

Suprabulbar Thinning of Hair in Telogen Effluvium

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Anagen effluvium (AE) is the result of a disturbance of proliferative activity of hair follicle matrix cells, which leads to the narrowing and subsequent breakage of the proximal portion of hair shafts.^{1,2} However, abrupt transition from anagen to telogen can affect the diameter of newly formed hair shafts in telogen effluvium (TE),^{3,4} therefore, we analyzed the proximal thinning of hair shafts at the suprabulbar level in TE.

Participants who were diagnosed TE based on the percentage of telogen hair in trichogram (>20%) were enrolled. Patients who have alopecia areata, scarring alopecia, or very short clipped hair, and those who were using cytotoxic agents were excluded. And chronic TE was defined as a condition with a duration of more than 6 months.

Telogen hair samples were collected from participants during a hair pull test. The telogen club hairs were gently pulled from more than three different areas of scalp. Randomly selected shed hairs were laid out on glass slides, aligned at both ends, and secured with transparent adhesive tape. The morphology of each proximal hair shaft was examined microscopically, and the diameters were measured across the suprabulbar levels and mid-shaft levels of hairs (distances of 3–5 cm from the proximal ends of hairs). Data from at least five hairs of each participant were collected. All data were analyzed by ANOVA test using SAS software, version 9.2 (SAS Institute Inc., Cary, NC, USA).

A total of 64 participants were enrolled in the study and divided into three groups: 21 acute TE patients, 32 chronic TE patients, and 11 healthy controls who had no history of medical or hair disease. Demographics of the study population and

calculated data are described in Supplementary Table 1 (only online). The most common conditions associated with TE were medications and systemic illness in both acute and chronic TE. Hair shaft thicknesses along suprabulbar or mid-shaft level were not statistically different among groups. However, the ratio of the diameter along the suprabulbar level to the mid-shaft level in hair shafts was significantly decreased in acute TE group (0.84 ± 0.05) compared with chronic TE (0.89 ± 0.07 , $p=0.004$) and controls (0.94 ± 0.07 ; $p<0.001$) in ANOVA ($p=0.003$), Tukey's post-hoc test (Fig. 1).

Insults which induce AE can cause abrupt cessation of mitotic activity of hair follicle matrix cells. It leads to the weakening of proximal hair shafts, thereby resulting in subsequent breakage of the hair shafts.⁵ However, tapered proximal hair shafts due to premature entry of follicles into telogen can be observed in cytotoxic agent-induced acute effluvium depending on the severity of insult.⁴ A previous report proposed the term "atrophic TE" to distinguish this condition from conventional TE or AE.⁴ In the present study, however, the tapering of proximal hair bulbs (suprabulbar thinning) was observed even in conventional TE. In TE, the causative follicular insult also impacts anagen follicles in the first instance, after which they enter telogen and hairs are lost as such. The difference in loss induced by cytotoxics is that hair shafts first taper prior to entering telogen.⁴ In conclusion, suprabulbar thinning in proximal hair can be a common change occurring in acute TE, therefore, this result suggests that proximal tapering is not a unique event in AE, but both TE and AE can have morphological similarity. And suprabulbar thinning of proximal hair shaft can happen also in TE, so that it cannot be used to differentiate between AE and TE.

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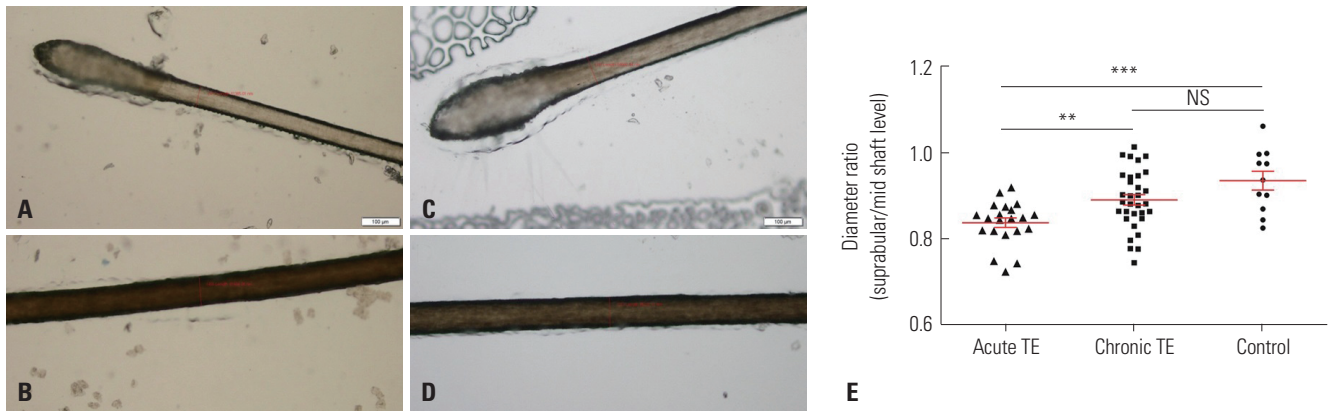


Fig. 1. The measurement of diameter along suprabulbar and mid-shaft level in hair shafts. (A) Bulbar portion of a hair and (B) mid-shaft portion of the same hair in a patient with acute TE. (C) Bulbar portion of a hair and (D) mid-shaft portion of the same hair in a healthy control. Significant thinning of the suprabulbar area of a hair is observed compared to the mid-shaft portion of a hair in acute TE (61.36 μm vs. 83.40 μm). In contrast, control shows similar thickness between the suprabulbar and mid-shaft portions of a hair (84.69 μm vs. 85.23 μm) (under 400 \times magnification). (E) The suprabulbar/mid-shaft level diameter ratios of hair in acute/chronic TE and controls. The diameters were measured across the suprabulbar and mid-shaft levels of hairs (about distances of 3–5 cm from the proximal ends of hairs) under a microscope. The ratio of the diameter along the suprabulbar level to the mid-shaft level in hair shafts was significantly decreased in acute TE group (0.84 ± 0.05) compared with chronic TE (0.89 ± 0.07 , $p=0.004$) and controls (0.94 ± 0.07 ; $p<0.001$) in ANOVA ($p=0.003$), Tukey's post-hoc test. TE, telogen effluvium.

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