

Follicular Anatomy of the Anterior Temporal Hairline and Implications for Rhytidectomy

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Background: Incisions made perpendicular to the hair follicles during anterior frontal hairline brow lifts or forehead shortening procedures help produce an inconspicuous forehead scar. The success of this “hidden” incision relies on the anteriorly directed frontal hairline follicles and their growth vector. The authors hypothesized that a similar incision could be made perpendicular to the hair follicles in the temple region during rhytidectomy. A well-designed anterior hairline beveled incision over the temple would allow for improved leverage during soft-tissue repositioning and a concealed hairline incision in the temple region.

Methods: Anterior temporal hairline strips 4 cm in length at the level of the lateral canthus were excised from 16 fresh cadavers. Hairline follicles ($n = 227$) were assessed for direction and angle of growth after appropriate tissue preparation and staining (hematoxylin and eosin). The hair follicle angle was analyzed microscopically as it approached the epidermis.

Results: The anterior temporal hairline follicles were oriented at a mean angle with the epidermis of 16 ± 3 degrees anteriorly and inferiorly.

Conclusions: The anterior temporal hairline follicles of the scalp are oriented anteriorly and inferiorly with the epidermis, providing the surgical rationale for using a beveled hairline incision angled 30 to 45 degrees to the external skin surface to undercut the distal flap. This incision is perpendicular to and transects the temporal hair follicles during rhytidectomy, permitting hair growth through and anterior to the scar. This modified anterior temporal hairline incision reduces visibility of the scar at the hairline for patients in whom scar show and hairstyle versatility are important concerns. (*Plast. Reconstr. Surg.* 119: 1891, 2007.)

One of the principal challenges involved with cosmetic surgery remains limiting incisional scar show following surgical procedures. When performing rhytidectomy, several techniques have been described for placing incisions posterior to the hairline. These incisions lack the advantage of one placed at the anterior hairline, which in rhytidectomy, provides improved leverage of pull during soft-tissue repositioning.¹ Camirand and Doucet have demonstrated that anterior hairline scars can be improved by making hairline incisions perpendicular to the follicles during forehead lifts.² This technique relies on the fact that the hair follicles over the forehead region are oriented in an

anterior and inferior direction. Beveling of the incision perpendicular to these follicles results in the growth of hair through and anterior to the scar. This technique goes against the conventional wisdom of making skin incisions parallel to the hair follicles in an attempt to transect as few follicles as possible.³

Although beveled incisions perpendicular to hair follicles result in follicular transection, transected hair follicles are able to produce hair growth through the incision scar, thereby camouflaging it.^{2,4} Despite this evidence, some clinicians have been hesitant to use this technique.⁵ Many clinicians have stressed preservation of the temporal hairline by using an anterior hairline incision.^{6,7} However, to date, there has been no discussion of temporal hairline follicle anatomy and its potential implication on incision technique. Follicle anatomy and orientation are critical to appreciate the application of the surgical technique being described (Fig. 1).

In the frontal hairline region, the follicle orientation has been established as anteroinferiorly directed. This orientation of the hair follicles has

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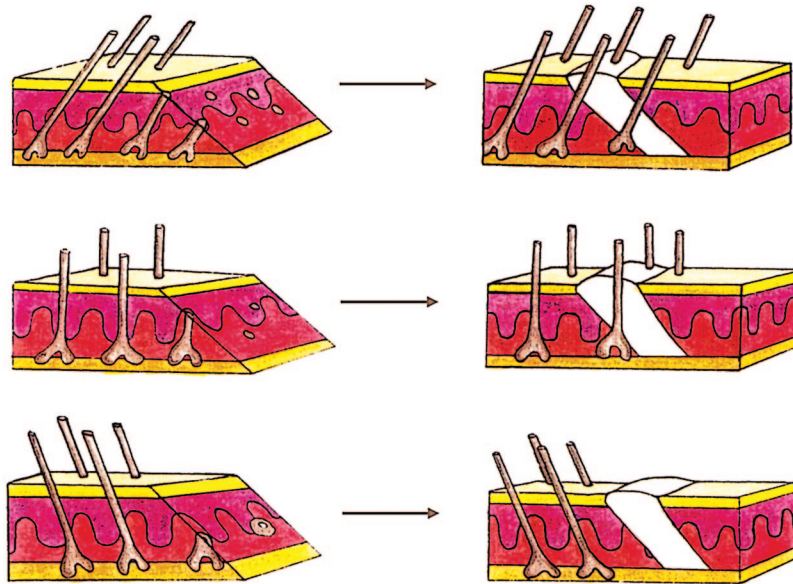


Fig. 1. The effect of hair follicle orientation on visibility of an incisional scar when using a beveled incision. Hairline follicle orientation is demonstrated angled: (*above*) anterior, (*center*) perpendicular, and (*below*) posterior. As demonstrated, the anterior and perpendicular orientation of hair follicles combined with the beveled incision allows growth of hair anterior to the scar, thereby concealing the incision.

been discriminated though the experience of surgeons who routinely perform micrografts.⁸ Moreover, the anterior orientation of follicles has been demonstrated by the superiority of the bilateral advancement temporal flap⁹ over the Juri temporoparieto-occipital flap.¹⁰ To advocate the use of the beveled incision perpendicular to the follicles over the temporal hairline when performing a rhytidectomy, it was necessary to investigate the follicular orientation in the temporal region and observe the application of the beveled incision clinically.

MATERIALS AND METHODS

Anterior temporal hairline samples were obtained from 16 cadaver specimens. Samples were obtained by excising a strip of skin 4 cm long in the axial plane at the level of the canthus (Fig. 2). Strips were cut so as to include a margin of non-hair-bearing skin at its anterior border and hair-bearing skin at its posterior border. After careful preservation tissue orientation, samples were embedded in paraffin, sectioned, mounted, and stained (hematoxylin and eosin). Samples were then analyzed by measuring hair follicle angles as they approached or exited the epidermis. Hairs that were aligned perpendicular to the skin were defined as 0 degrees. Anteriorly oriented hairs

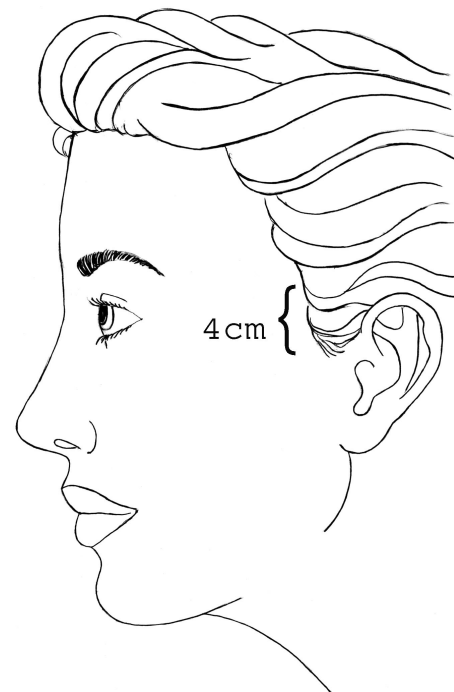


Fig. 2. Illustration of anterior temporal hairline biopsy specimen sites. Four-centimeter-long strips of the anterior hairline in the temporal region of 16 cadavers were excised. Samples were oriented, embedded in paraffin, and sectioned with hematoxylin and eosin staining to determine the hair follicle angles.

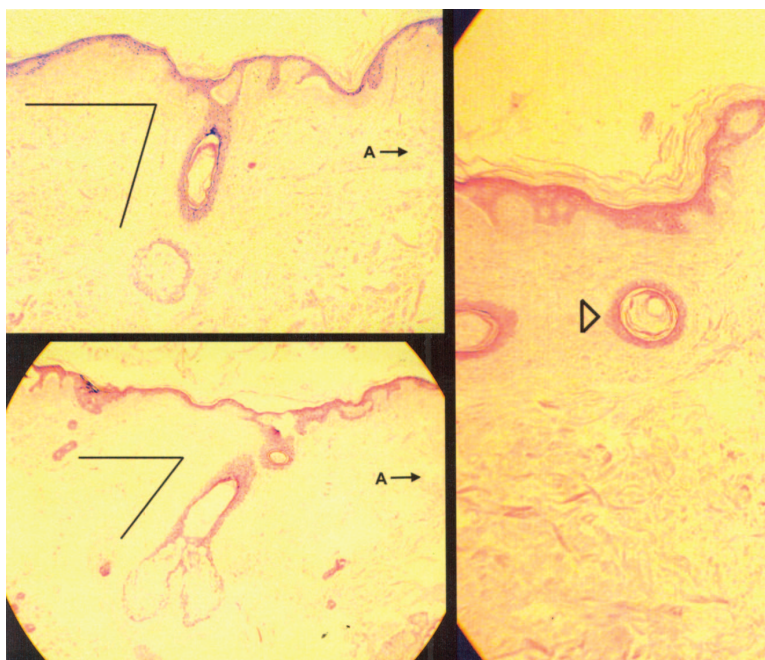


Fig. 3. Histochemical illustration of the anterior temporal hairline demonstrates the hair follicles oriented anteriorly. A marks the anterior aspect of the section and the measured angle is indicated. In some instances, the hair shaft was seen in full cross-section (*open arrowhead*). Although these most likely represented hairs oriented inferiorly and perpendicular to our sections, because accurate follicle angle could not be judged, these follicles were not tabulated. Representative micrographs are shown.

were measured in positive degrees and posteriorly oriented hairs in negative degrees (Fig. 3). In some instances, the hair shafts were seen in full cross-section. Although these most likely represented hairs oriented inferiorly and perpendicular to our sections, because accurate follicle angle could not be judged, these follicles were not tabulated (mean \pm SD) as a part of the results. Statistical analysis was performed using descriptive analysis and a one-way analysis of variance test (SigmaStat; SPSS, Inc., Chicato, Ill.).

RESULTS

All cadaver hairlines demonstrated an antero-inferior directed follicle orientation. No significant difference was noted among cadaver specimens, the range of which averaged 27 to 7 degrees ($p > 0.05$). Subsequently, all measured follicle angles were combined to determine the overall follicle orientation at the temporal hairline. The average angulation of hair follicles ($n = 227$) was equal to 16 ± 3 degrees. In addition, most hair follicles were inferiorly directed.

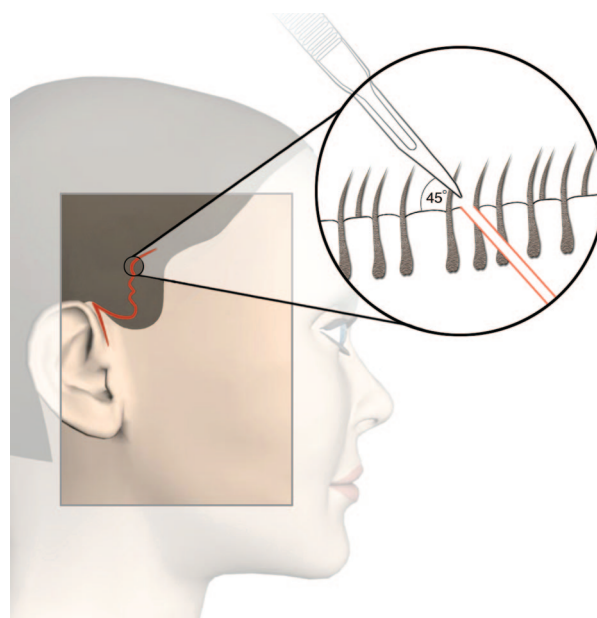


Fig. 4. Schematic representation of the anterior temporal hairline incision. The *solid line* depicts the beveled incision within the sideburn. The new sideburn should be a minimum of 2×2 cm in width and length.



Fig. 5. Six different patient photographs demonstrating the anterior temporal hairline using a beveled incision 30 to 45 degrees to the external skin plane. Note that the hairs growing anterior to the incisional scar line obscure the scar, even with the hair pulled posteriorly.

DISCUSSION

The current study provides the histologic rationale for performing a beveled incision oriented perpendicular to the hair follicles at the temporal hairline during rhytidectomy. Use of the beveled incision at the anterior frontal hairline has been previously demonstrated to improve scar appearance through preservation of the hair follicles in the distal flap and the directional growth of new hair through the proximal flap and anterior to the scar.^{2,4} Although undercutting the proximal flap at approximately 45 degrees transects the follicle shaft, it preserves the deeper follicle bulb and

subsequent hair growth across the incision scar ensues (Fig. 1, *above*). In fact, even if the hairs were oriented roughly perpendicular to the skin, use of a beveled incision could result in hair growth through the scar, provided that a sufficiently acute angle was used (Fig. 1, *center*). However, if the hair follicles were posteriorly oriented, the use of this beveled incision would result in cutting parallel to the hair follicles, damaging the hair bulb, with resultant hair loss and an obvious scar (Fig. 1, *below*).

The current anatomical study demonstrates that the follicles of the anterior temporal hairline

are oriented not posteriorly but instead anteriorly at 16 ± 3 degrees. Also, it is important to note that the majority of hair follicles were oriented inferiorly. These findings provide the premise for the proposed micro-W or curvilinear pattern beveled incision advocated for the temporal anterior hairline.² This incision not only provided lengthening of the posterior skin flap resulting in a tension-free suture closure but also allowed transection of the follicles oriented inferiorly. An angulation of 30 to 45 degrees for the beveled incision of the temporal skin flap is recommended. When necessary, the edge of the proximal temporal skin flap can be thinned to avoid fat interposition between the skin flaps, which could interfere with extension of hair elements through the skin flap. This technique has been routinely used by the senior author (A.M.) in rhytidectomy patients as previously described.^{11,12} Although the temporal hairline incision can be placed at the temporal hairline, when it is beveled and placed 1 to 3 mm posterior to the anterior temporal hairline (Fig. 4), the scar concealment is improved.¹² Hair growth as little as 2 to 3 mm onto the anterior cheek skin flap avoided scar show, even when the hair was combed back (Fig. 5).

The advantages of the temporal hairline incision are numerous. First, the placement of an anterior temporal hairline incision results in more effective lift of the ptotic facial skin. In the past, some surgeons advocated that the most appropriate way to address ptotic facial skin lateral to the canthus in rhytidectomy patients was with the addition of a transcoronal forehead lift.¹³ This, however, can easily be addressed with the anterior temporal incision.^{11,12} In addition, the previous stigmata of rhytidectomy,^{14–16} including displacement of the temporal hair line, loss of the sideburn, and distortion of the lateral brow, can be avoided with the temporal hairline incision. The distortion of the sideburn can be especially disfiguring in male patients and those undergoing repeated face lift procedures. Finally, this technique avoids limitation of hairstyles to forward combed hair that is necessary for coverage of conventional anterior temporal hairline incisions.

CONCLUSIONS

We have demonstrated the anatomy of the anterior temporal hairline follicles as having an

anteroinferior orientation. Beveling of the temporal hairline incision undercuts the proximal flap and preserves the hair follicle bulbs of the distal hair-bearing temple, permitting future hair growth anterior to the incision. This technique, when incorporated into the temple incision for facial rhytidectomy, helps to maximize rhytidectomy outcomes by limiting incisional show.

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DISCLOSURE

The authors have no financial interest or commercial associations with any of the products, devices, or drugs mentioned in this article.

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