

Evaluating the Long-term Outcomes of Chemical Hair Treatments on Hair Structure and Scalp Health

Dominic Chase*

Department of Trichology, University of Casinò, Viale dell'Università, 03043 Cassino FR, Italy

Introduction

Chemical hair treatments, including coloring, straightening, perming, and relaxing, have become a prevalent part of cosmetic routines worldwide. While these treatments provide aesthetic benefits, concerns regarding their long-term impact on hair structure and scalp health persist. This article aims to evaluate the effects of such treatments on hair fibers and scalp conditions, focusing on the mechanisms of damage, long-term health implications, and potential preventive measures. By reviewing current scientific literature and clinical findings, we aim to provide a comprehensive understanding of the long-term outcomes of chemical hair treatments, offering insights for both consumers and professionals in the beauty industry. Chemical hair treatments, such as hair dyes, perms, relaxers, and straighteners, have been widely used to alter the appearance of hair. While these treatments provide individuals with the opportunity to express their identity and enhance aesthetic appeal, concerns have been raised regarding the potential detrimental effects on hair structure and scalp health over time. This article explores the scientific underpinnings of chemical hair treatments, assesses their impact on hair fibers and the scalp, and investigates long-term consequences on hair health. Chemical treatments function by altering the hair's natural structure, which is primarily composed of keratin, a protein that provides strength and elasticity. Each chemical treatment has a different mechanism of action: Hair dyes typically work by opening the cuticle layer of the hair to allow colorant molecules to penetrate the cortex, where they interact with the hair's melanin [1-3]. This process can weaken the hair structure, making it more susceptible to damage.

Perming involves the application of a chemical solution to break the disulfide bonds in the hair, allowing the hair to be reshaped. Once the desired shape is achieved, a neutralizer is used to reform the bonds. Overuse of perming treatments can cause hair to become brittle and frayed. Relaxers, often based on sodium hydroxide or ammonium thioglycolate, break the disulfide bonds in curly hair, leading to a straighter appearance. These treatments can significantly weaken the hair, leading to thinning, breakage, and increased susceptibility to environmental damage. Repeated exposure to chemicals can degrade the keratin fibers, causing the hair shaft to become thinner and more fragile. Studies have shown that the cuticle layer, which serves as a protective barrier, may become more porous and less effective at shielding the inner cortex, leading to increased moisture loss and protein depletion.

Description

Over time, chemically treated hair tends to become more brittle, prone to

*Address for Correspondence: Domini Chase, Department of Trichology, University of Casinò, Viale dell'Università, 03043 Cassino FR, Italy; E-mail: chased25678@gmail.com

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split ends, and susceptible to breakage. The weakening of the disulfide bonds and the degradation of natural oils can strip the hair of its elasticity and strength. Some chemical treatments, especially relaxers and perms, permanently alter the natural texture of hair. Hair may lose its natural curl or wave, becoming straight or excessively curly, which can lead to uneven textures and an overall lack of smoothness. The scalp plays a crucial role in maintaining the health of hair follicles and, by extension, the overall quality of hair. Long-term exposure to chemical treatments can lead to various scalp health issues: Many chemical hair treatments, particularly dyes and relaxers, can irritate the scalp. The chemicals used in these treatments, such as ammonia or peroxide, can cause redness, itching, or even burns, especially when applied frequently. Relaxers and permanent straightening treatments are known to cause chemical burns on the scalp, especially when left on for prolonged periods. These burns can lead to scarring, hair loss, and permanent damage to hair follicles, contributing to a decline in overall hair growth. Chemical treatments often disrupt the scalp's natural moisture balance, leading to dryness and an increased risk of dandruff. The disruption of the sebaceous glands, which secrete sebum (the scalp's natural oil), can leave the scalp parched, exacerbating conditions like dandruff and seborrheic dermatitis. The accumulation of chemicals and irritation on the scalp can lead to inflammation of the hair follicles, potentially impairing their ability to produce new hair. Chronic irritation and scarring can result in hair thinning or permanent hair loss.

The cumulative effects of chemical treatments, combined with other factors like genetics, age, and environmental stressors, can cause significant thinning of the hair. Hair follicles may become dormant, resulting in slower hair growth or, in severe cases, permanent hair loss. Persistent scalp irritation from chemical treatments can result in inflammation or folliculitis, a condition where the hair follicles become infected or inflamed. This can compromise the growth of new hair and create an unhealthy environment for hair regeneration.

While the damage from chemical hair treatments is sometimes irreversible, there are strategies to mitigate the long-term impact: Regular use of moisturizing and protein-infused hair masks can help restore lost moisture and protein to the hair shaft, strengthening the fibers and reducing brittleness. Proper scalp care is essential for maintaining healthy hair growth. Using gentle, chemical-free shampoos, massaging the scalp, and using soothing oils like coconut or tea tree oil can help reduce irritation and maintain scalp health. Reducing the frequency of chemical treatments and opting for gentler formulations can minimize the long-term damage to both hair and scalp [4,5]. Additionally, allowing hair to recover between treatments can help restore some of its natural strength. Regular consultation with a professional stylist or dermatologist can help determine the best course of action for hair and scalp health. They can recommend appropriate treatments and ensure that chemicals are applied correctly to minimize potential harm.

Conclusion

Chemical hair treatments can provide individuals with transformative aesthetic results, but they come at a cost to the long-term health of both hair structure and the scalp. The repeated use of hair dyes, perms, relaxers, and straighteners can weaken the hair shaft, causing brittleness, breakage, and loss of natural texture. The scalp may also suffer from irritation, dryness, and damage to hair follicles. However, with appropriate care, the negative effects of chemical treatments can be minimized. Consumers should be informed about the potential risks and adopt preventive measures to maintain healthy

hair and scalp over time. Further research is needed to explore alternative, less damaging treatments that provide the desired cosmetic outcomes without compromising long-term hair and scalp health.

Acknowledgement

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Conflict of Interest

None.

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