INTRODUCTION

The hairline and ratio of the forehead to the face are important elements to make an attractive face. When the hairline is disrupted, the overall balance of the face changes.¹,² The shape of the hairline is very important to a person’s identity and is an important factor in determining the impression they make.³,⁴ There is a difference in the shape of the hairline between men and women. A wide forehead and deep fronto-temporal recess create a more masculine image and a round forehead creates a more feminine image.⁵,⁶ In recent years, the importance of the hairline came to be discussed in facial gender confirmation surgery and aesthetic surgery.⁷,⁸ However, reports on the morphology of the normal hairline are still scarce. Differences in the shape of male and female normal hairlines in Japanese subjects are discussed in this study.

MATERIALS AND METHOD

Samples

Healthy Japanese men and women aged 20-39 years old with normal hair and scalp appearance were recruited to the study. The sample size (n) was calculated according to the formula in Supplemental Digital Content 1. (See figure 1, Supplemental Digital Content 1, which displays the sample size (n) calculated according to the following formula: \( n = \frac{z^2 \times p \times (1 - p)}{e^2} \times \frac{1}{1 + \frac{z^2 \times p \times (1 - p)}{2 \times e^2 \times N}} \) http://links.lww.com/PRSGO/B744.)

The sample size (with finite population correction) was 385. Recruitment of the research subjects was done using posters in our hospital. The research subjects were asked to come to the plastic surgeon’s office to fill out the questionnaire and have measurements taken. A separate room was set up so the researcher could not see the research subjects fill out the answers to the questionnaire. Measurements were taken by the researcher. Responses

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were obtained from all research subjects. The exclusion criteria included a history of hair and scalp abnormalities, a history of treatment for internal diseases, a history of medication, a history of operation on the head or face, those who have a habit of tying their hair up every day, those who shave their hairline or have had procedures to remove or replant hair from their hairline to shape it, those whose hairline has changed compared with when they were 20 years old. An estimated 456 healthy subjects (122 men and 334 women) participated in this study. The mean age of the men was 35.1 years (range 22–39), and that of the women was 35.2 years (range 20–39). This prospective study was conducted after obtaining approval of the ethics committee of Nagasaki University Hospital, and in accordance with the Declaration of Helsinki principles. The researcher explained the research based on the research protocol to the research subjects and obtained their verbal consent.

**Questionnaire**

A questionnaire about the hairline type and presence or absence of a widow’s peak was given to all subjects, and their width and height of the forehead were measured. We categorized four types of frontal hairline forms and four types of temporal hairline forms with reference to previous literature.8–11 The evaluators selected the closest type among the patterns. The reference line of the forehead measurements comprised four lines: (1) mid-frontal line, vertical line from the glabella to the mid-point of the frontal hairline, (2) intertemporal line, the horizontal line between both temporal points, (3) lateral horizontal line, line horizontally drawn from the lateral canthus to the temporal hairline, (4) head circumference, through the lateral part of the eyebrow ridge and the occipital external protuberance (Fig. 1). Evaluation and measurements were done by the researcher. When measuring the hair line, facial hair on the forehead was not treated as hair, and the thick hairline was used as the measurement site.

**Statistical Analysis**

Statistical analyses were carried out using Mann-Whitney analysis of variance. P values of less than 0.05 were defined as significant. All statistical analyses were carried out with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan).12

**RESULTS**

**Measurements of the Forehead**

The mean length of the mid-frontal line was 6.2 cm (2–8.5 cm) in women and 6.65 cm (2.7–9.5 cm) in men (Fig. 2A).

The mean length of the intertemporal line was 14.9 cm (9–23.5 cm) in women and 15.8 cm (12–23 cm) in men (Fig. 2B). The mean length of the lateral horizontal line on the both side was 4.2 cm (2–7 cm) in women and 4.4 cm (2–8 cm) in men (Fig. 2C). The mean length of the head circumference was 55 cm (42–66 cm) in women and 57 cm (42–64 cm) in men (Fig. 2D).

**Hairline Classification**

Frontal hairline types (Fig. 3, Table 1). (See figure 2, Supplemental Digital Content 2, which displays frontal hairline types. (a) Linear: 36.1% of women and 45.9% of men. (b) Triangular: 7.2% of women and 0.82% of men. (c) Round: 38.5% of women and 10.7% of men. (d) M-shaped: 18.2% of women and 42.6% of men. http://links.lww.com/PRSGO/B745.)

Temporal hairline types (Fig. 4, Table 2). (See figure 3, Supplemental Digital Content 3, which displays temporal hairline types. (e) Inverted triangle: 20.3% of women and 65.6% of men. (f) Inverted round: 27.8% of women and 17.2% of men. (g) Straight: 24.8% of women and 10.6% of men. (h) Convex: 27.2% of women and 6.6% of men. http://links.lww.com/PRSGO/B746.)

Presence or absence of a widow’s peak (Table 3). A widow’s peak was found in 29.6% of women and 32.8% of men.

**DISCUSSION**

To prepare the questionnaire, we philologically classified the hairline morphology referring to past reports. Jung et al investigated the hairline in 234 Korean female volunteers and classified the Asian female hairline into five types based on the frontal view: round, M-shaped, rectangular, bell, and triangular.8 Natpracha et al investigated

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**Fig. 1. Reference line of the forehead measurements. A, (1) mid-frontal line, (2) intertemporal line. B, (3) lateral horizontal line. C, The red point represents the occipital external protuberance, and the blue point represents the lateral part of the eyebrows. The yellow line represents the measured head circumference. (4) Head circumference.**
the hairline in 229 Thai female volunteers and classified the female hairline into five types: triangular, linear, inverted triangle, concave, and convex. Jung classified the normal forehead width with a vertical height of more than 2 cm higher than normal (6.38 cm) as bell shaped. However, it was difficult to define and distinguish the differences between the round and bell shapes by observing figures and photographs; so they were combined as the round type in our questionnaire. In the classification by Natpracha et al, M-shaped is classified as inverted triangle and convex based on the shape of both ends of the hairline, but these are also difficult to distinguish in a questionnaire, and so, were combined as M-shaped. Koo et al classified Asian male hairlines into four types: linear, linear with a central protrusion, round, and round with a central protrusion. Referring to the above four studies, we classified the frontal hairline into the following four types in preparation of the questionnaire: linear, triangular, round, and M-shaped (Fig. 3, Table 1). (See figure 2, Supplemental Digital Content 2, which displays frontal hairline types. (a) Linear: 36.1% of women and 45.9% of men. (b) Triangular: 7.2% of women and 0.82% of men. (c) Round: 38.5% of women and 10.7% of men. (d) M-shaped: 18.2% of women and 42.6% of men. [http://links.lww.com/PRSGO/B745](http://links.lww.com/PRSGO/B745)

In addition, a literature search was made to prepare a similar questionnaire concerning the temporal hairline types. Natpracha et al classified the temporal hairline shape into four types: triangular, linear, concave, and convex, and Nusbaum et al classified it into concave triangle, straight, concave oval, and convex. According to the photographs presented in these two references, triangular may correspond to concave triangular, linear may correspond to straight, and concave oval may correspond to concave. Referring to these studies, we divided the temporal hairline into the following four types and prepared a questionnaire: inverted triangle, inverted round, straight, and convex (Fig. 4, Table 2). (See figure 3, Supplemental Digital Content 3, which displays temporal hairline types.)
(f) Inverted round: 27.8% of women and 17.2% of men. (g) Straight: 24.8% of women and 10.6% of men. (h) Convex: 27.2% of women and 6.6% of men. http://links.lww.com/PRSGO/B746.

In frontal hairline morphology, linear and M-shaped accounted for 88.5% of men. In women, the frequencies of triangular and round were low, accounting for about 11.5%, and the frequency of linear was relatively high (36.1%), which is lower than that in men. Round was most frequent in women and accounted for 38.5%. Following the classification by Jung et al, round was classified into normal round and a type 2-cm higher than the mean, round (bell), and investigated. No bell shape was noted in men, but it was noted in 0.9% (3 subjects) of women.
Regarding the temporal hairline, hairless regions (inverted triangle and inverted round) were noted and accounted for 82.8% of men. In women, hairless regions were noted and accounted for 48.1%, whereas a hairless region was absent (straight and convex) in 51.9%. A hairless region was present in most men, but slightly more cases had no hairless region in women.

Regarding the presence or absence of a widow’s peak, in a study involving 360 American women performed by Nusbaum et al, a widow’s peak was noted in 81%. In a study involving 105 Spanish women reported by Ceballos et al, a widow’s peak was noted in 94% of women. On the other hand, in a study involving 400 Nigerians, a widow’s peak was noted in 14.7% and 16.5% of men and women, respectively. In a study in Asia, a widow’s peak was noted in only 24.5% of 229 Thai women. In our study, a widow’s peak was noted in 32.8% and 29.6% of men and women, respectively. It was clarified that a widow’s peak tends to

### Table 1. Frequencies of Frontal Hairline Types, Percentage (Cases)

|       | Linear | Triangular | Round | M-shaped |
|-------|--------|------------|-------|----------|
| Women | 36.1% (121) | 7.2% (24) | 38.5% (129) | 18.2% (61) |
| Men   | 45.9% (56)  | 0.82% (1)  | 10.7% (13)  | 42.6% (52)  |

**Fig. 4.** Frequencies of temporal hairline types. A, inverted triangle (the apex of the hairless region is an acute angle): 20.3% of women and 65.6% of men. B, inverted round (the apex of the hairless region is a semicircle): 27.8% of women and 17.2% of men. C, straight (straight line of the recess): 24.8% of women and 10.6% of men. D, Convex (recess was convex to the face): 27.2% of women and 6.6% of men.
Women 20.3% (68) 27.8% (93) 24.8% (83) 27.2% (91)

Natpracha et al reported: triangular, 44.97%; concave, 27.2%, showing differences from the data reported by straight accounted for 24.8%, and convex accounted for 5.24%.

In this study, a hairless region was noted in the mid-frontal line measured in Caucasians was 5.54 cm (3.5–8.0 cm), and 5.89 cm (4.5–9 cm), and that measured in Asians was 6.45 ± 0.89 cm and 6.38 ± 0.89 cm. Our measured value was 6.2 cm (range: 2–9.5 cm). In our study, a hairless region was noted in 50.92% of men. In previous reports, round and linear were found to be relatively frequent frontal hairlines in women. Although a simple comparison is difficult because the classification was different from ours, high frequencies of linear and M-shaped are common in men. In addition, in these two references, the mean length of the mid-frontal line was 6.53 cm (range: 4–8.5 cm) and 6.78 ± 0.75 cm, respectively, being very close to our measured value, 6.65 cm (range: 2.7–9.5 cm), suggesting that linear and M-shaped are the mainstream of the hairline morphology in men in East Asia. Regarding the temporal hairline, we could not find a reference in which detailed statistics were acquired, but considering that linear with a central protrusion and round with a central protrusion are the most frequent types, although a simple comparison is difficult because the classification was different from ours, high frequencies of linear and M-shaped are common in men.

Multiple outliers were noted in the measurement of the mid-frontal line, intertemporal line, and lateral horizontal line. The distance was measured setting several baseline points, in which a soft tape measure was used, and the distance was measured along with the skin. Therefore, the distance between two points included not only the two-dimensional distance but also curves, suggesting that the measured distance was long in subjects with a round skull and short in subjects with a flat forehead. Multiple outliers may have been affected by complex influences of this measurement method and an extremely narrow or wide forehead.
the questionnaire was simplified as much as possible, but the evaluation is likely to be subjective, for which investigation of the classification based on evaluations made by researchers may be necessary in the future.

CONCLUSIONS

The hairline morphology in Japanese subjects was investigated using a questionnaire and measurements taken of their foreheads. In the frontal hairline, linear and M-shaped were frequently noted in men, and round and linear were frequently noted in women. Regarding the temporal hairline type, a fronto-temporal recess was found in about half of men.

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PATIENT CONSENT

The patients provided written consent for the use of their images.

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