

Hair Weathering, Part 2: Clinical Features, Diagnosis, Prevention, and Treatment

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Hair weathering is the deterioration of the hair shaft from root to tip due to cosmetic and environmental factors. In weathered hair, structural damage to the hair fiber causes the cuticle to become raised and porous, exposing the cortex to further damage. A decrease in hair shine, elasticity, and strength is observed, with ultimate hair breakage. The clinical presentations of hair weathering include trichorrhexis nodosa, trichoclasia, trichoschisis, trichoptilosis, bubble hair, trichonodosis, hair matting, and peripilar keratin casts. The main standards for the prevention and treatment of hair weathering include avoidance of unnecessary or damaging hairstyling techniques, regular haircuts, shampooing and conditioning, and regular use of photoprotection. This article provides an overview of the clinical features, diagnosis, prevention, and treatment of the condition.

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Hair weathering consists of hair shaft defects resulting from cosmetic or environmental manipulation including physical or chemical trauma such as hairstyling procedures, UV radiation, wind, humidity, sea salt, chlorinated water, dust, pollution, and friction.¹ It usually is noticed in scalp hair, but body hair also can be affected.² After hair loss and thinning, it is the most common concern related to hair among patients who present to dermatologists.³ Weathering can occur in normal hair, particularly in the distal

part of long hair shafts, but certain conditions predispose hair to weathering after minimal damage.⁴⁻⁶

This article is the second of a 2-part series on hair weathering; we review the clinical features, diagnosis, prevention, and treatment of the condition.

CLINICAL FEATURES

The clinical presentations of hair weathering include trichorrhexis nodosa, trichoclasia, trichoschisis, trichoptilosis, bubble hair, trichonodosis, hair matting, and peripilar keratin casts.

Trichorrhexis Nodosa

Trichorrhexis nodosa can be acquired or congenital. Acquired trichorrhexis nodosa is one of the most common hair shaft defects and is the result of physical or chemical trauma, usually related to excessive hairstyling.^{7,8} Due to weathering, the cuticle is lost and the exposed cortical fibers separate and fray, producing nodular swelling. Characteristic hair nodes are small and white and can be divided into 3 clinical types¹: (1) the proximal type typically is seen in black patients because the oval cross-section fibers

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HAIR WEATHERING

of the hair shaft weather and knot more easily; (2) the distal type is common in other clinical hair types; and (3) the localized type is the rarest form, with broken hair and node formation seen on the beard, scalp, or moustache. Genetic defects such as trichothiodystrophy, monilethrix, and pili torti may show proximal trichorrhexis nodosa without excessive environmental or cosmetic damage.¹ Rushton et al⁹ reported significant reductions in cystine in the pre-nodule, nodule, and postnodule sections of scalp hair exhibiting trichorrhexis nodosa ($P < .001$), which decreased by 17.2%, 19.8%, and 14.3%, respectively. The authors also found an increase in the acidic amino acids compared to values obtained from the proximal shaft of the same hairs.⁹

Trichoclasia

Trichoclasia also presents as transverse fractures of the hair shaft resulting from physical or chemical trauma, but the cuticle remains intact. The condition usually is patchy rather than widespread and can occur in normal hair as well as hair associated with congenital hair shaft abnormalities.^{7,8}

Trichoschisis

Trichoschisis presents as transverse fractures of the hair shaft related to trauma, but a localized absence of cuticular cells is found. Although the condition can occur in normal hair, it more frequently is associated with trichothiodystrophy. The hairs break off near the skin surface, with alopecia of the scalp, eyebrows, or eyelashes.^{7,8}

Trichoptilosis

Trichoptilosis results in longitudinal fractures of the hair shaft, consisting of distal end splitting (2–3 cm in length) commonly referred to as frizzies. Central trichoptilosis, a longitudinal split in the hair shaft without involvement of the tip, also can occur.¹⁰

Bubble Hair

Many styling procedures overheat the hair shaft (above the boiling point of water), which can lead to the formation of cavities filled with steam within the hair shaft. This effect produces bubble hairs, which have a Swiss cheese appearance when viewed on light microscopy. Hair typically breaks 1 to 4 cm from the scalp, particularly on occipital and parietal areas.^{7,8}

Trichonodosis

Trichonodosis is the formation of single or double knots along the hair shaft caused by trauma from combing, brushing, and scratching, whereby the hair subsequently splinters and fractures. It most commonly affects curly and short hair.^{7,8}

Hair Matting

Hair matting occurs when tangled locks of hair stick together (Figure 1). It can either be reversible or



Figure 1. Irreversible hair matting after shampooing shown macroscopically (A). Dermoscopically, note the telogen hair roots due to matting and the inability of the telogen hairs to shed (B)(original magnification $\times 50$). The white nodes of trichorrhexis nodosa also can be seen (C)(original magnification $\times 40$).

irreversible. Reversible matting can resolve with conditioning treatments and gentle combing, but tangled hair from irreversible matting must be cut.⁸

Friction and scratching are the main causes of hair matting, and the condition tends to affect people with long damaged hair, especially in humid environments.⁸ The most dramatic and irreversible matting typically follows the use of a shampoo whose primary surfactant is cationic. Cetrimide (antiseptic) shampoos also have been linked to a number of cases in which matted hair developed within 1 minute of applying the product.^{1,11}

The mechanism of hair matting remains unclear, but felting, viscous fluid webbing, electrostatic attraction between fibers, and the formation of liquid crystals have all been suggested as factors.¹

Peripilar Keratin Casts

These keratinized masses that surround scalp hairs usually are observed in disorders such as psoriasis or seborrheic dermatitis, but they also can be associated with the use of hair sprays and traction hairstyles (Figure 2).¹⁰

PARTICULAR CONDITIONS

In both monilethrix and pili torti, acute fractures and trichorrhexis node formation occur with little or no cuticular erosion or disruption, possibly because the fibers are unable to withstand the force of bending or pulling to the same extent as normal hair.⁴

In patients with trichothiodystrophy, severe cuticular and secondary cortical degeneration is evident along almost the entire length of the hair shaft, with cuticle loss, trichorrhexis nodosa formation, and trichoschisis; however, the severity of these changes appears to vary between patients.⁶



Figure 2. Peripilar keratin casts due to traction hairstyle.

In pili annulati, there is a normal hair tensile strength and the majority of affected hair shafts seem to present minor surface abnormalities at regular intervals (nodes) associated with underlying air spaces (light bands); however, some patients may present with an unusual weathering pattern with marked damage at the nodes (Figure 3).⁵

DIAGNOSIS

The clinician should record a comprehensive history of the patient's hair care practices and product use. The patient's hair and scalp also should be carefully examined. It is important to collect hair shaft samples to be evaluated under magnification; light microscopy traditionally is used for this purpose,⁷ but dermoscopy also can be helpful. The entire length of the hair shaft should be examined because the effect of weathering usually is better observed at the distal end. Although electron microscopy is extremely important as a research tool, it is seldom used in clinical practice for diagnostic purposes.⁷

PREVENTION AND TREATMENT

General measures for hairstyling, shampooing, conditioning, and protecting against UV exposure can improve the cosmetic value and function of the hair shaft and help to prevent further damage.

General Measures for Hairstyling

When hair is damaged, it is important to get a good-quality haircut. The patient should be encouraged to get his/her hair cut shorter than normal; thereafter, regular trimming of the distal tips should be recommended.¹²

Use of chemical or physical hair manipulation should be minimized as much as possible.^{13,14} To minimize frictional damage from combing and brushing, patients

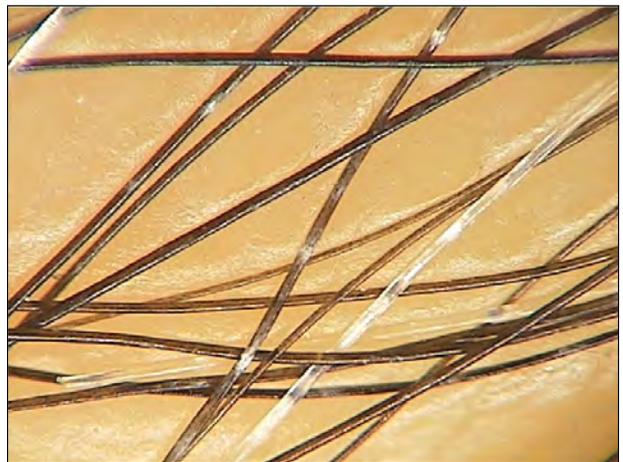


Figure 3. Trichorrhexis nodosa associated with pili annulati shown dermoscopically (original magnification $\times 50$).

should use a wide-toothed, round-tipped comb made of bendable plastic or a soft brush. Wet hair is much more likely to fracture than dry hair; therefore, patients should be advised to detangle wet hair from the distal to proximal ends with fingers and not to comb or brush hair until it is almost dry.^{13,14}

Hair should be allowed to air-dry, avoiding heated drying appliances. When using a blow-dryer, a gradual increase in temperature is recommended to avoid bubble hair. Heated hair rollers and curling irons can be used more safely if allowed to cool before application to the hair.¹⁴

Less damaging hairstyles should replace sculpted styles.¹⁵ The correct use of styling aids such as mousses, sprays, or gels can have a notable impact on the overall appearance of hair; for example, a styling mousse or hair spray can be used to increase the perception of volume.^{3,11}

Pruritic scalp diseases should be treated to avoid damage from scratching.¹⁴

Shampooing

Patients with weathered hair should be advised to shampoo frequently, especially when hair is greasy, which will leave hair fluffy and give the illusion of thicker hair.¹⁶ Cleansing is carried out by surfactants, which can be anionic, cationic, amphoteric, or nonionic. Shampoos generally are safe products, but mild shampoos with amphoteric or nonionic surfactants should be used in damaged hair.¹⁷ Massaging should be kept to a minimum when shampooing, and long hair should be washed straight and never piled on top of the head.¹² After washing, if wet hair is piled up and vigorously massaged dry, matting also becomes more likely. Thus long hair should be dried from tips to roots.¹

Conditioning

Conditioners are available in a number of different forms (eg, rinse out, leave in), and they are designed to improve smoothness, shine, and manageability; decrease static electricity; and increase hair strength.^{3,18} Silicones, such as dimethicone, readily spread over the hair's surface to form a thin, uniform, hydrophobic film that increases luster and gloss. The lubricant nature of the film reduces interfiber friction, resulting in less need for force during combing and therefore less damage.^{11,16}

Cationic surfactants and cationic polymers, such as quaternary ammonium compounds, help to control static electricity caused by negatively charged hair fibers from combing or brushing.^{3,18} High-molecular-weight hydrolyzed proteins diffuse into the hair shaft through defects in the protective cuticular scale and can temporarily fill in fractures and fissures until the next cleansing.¹⁸

Photoprotection

Hats provide the best protection of the scalp against UV exposure, but not all patients consider them to be an acceptable or convenient option. Hair dyes also can protect against photodamage. Cinnamidopropyltrimonium chloride, a quaternized UV absorber, may be suitable for hair photoprotection when delivered in a shampoo system. Solid lipid nanoparticles have been developed as carriers of UV blockers for use on skin and hair while also offering their own photoprotective properties by reflecting and scattering UV rays.^{17,19,20}

CONCLUSION

Because hair is a nonliving structure, damage to the hair shaft caused by cosmetic or environmental factors is irreversible. Although it is important to practice appropriate hair care techniques to improve function and prevent further damage, hair fibers cannot be restored to their original structure; therefore, it is essential that patients avoid poor and incorrect cosmetic procedures that are performed by inexperienced staff. Fortunately, hair is in continuous growth, and unless the follicles are affected, hair shafts can be totally renovated. If weathering is prevented, new hair fibers will grow healthy, lustrous, and strong, improving both the patient's well-being and self-esteem.

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