

Study of Frontal and Temporal Hairline Patterns in Japanese Subjects

Kazuya Kashiyama, MD, PhD
 Rina Haraguchi, MD
 Fuko Ban, MD
 Daisaku Yoshida, MD
 Maimi Fukuda, MD
 Naoto Date, MD
 Koko Koga, MD
 Kazufumi Koga, MD
 Katsumi Tanaka, MD

Background: The shape of the hairline is very important in a person's identity and in determining the impression they make. Reports on the morphology of a normal hairline are still scarce. Differences in the shape of male and female hairlines in Japanese subjects are discussed in this study.

Methods: A questionnaire about hairline type, the presence or absence of a widow's peak, and measurement of the width and height of the forehead was given to 456 healthy subjects, and their responses were recorded.

Results: Percentages of frontal hairline types were found to be linear (women 36.1%, men 45.9%), triangular (7.2%, 0.82%), round (38.5%, 10.7%), and M-shaped (18.2%, 42.6%). Temporal hairline types: inverted triangle (20.3%, 65.6%), inverted round (27.8%, 17.2%), straight (24.8%, 10.6%), and convex (27.2%, 6.6%). The incidence of a widow's peak was 29.6% in women and 32.8% in men. The mean length of the mid-frontal line was 6.2 cm in women and 6.65 cm in men.

Conclusions: Regarding the hairline morphology of the frontal view, two types (linear and M-shaped) accounted for 88.5% of men. In women, linear accounted for 36.1%, being relatively high, but lower than the frequency in men. Round accounted for 38.5%, being the highest. Regarding the temporal hairline, a hairless region (inverted triangle and inverted round) was noted in 82.8% of men. In women, a hairless region was present in 48.1% and was absent (straight and convex) in 51.9%. A temporal hairline with a hairless region was noted in the majority of men, whereas it was absent in slightly more cases in women. (*Plast Reconstr Surg Glob Open* 2021;9:e3751; doi: [10.1097/GOX.0000000000003751](https://doi.org/10.1097/GOX.0000000000003751); Published online 13 August 2021.)

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.

From the Department of Plastic and Reconstructive Surgery, Nagasaki University Hospital, Nagasaki, Japan.

Received for publication May 11, 2021; accepted June 22, 2021.

Copyright © 2021 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: [10.1097/GOX.0000000000003751](https://doi.org/10.1097/GOX.0000000000003751)

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: $n = [z^2 * p * (1 - p) / e^2] / [1 + (z^2 * p * (1 - p) / (e^2 * N))]$ <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

Disclosure: *The authors have no financial interest to declare in relation to the content of this article. This study was not supported by any grant.*

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

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 midpoint 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

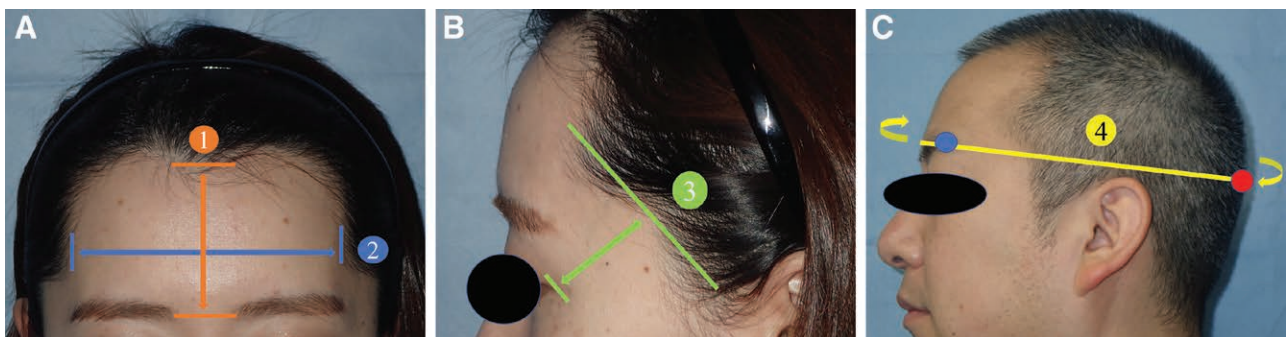


Fig. 1. Reference line of the forehead measurements. A, (1) mid-frontal line, (2) intertemporal line. B, (3) lateral horizontal line. C, The red point represents the occipital external protuberance, and the blue point represents the lateral part of the eyebrows. The yellow line represents the measured head circumference. (4) Head circumference.

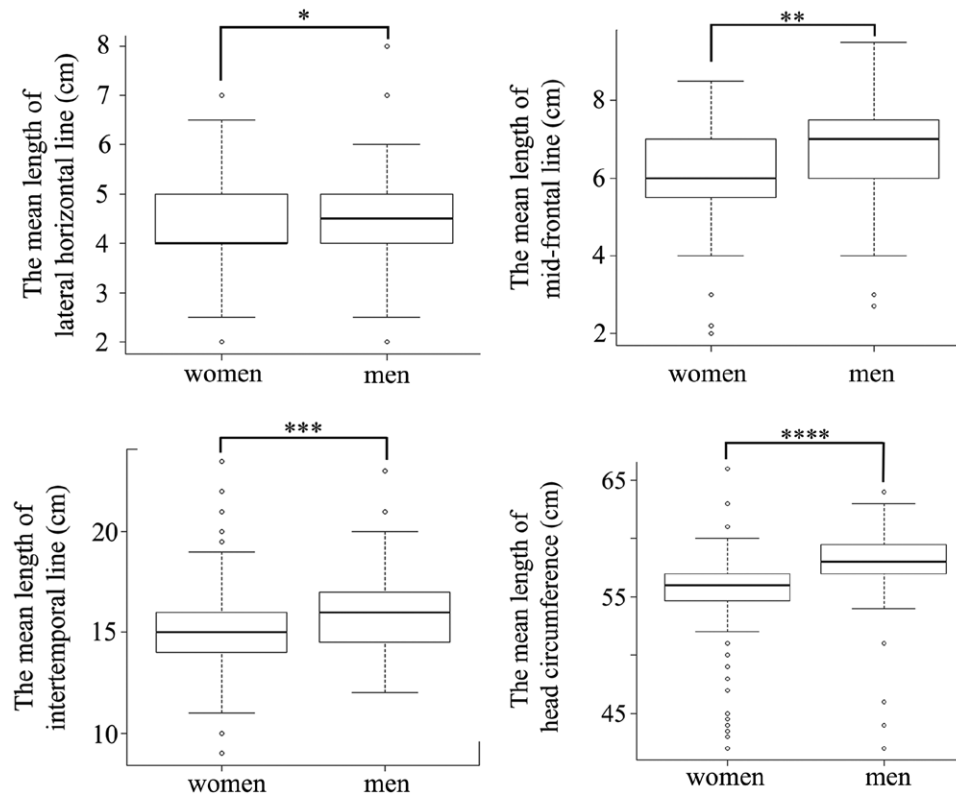


Fig. 2. Measurements of the forehead. A, The mean length of the lateral horizontal line of the right side was 4.2 cm (2–8 cm) in women and 4.4 cm (2–8 cm) in men. $*P = 0.33$. The P values were obtained by the Mann–Whitney test. Q4/4: maximum, Q3/4: upper quartile, Q2/4: median, Q1/4: lower quartile, Q0/4: minimum, ○: outliers. B, 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. $**P < 0.00001$. The P values were obtained by the Mann–Whitney test. Q4/4: maximum, Q3/4: upper quartile, Q2/4: median, Q1/4: lower quartile, Q0/4: minimum, ○: outliers. C, 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. $***P < 0.00001$. The P values were obtained by the Mann–Whitney test. Q4/4: maximum, Q3/4: upper quartile, Q2/4: median, Q1/4: lower quartile, Q0/4: minimum, ○: outliers. D, The mean length of the head circumference was 55 cm (42–66 cm) in women and 57 cm (42–64 cm) in men. $****P < 0.00001$. The P values were obtained by the Mann–Whitney test. Q4/4: maximum, Q3/4: upper quartile, Q2/4: median, Q1/4: lower quartile, Q0/4: minimum, ○: outliers.

the hairline in 229 Thai female volunteers and classified the female hairline into five types: triangular, linear, inverted triangle, concave, and convex.⁹ Jung classified the normal forehead width with a vertical height of more than 2 cm higher than normal (6.38 cm) as bell shaped.⁸ 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.⁹ Koo et al classified Asian male hairlines into four types: linear, linear with a central protrusion, round, and round with a central protrusion.¹⁰ 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>.)

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,⁹ and Nusbaum et al classified it into concave triangle, straight, concave oval, and convex.¹¹ 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. (e) Inverted triangle: 20.3% of women and 65.6% of men.

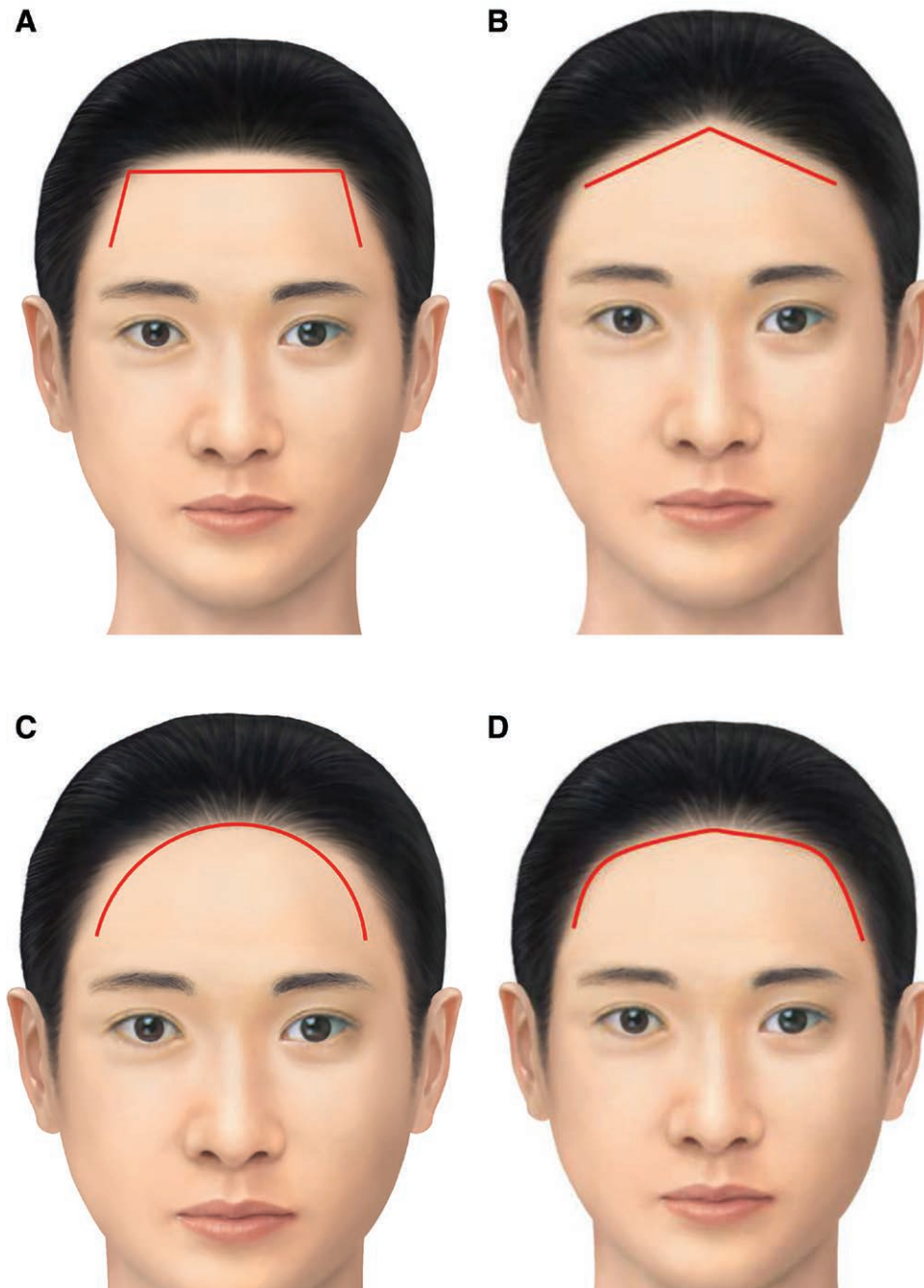


Fig. 3. Frequencies of frontal hairline types. A, Linear (straight hairline, the hairline looks rectangular when viewed from the front): 36.1% of women and 45.9% of men. B, Triangular (fronto-temporal recess is convex and the frontal hairline appears triangular): 7.2% of women and 0.82% of men. C, Round (the frontal hairline is round, the hairline appears to be semicircular when viewed from the front): 38.5% of women and 10.7% of men. D, M-shaped (the fronto-temporal recess is deep in the frontal hairline, forming an M-shape): 18.2% of women and 42.6% 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>.)

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.⁸ No bell shape was noted in men, but it was noted in 0.9% (3 subjects) of women.

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

	(a) Linear	(b) Triangular	(c) Round	(d) 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)

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%.¹¹ In a study involving 105 Spanish women reported by Ceballos et al, a widow's peak was noted in 94% of women.¹³ 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.¹⁴ In a study in Asia, a widow's peak was noted in only 24.5% of 229 Thai women.⁹ 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

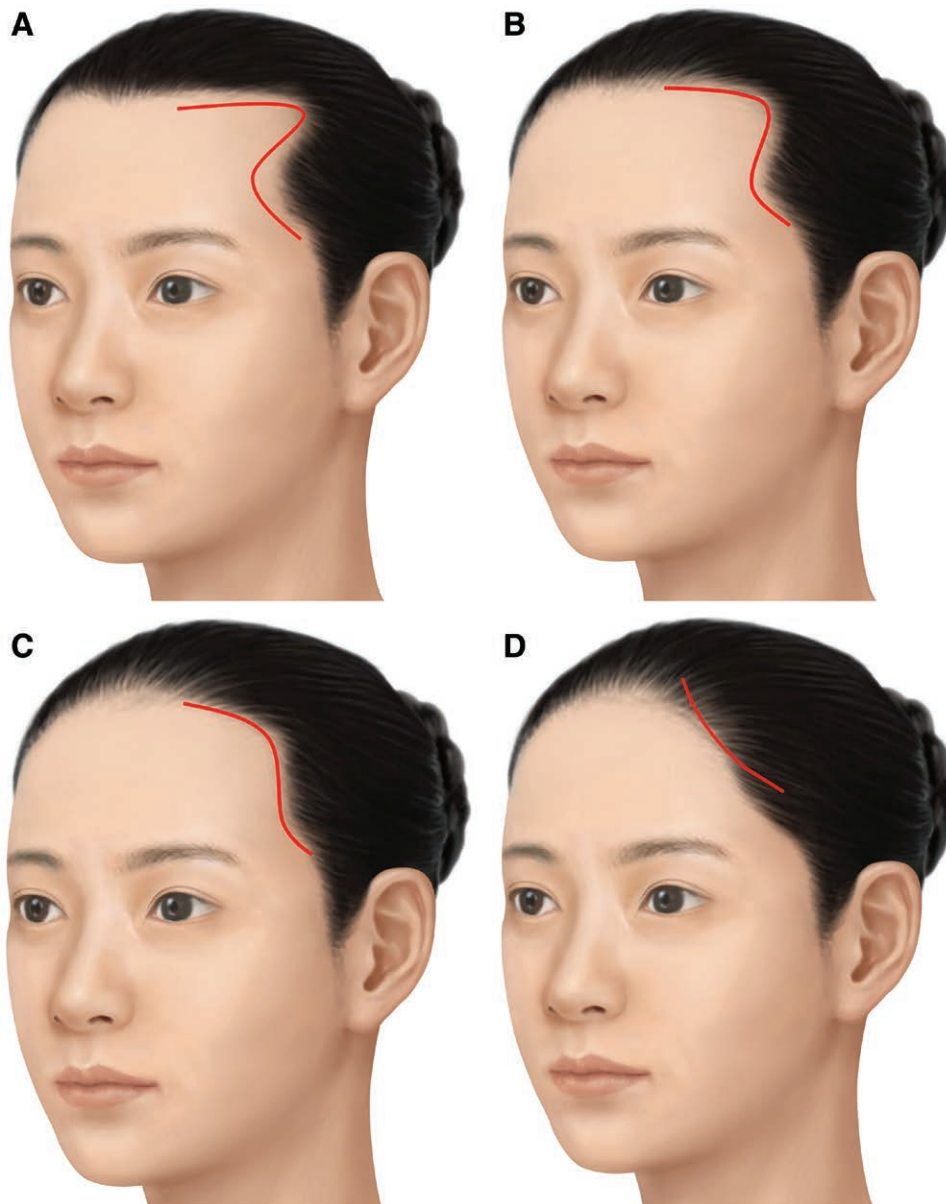


Fig. 4. Frequencies of temporal hairline types. A, inverted triangle (the apex of the hairless region is an acute angle): 20.3% of women and 65.6% of men. B, inverted round (the apex of the hairless region is a semicircle): 27.8% of women and 17.2% of men. C, straight (straight line of the recess): 24.8%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

Table 2. Frequencies of Temporal Hairline Types, Percentage (Cases)

	(e) Inverted Triangle	(f) Inverted Round	(g) Straight	(h) Convex
Women	20.3% (68)	27.8% (93)	24.8% (83)	27.2% (91)
Men	65.6% (80)	17.2% (21)	10.6% (13)	6.6% (8)

occur less frequently in Asians. A widow’s peak is considered to be formed by the central region of a childhood protruding hairline which remained without recession and the appearance rate and morphology change from after birth to adolescence.^{15,16} Because it is considered to have a genetic background, there may be differences in the appearance rate and morphology.

In the lateral horizontal line, no significant sex difference was noted (Fig. 2A). A sex difference was noted in the mid-frontal line and intertemporal line, and both lines were larger in men (Fig. 2B, C). However, the head circumference was also larger in men, and when the ratio of each forehead measurement relative to the head circumference was investigated, no significant sex difference was noted, suggesting that the cause of the sex difference in the distance between the two measured forehead points was due to the skeletal difference that the face is larger in men than women.^{17,18} (See figure 4, Supplemental Digital Content 4, which displays the rate of the lateral horizontal line by head circumference. <http://links.lww.com/PRSGO/B747>.) (See figure 5, Supplemental Digital Content 5, which displays the rate of the mid-frontal line by head circumference. <http://links.lww.com/PRSGO/B748>.) (See figure 6, Supplemental Digital Content 6, which displays the rate of the intertemporal line by head circumference. <http://links.lww.com/PRSGO/B749>.)

Only the mid-frontal line, intertemporal line, and lateral horizontal line were measured in this study. Because hairlines with a deep fronto-temporal recess, such as M-shaped, were frequently noted in men compared with the round type, the forehead may be narrower in women when the width is investigated based on the area.

In previous reports, round and linear were found to be relatively frequent frontal hairlines in women.^{8,9,19} In our study, when round and linear were combined, they accounted for 74.6%, which is consistent with previous studies. It has been reported that the mean length of the mid-frontal line measured in Caucasians was 5.54 cm (3.5–8.0 cm)¹¹ and 5.89 cm (4.5–9 cm),¹⁹ and that measured in Asians was 6.45 ± 0.89⁹ and 6.38 ± 0.89 cm.⁸ Our measured value was 6.2 cm (range: 2–9.5 cm). Regarding the temporal hairline, Nusbaum et al reported that in a study involving Whites, the frequency of concave triangle was 61%; concave oval, 26%; straight, 3%; and convex, 9%.¹¹ Natpracha et al reported: triangular, 44.97%; concave, 15.28%; linear, 34.39%; and convex, 5.24%.⁹ In our study, inverted triangle (corresponding to concave triangle, triangular) accounted for 20.3%, inverted round (corresponding to concave oval, concave) accounted for 27.8%, straight accounted for 24.8%, and convex accounted for 27.2%, showing differences from the data reported by

Table 3. Presence or Absence of a Widow’s Peak, Percentage (Cases)

	Present	Absent
Women	29.6% (99)	70.4% (236)
Men	32.8% (40)	67.2% (82)

other researchers, but the appearance rates of the four types were roughly equal.

There have been several reports on the morphology of hair loss and hair transplantation in men, but fewer studies on the normal hairline in men without androgenetic alopecia.^{10,20,21} In Japan, in 1960, Hatanaka et al investigated the hairline in 131 men aged 15–59 years and reported that linear was frequently noted in men.²⁰ However, the presence or absence of androgenetic alopecia and changes with aging were not taken into consideration in their study. Koo et al investigated the hairline in 108 male subjects aged 20 years or older without androgenetic alopecia,¹⁰ in which they classified the male hairline into four morphologies: round with a central protrusion, linear with a central protrusion, and linear, and concluded that linear and linear with a central protrusion are the most frequent types in Koreans. Bao et al investigated the hairline in 1000 Chinese men without androgenetic alopecia, using a classification similar to that reported by Koo et al and similarly concluded that linear and linear with a central protrusion are the most frequent types.²¹ 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 hairline types with a hairless region in the classification by Koo et al, a hairless region was noted in 50.92% of men. In our study, a hairless region was noted in the temporal hairline of 82.8% of 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 hairline.

We investigated the hairline morphology in Japanese subjects using a questionnaire and measurements taken of their foreheads. Because individual differences in the hairline morphology are large, the classification used in

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.

Kazuya Kashiyama, MD, PhD

Department of Plastic and Reconstructive Surgery
Nagasaki University Hospital
1-12-1 Sakamoto, Nagasaki 852-8501
Japan
E-mail: kkashiyama@nagasaki-u.ac.jp

ACKNOWLEDGMENTS

We thank Motoi Nakano, MD, PhD, Takehiro Daian, MD, PhD, Satoko Ishiyama, MD, Kouhei Fuziwara, MD, Miss Yukiko Kusano, Mrs. Miho Matsuyama, and Mrs. Yukiko Nagaiishi for collecting data and performing the statistical analysis.

PATIENT CONSENT

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

REFERENCES

- Ramirez AL, Ende KH, Kabaker SS. Correction of the high female hairline. *Arch Facial Plast Surg*. 2009;11:84–90.
- Holcomb JD, McCollough EG. Trichophytic incisional approaches to upper facial rejuvenation. *Arch Facial Plast Surg*. 2001;3:48–53.
- Hillairet de Boisferon A, Uttley L, Quinn PC, et al. Female face preference in 4-month-olds: the importance of hairline. *Infant Behav Dev*. 2014;37:676–681.
- DeBruine LM, Jones BC, Smith FG, et al. Are attractive men's faces masculine or feminine? The importance of controlling confounds in face stimuli. *J Exp Psychol Hum Percept Perform*. 2010;36:751–758.
- Shapiro R. Principles and techniques used to create a natural hairline in surgical hair restoration. *Facial Plast Surg Clin North Am*. 2004;12:201–217.
- Beehner M. Hairline design in hair replacement surgery. *Facial Plast Surg*. 2008;24:389–403.
- Capitán L, Gutiérrez Santamaría J, Simon D, et al. Facial gender confirmation surgery: a protocol for diagnosis, surgical planning, and postoperative management. *Plast Reconstr Surg*. 2020;145:818e–828e.
- Jung JH, Rah DK, Yun IS. Classification of the female hairline and refined hairline correction techniques for Asian women. *Dermatol Surg*. 2011;37:495–500.
- Natpracha W, Sukanjanapong S, Chanprapaph K, et al. Characterization and classification of different female hairline patterns in the Thai population. *J Cosmet Dermatol*. 2021;20:890–896.
- Koo SH, Chung HS, Yoon ES, et al. A new classification of male pattern baldness and a clinical study of the anterior hairline. *Aesthetic Plast Surg*. 2000;24:46–51.
- Nusbaum BP, Fuentesfria S. Naturally occurring female hairline patterns. *Dermatol Surg*. 2009;35:907–913.
- Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. *Bone Marrow Transplant*. 2013;48:452–458.
- Sirinturk S, Bagheri H, Govsa F, et al. Study of frontal hairline patterns for natural design and restoration. *Surg Radiol Anat*. 2017;39:679–684.
- Ebeye OA, Chris-Ozoko LE, Ogeneovo P, et al. A study of some morphogenetic traits among the esan ethnic group of Nigeria. *East Afr Med J*. 2014;91:420–422.
- Rassman WR, Pak JP, Kim J. Phenotype of normal hairline maturation. *Facial Plast Surg Clin North Am*. 2013;21:317–324.
- Perrone E, Zanolta TA, Fock RA, et al. Determining the frequency of morphological characteristics in a sample of Brazilian children. *J Pediatr (Rio J)*. 2017;93:592–600.
- Lambros V, Amos G. Facial shape, size, and gender. *Plast Reconstr Surg*. 2020;146:1012–1014.
- Ousterhout DK. Feminization of the forehead: contour changing to improve female aesthetics. *Plast Reconstr Surg*. 1987;79:701–713.
- Ceballos C, Priego C, Méndez C, et al. Study of frontal hairline patterns in Spanish Caucasian women. *Actas Dermosifiliogr*. 2013;104:311–315.
- Hatanaka N. Measurement of the forehead in Japanese after adolescence. *Zinruigaku Ronbunshu*. 1960;39:15.
- Bao Y, Wu K, Lin J, et al. Study on hair distribution in healthy men for hair restoration design. *J Craniofac Surg*. 2018;29:e785–e790.