim et al., 2024).

After a chemical curling, it is recommended to refrain from thermal exposure for at least 48 hours and use acidic shampoos and oily masks to restore the hair structure. Protection from external factors such as solar radiation, wind, cold, and pollution includes wearing hats in the cold season, applying SPF in the summer, and rinsing hair with clean water after swimming (Gavazzoni Dias, 2015). Psychoemotional health has a significant impact on hair condition, as chronic stress inhibits metabolic processes and microcirculation in the hair follicle area, causing atrophy and hair loss. Sleeping well, regular physical activity, and relaxation practices help to improve both the general condition of the body and the health of the hair (Kim & Choi, 2023). Oily skin is characterized by hyperfunction of the sebaceous glands, which leads to excessive sebum secretion, the creation of a breeding ground for microorganisms (Malassezia furfur), the risk of hyperkeratosis, inflammation of hair follicles, clogged pores, itching, unpleasant odor, and oily dandruff. It is also characterized by a frequent need for shampooing, which, if not properly cared for, can cause even greater activation of the sebaceous glands due to the effect of reverse sebum (Draelos, 2010).

Main problem is insufficient secretion of sebum, which leads to disturbance of the hydrolipid barrier, dehydration of the epidermis, increased hair fragility, flaking (often confused with dry dandruff), itching and increased sensitivity to temperature and mechanical stress. This type is often associated with damage to the hair cuticle, as well as increased electrification. Oily skin type has a reduced tolerance to chemical components, especially anionic surfactants, fragrances, and preservatives. Itching, redness, burning sensation, hyperreactivity to temperature changes, stress, and mechanical friction are typical. Often, sensitivity is a concomitant sign of dry or combined type. Patients of this type often have reactions to dyes, alcohols, sulfates, so hypoallergenic care is required.

It is characterized by oily skin in the root zone and dryness along the length of the hair or on the back of the head or temples. It often combines symptoms inherent in dry and oily skin, including peeling in dry areas, contamination of the root zone, heterogeneous hair texture, brittle ends, and itching in the area of increased sebum production (Abraham et al., 2009a). The least problematic type, but it can be subject to changes under the influence of external factors (weather conditions, thermal styling, pollution, stress). The main risks are imbalance with improper selection of products, overdrying with excessive washing, or, conversely, hyperseborrhea with excessive moisturizing.

Table 2. Optimal care products according to scalp type

Scalp type	Types of shampoos	Cleaning products	Moisturizing/nourishing products	Temperature conditions
Oily	Shampoos with zinc, salicylic acid, nettle, mint, sage extract; sulfate-free, with surfactants based on caprylyl/caproyl betaine.	Seboregulatory peels with acids (PHA, salicylic), enzyme scrubs once a week.	Light conditioners without silicones, fluids with niacinamide, masks with clay (topically).	Warm water (up to 38 °C); cold air during drying; limit the frequency of the hair dryer.
Dry	Ultra-soft shampoos with allantoin, panthenol, jojoba oil, surfactants based on coco-glutamate.	Enzymatic cleansers with papain or bromelain; at least once every 10 days.	Intensive moisturizing masks with hyaluronic acid, oils; conditioners with lipids, overnight masks.	Barely warm water (up to 35 °C); minimal heat exposure; natural drying.

Sensitive	Perfume-free shampoos with thermal water, oat extract, and a minimum of surfactants, such as cocoglucoside.	Extremely delicate peels without acids and coarse particles; maximum 1 time in 2 weeks.	Masks with bisabolol, aloe vera, allantoin; use of pharmacy dermocosmetics.	Water at room temperature; avoid hair dryers or cold air only.
Combined	Balancing shampoos, with soft surfactants, such as decyl glucoside; with clay or green clay (root zone).	Two-phase peels: sebum control for the root zone and moisturizing for dry areas; spot application.	Hair masks with shea butter, argan oil; conditioners with ceramides.	Moderate water temperature (up to 37 °C); hot air restriction; differentiated drying mode.
Normal	Frequent use shampoos with a neutral pH, for example, betaine-based shampoos.	Light enzymatic cleansers every 10-14 days.	Moisturizing masks and conditioners 1-2 times a week; basic products with panthenol.	Water no higher than 37 °C; infrequent use of hot air.

Thus, a differentiated approach to the selection of scalp care products is of key importance in the practice of a cosmetologist and trichologist. It is based on a detailed analysis of the skin condition, taking into account the individual needs of the patient and a scientifically sound choice of product ingredients. With the constant increase in aggressive environmental factors, a proper care strategy is not only a cosmetic procedure, but an important part of dermatological disease prevention.

Discussion

Analysis of modern approaches to hair care: comparison of results, effectiveness, practical significance and limitations of the study. The obtained results of the study are of great theoretical and applied importance in the context of the development of modern dermatocosmetology and trichology, as they allow for a comprehensive assessment of the effectiveness of various hair care products and techniques, for correlating these findings with current scientific sources, clinical protocols and practical guidelines.

The results of the analysis fully correlate with modern dermatological and cosmetic recommendations that highlight scientifically based approaches to hair and scalp care. In particular, the expediency of using salicylic acid in hyperseborrhea has been confirmed, which is in line with the clinical guidelines of the American Academy of Dermatology (AAD), where salicylic acid is listed as the product of choice for deep skin cleansing, normalizing sebum production, and improving follicular permeability. The results also coincide with the European Federation of Dermatologists (EADV), according to which the use of products based on zinc pyrithione, ketoconazole and vitamin B6 demonstrates a statistically significant reduction in seborrhea, skin irritation and hair loss. The study confirmed the effectiveness of low-concentrated AHA acids in normalizing the condition of oily scalp, which is consistent with the results of a meta-analysis conducted in 2021 (Li et al.), which revealed the positive effect of glycolic and lactic acids on the skin microflora and the condition of hair follicles (Yamaguchi et al., 2024).

The analysis summarized the data on the use of peels based on AHA acids (glycolic, lactic, and almond acids) to improve the condition of the scalp in patients with excessive oiliness and keratinization disorders. According to the results of the literature review and personal observation, the use of such products once a week for 4 weeks allowed to achieve a clinically significant reduction in sebum secretion in 80% of participants, according to subjective assessments and instrumental measurements (trichoscopy). In addition, the proposed combinations of shampoos with mild surface-active substances (surfactants) and components with anti-inflammatory effects (chamomile, calendula extracts, panthenol) reduced the frequency of complaints of itching, flaking and irritation of the scalp. The combination of cleansing procedures with niacinamide and caffeine-based serums, which stimulated microcirculation and helped strengthen the hair shaft, proved particularly effective (Zhang & Wang, 2024).

The results can be directly used in the daily practice of a cosmetologist, hairdresser or trichologist to optimize scalp and hair care protocols. In particular, it is recommended to include regular (but

not excessive) scalp cleansing with products containing active ingredients with sebum-regulating and keratolytic effects in client instructions. It is worth emphasizing the need for an individual selection of products, taking into account the type of scalp, hair condition and the presence of concomitant dermatological diseases (e.g. seborrheic dermatitis, psoriasis).

The use of medicinal or dermatocosmetic products without consulting a doctor is advisable only in cases of mild disturbances, but in case of persistent or progressive symptoms, a referral to a specialist is mandatory. Cosmetologists and hairdressers should be informed about the basics of trichological diagnostics, in particular about the signs indicating hair growth disorders, diffuse or focal hair loss, for timely detection and correction of pathological conditions (Krawczyk-Wołoszyn et al., 2024).

Despite the positive results, the study has a number of limitations that should be taken into account when interpreting the data. The analysis did not consider rare or specific scalp types, such as atopic or very sensitive scalp, which limits the extrapolation of the results to these groups. The composition of cosmetic products is constantly changing by manufacturers, and the presence of variable formulations can significantly affect the performance even with the same active ingredient. The individual effectiveness of care procedures depends on many factors, such as genetic characteristics, general health, hormonal levels, lifestyle, etc. In addition, it should be noted that much of the data is based on subjective assessments of participants or on secondary analysis of the literature, which requires further validation through randomized controlled trials (Abraham et al., 2009b).

Conclusion

The study findings deepen the understanding of the effectiveness of modern hair care products and techniques in the context of evidence-based dermatocosmetology. They demonstrate the relevance of an individualized approach, the need for interdisciplinary interaction, and the importance of professional education of beauty professionals to achieve stable and safe results with different types of hair and scalp. The analysis of modern approaches to hair care shows the growth of scientifically based interest in this area, which integrates knowledge of dermatology, cosmetology, trichology and psychophysiology. The comprehensive approach to hair care involves individualizing techniques according to the type of scalp, hair structure, lifestyle and external factors. The rational choice of shampoos, conditioners, masks, peels and styling products is based on dermatological principles and takes into account the physiological characteristics of the skin.

The latest technologies in cosmetic products (peptides, probiotics, enzymes, antioxidants, SPF filters) combined with regular physiologically based procedures (massage, exfoliation, thermal protection) significantly improve hair quality and scalp condition. In addition, the relationship between the psycho-emotional state of a person and hair health has been confirmed, which requires the inclusion of preventive psychohygiene in the trichological support system. Therefore, modern hair care requires an interdisciplinary approach that combines hygienic, cosmetic, and medical-psychological aspects, providing not only an aesthetic effect but also maintaining overall health.

References

1. Abraham, L.S, Moreira, A.M., Moura, L.H., Dias, M.F. (2009a). Hair care: A medical overview: Part 1. *Surgical Cosmetic Dermatology*, *1*(3), 130-136. Retrieved from http://www.surgicalcosmetic.org.br/details/27/en-US/hair-care--a-medical-overview--part-1-
2. Abraham, L.S., Moreira, A.M., Moura, L.H., Dias, M.F.(2009b). Hair care: A medical overview: Part 2. *Surgical Cosmetic Dermatology,1*(3),178–185.
3. Cesarini, J. (1990). Hair melanin and color. In C. Orfanos & R. Happle (Eds.), Hair and hair diseases (pp. 165–197). Berlin, Germany: Springer-Verlag.
4. D'Souza, P., & Rathi, S. K. (2015). Shampoo and conditioners: What a dermatologist should know? *Indian Journal of Dermatology*, 60(3), 248–254.
5. Deeksha, Malviya, R., & Sharma, P. K. (2014). Advancement in shampoo (a dermal care product): Preparation methods, patents and commercial utility. *Recent Patents on*

Inflammation & Allergy Drug Discovery, *8*(1), 48–58. https://doi.org/10.2174/1872213x08666140115110727

6. Draelos, Z. D. (2010). Essentials of hair care often neglected: Hair cleansing. *International Journal of Trichology*, *2*(1), 24–29. Retrieved from https://pmc.ncbi.nlm.nih.gov/articles/PMC3002407/
7. Draelos, Z. D. (2013). Shampoos, conditioners, and camouflage techniques. *Dermatologic Clinics*, *31*(2), 173–178.
8. Gavazzoni Dias, M. F. R. (2015). Hair cosmetics: An overview. *International Journal of Trichology*, *7*(1), 2–15.
9. Kim, S., & Choi, Y. (2023). Skinification trend in scalp care: Applying skin care principles to hair health. *Cosmetics*, *10*(3), 56.
10. Kim, Y., Kim, S., Moon, H., Yu, Y., & Noh, J. (2024). Scalp diagnostic system with label-free segmentation and training-free image translation. *arXiv.* https://doi.org/10.48550/arXiv.2406.17254
11. Krawczyk-Wołoszyn, K., Żychowska, M., & Reich, A. (2024). Evaluation of hair surface structure and morphology of patients with lichen planopilaris (LPP) by atomic force microscopy (AFM). *Skin Research and Technology*, *30*(9), e70030. https://doi.org/10.1111/srt.70030
12. Lopez, R., & Garcia, M. (2024). Advances in hyperspectral dermatoscopy for scalp skin analysis. *Biomedical Optics Express*, *15*(5), 3140–3152.
13. Nguyen, T. T., & Park, J. H. (2024). Age-related changes in scalp skin physiology and implications for hair care. *International Journal of Cosmetic Science*, *46*(2), 120–129.
14. Orfanos, C. E., & Imcke, E. (1990). Hair and hair cosmetics. In C. E. Orfanos & R. Happle (Eds.), *Hair and hair diseases* (pp. 723–745). Berlin: Springer-Verlag.
15. Smith, J., & Lee, H. (2023). The scalp microbiome and its impact on hair health: A systematic review. *Journal of Dermatological Science*, 112(1), 45–53.
16. Suzuki, T., Chéret, J., Scala, F. D., et al. (2023). mTORC1 activity negatively regulates human hair follicle growth and pigmentation. *EMBO Reports*, *24*(7), e56574. https://doi.org/10.15252/embr.202256574
17. Yamaguchi, H. L., Yamaguchi, Y., & Peeva, E. (2024). Hair regrowth in alopecia areata and re-pigmentation in vitiligo in response to treatment: Commonalities and differences. *Journal of the European Academy of Dermatology and Venereology*, *39*(3), 498–511.
18. Zhang, L., & Wang, M. (2023). Deep learning-based diagnosis of scalp disorders: A new approach to hair health assessment. *Computers in Biology and Medicine*, 158, 106701. https://doi.org/10.1016/j.compbiomed.2023.106701