



Morphological characteristics and factors in the plucked human hair follicle tissue of curved hair caused by acquired factors

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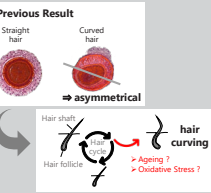
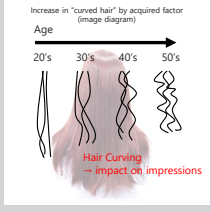
Introduction:

Background

In addition to congenital factors, acquired factors such as ageing may cause hair curving [1]. The increase in acquired curly hair i.e., "curved hair" is considered to become worse the impression of appearance. Thibaut *et al.* reported that hair follicle tissue became asymmetrical, resulting in hair curling because of mechanical action in congenital curled hair follicles such as Africans [2]. However, there are few reports based on embryological perspectives on hair curving caused by ageing.

Objective & hypothesis

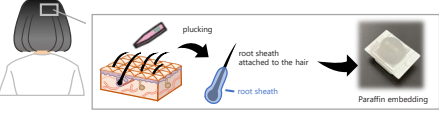
We previously demonstrated that hair follicle tissue cross section of curved hair was asymmetrical compared to identical participant's straight hair [3]. In this study, we hypothesized that some adverse effects with ageing prevented the formation of normal hair follicle tissue and resulted in acquired curved hair and attempted morphological and immunohistochemical analysis.



Materials & Methods:

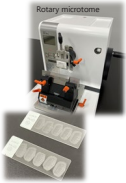
Specimen collections

Hairs were plucked from the participant's scalp. The participants were Japanese men and women in their 30s-50s, and straight hair and curved hair were collected from the identical participant, respectively.



Preparation of hair follicle tissues cross section

Hair follicle tissues were fixed in 4% paraformaldehyde and embedded in paraffin. Continuous cross sections with a thickness of 10µm were obtained using a rotary microtome.



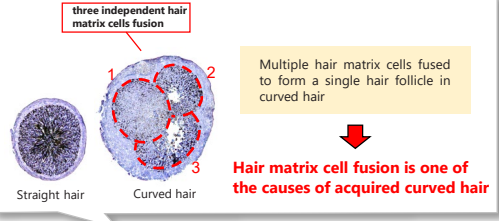
Immunohistochemical staining

After antigen retrieval, primary antibodies, secondary antibodies and 3,3'-diaminobenzidine tetrahydrochloride (DAB) were applied to detect the protein of interest.

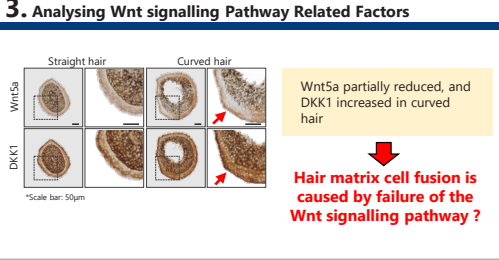
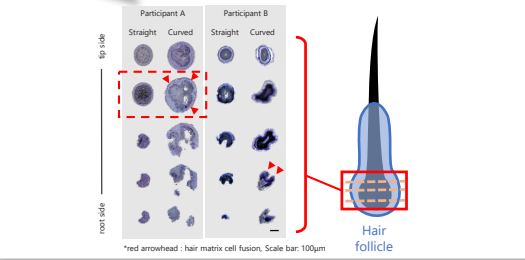
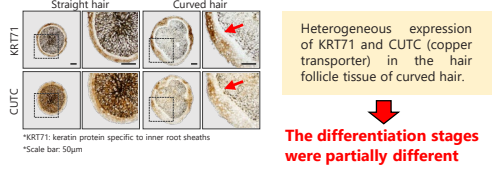
Results & Discussion:

1. Observation of characteristic forms found in acquired curved hair

◆ Cross section images of hair follicle tissues



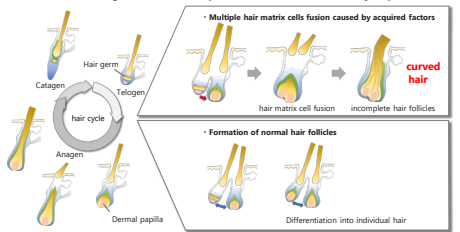
2. Immunohistochemical staining of plucked hair follicle tissue



Conclusions:

- We found that multiple hair matrix cells might fuse to form a single hair follicle and hair shaft, resulting in acquired curved hair.
- We consider that the fusion of hair matrix cells with different positions in the depth and the timing of differentiation forms hair follicles with partial differences in the thickness of the follicle sheath.

Schematic diagram of formation process in curved hair caused by acquired factors



References:

[1] Nagase S, Kajiuira Y, Yamada A, Abe H, Shibuichi S, Satoh N, Itou T, Shinohara Y, Amemiya Y (2009) Changes in structure and geometric properties of human hair by aging. *J Cosmet Sci* 60:637-648.
[2] S Thibaut, O Gaillard, P Bouhanna, DW Cannell, BA Bernard (2005) Human hair shape is programmed from the bulb. *Br J Dermatol* 152:632-638.
[3] The IFSCC Congress 2020 Yokohama, Poster-101 Relationship between collagen production and endoplasmic reticulum stress in human hair follicle outer root sheath cells