Variations of the Double Eyelid and the Upper Tarsus in Asians

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Objective: *To identify the variations of the double eyelid shapes and the tarsal shapes in Asians and find the association between them.*

Material and Method: *Healthy subjects with natural double eyelid and age between 20-40 years were enrolled. Characteristics and variations of the eyelid shapes and the tarsal shapes were evaluated.*

Results: *Of 101 subjects, 50 were males and 51 were females. The most common shape of double eyelid fold was nasally-tapered with merging into medial upper lid fold (39.6%). Then lateral flare configuration (27.7%), parallel (26.7%), and nasally-tapered without merging into medial skin fold (5.9%), followed in descending order of frequency. Sickle type was the most common tarsal shapes observed (45.5%), then trapezoid (32.7%) and triangular type (21.8%). There was a significant association between the double eyelid shapes and the tarsal shapes.*

Conclusion: *Variations of double eyelids and tarsus morphology were present among Asians. Ethnic differences should be accounted for when performing aesthetic blepharoplasty as to maintain a natural ethnic appearance.*

Keywords: *Asian blepharoplasty, Double eyelid surgery, Tarsus, Tarsal height, Eyelid crease*

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In western aspect, typical Asian eyelids are characterized by absent of eyelid crease (single crease), upper eyelid fullness and prominent epicanthal fold[1]. In fact, 30-87% of Asians do have apparent double eyelids[2,3]. Thus, the traditional surgery with creation of a high, arched crease would result in an unnatural and overly "westernized" the appearance. Contemporary, the goal of Asian blepharoplasty or double eyelid surgery is to make the eyes look brighter with the most natural-appearing crease while maintaining ethnic appearance. There is also a considerable variation in the crease position and shapes in Asian eyelids. Therefore, understanding the anatomical differences between Asian eyelids and Caucasian eyelids are important for surgeon to master a range of surgical procedures to manage these variations adequately.

Moreover, variations of the tarsus morphology in Asians were identified by Nagasao[4], however, primarily in cadavers. The tarsus is believed to play an important role in eyelid crease formation as a part of the skin-orbicularis-tarsus complex formed by the peripheral fibers of the levator aponeurosis[2,5,6]. Variations of double eyelids and upper tarsus in Asians had been known, however, scarce information has been described. So this present research, the author aims to study 1) the characteristics and variations of Asian double eyelid 2) the morphologic variations of the upper eyelid tarsus, in vivo and 3) the association between the double eyelid shapes and the upper tarsal shapes.

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Material and Method

The study was conducted under the supervision of the institutional review board and ethics committee of Faculty of Medicine, Srinakharinwirot University. Healthy volunteer subjects with apparent natural double eyelids with at least 1 mm of pretarsal skin height and age between 20-40 years were enrolled. Subjects with shallow, discontinuous, multiple or asymmetrical creases, and a history of periocular trauma or surgery were excluded. The physical examination included the upper eyelid crease height in closed eye position, pretarsal skin height (eyelid crease height in opening eye position) and crease to brow distance. Shapes of the double eyelid folds were categorized into 1) nasally tapered with merging into medial skin fold, 2) nasally tapered without merging into medial skin fold, 3) parallel crease and 4) lateral flare

configuration.

The upper eyelid was then everted and the tarsus was measured at the highest central part. Shapes of the tarsus were classified into 3 types: sickle, triangular, and trapezoid type according to the study by Nagasao[4]. All examinations were performed by the author. The eyelid measurements were compared between genders and analyzed by pair t-test. The association between the eyelid shapes and the tarsal shapes were analyzed by Pearson Chi-square test. A *p*-value of less than 0.05 was considered statistically significant.

Results

A total of 101 subjects (50 males and 51 females) were included in the study. Mean age was 26.14 years (20-40 years). The eyelid measurements are shown in Table 1. The values of eyelid crease height and tarsal height showed no statistically significant differences between both sexes. Pretarsal skin height and crease to brow distance were statistically greater in females compared to males (*p*-value <0.001 and 0.02, respectively). The most common shape of double eyelid fold was nasally tapered with merging into medial skin fold (39.6%). Then lateral flare configuration (27.7%), parallel (26.7%), and nasally-tapered without merging into medial skin fold (5.9%), followed in descending order of frequency (Fig. 1). For lateral flare shape, 78.6% had 1-mm flare and 21.4% had 2-mm flare. For tarsal shape, 45.5% of sickle shape, 32.7% of trapezoid shape, and 21.8% of triangular shape were found (Fig. 2). Distribution of the eyelid shapes and the tarsal shapes are demonstrated in Table 2. There was a significant association between the double eyelid shapes and the tarsal shapes (*p*-value = 0.008).

Discussion

Recognizing ethnic characteristics of Asian double eyelid is essential for surgeons to achieve satisfactory outcome when performing Asian blepharoplasty. The present study found the average lid crease height was 8.1 mm in males and 8.5 mm in females. Pretarsal skin height was 2.0 mm in males and 2.6 mm in females. Previous studies of Asian double eyelids had reported the average lid crease height was 6.6-7.1 mm in males and 5.8-7.4 mm in females[3,7,8]. For pretarsal skin height, Dharap[7] had reported 2.9 mm in males and 3.0 mm in females, and Cho[9] had reported 3.8-3.9 mm in both genders. The differences among several studies may have occurred due to different inclusion criteria, interracial variations or technical errors between interobservers. It is notable that the average lid crease height was not statistically different between the genders, however, pretarsal skin height was significantly greater in females compared to males (*p*-value <0.001). These findings are probably due to lower position of the eyebrow in males, therefore, there is more overhanging skin resulting in lower pretarsal skin height. Consequently, males have apparently lower eyelid crease than females, so the designed crease should always be lower to avoid unfavorable feminization.

In general, shapes of the double eyelid in Asians are divided into nasally tapered and parallel fold. Variations of the nasally taper fold were observed in the present study. At medial, the fold converges down to the medial canthal angle; either with or without merging into the medial skin fold. At lateral, the fold either runs laterally leveled or had a flared configuration. Thus four different variations of double eyelid fold were identified; nasally-tapered with merging into the medial skin fold (39.6%) was the most common type obseved, then lateral flare configuration (27.7%), parallel (26.7%), and nasally tapered without merging into medial skin fold (5.9%), followed in descending order of frequency. The variations found in the present study correspond to published studies[10-12] and Ophthalmic text[13].

Other surgeons may classify a nasally tapered without merging into medial skin fold as a parallel crease by observing that the medial end of the crease falls above and remains separated from the medial canthal angle. However, these two types can be distinguished by medially extending an imaginary line from the

Table 1. Eyelids measurements of males and females in mean ± SD (range) mm

Measurement	Male	Female	Total	*p*-value
Eyelid crease height	8.1±1.1 (6-10)	8.5±1.2 (6-12)	8.3±1.1 (6-12)	0.370
Pretarsal skin height	2.0±0.9 (1-4)	2.6±0.8 (1-4)	2.3±0.9 (1-4)	<0.001
Crease to brow distance	9.7±1.7 (6-14)	12.5±2.4 (8-18)	11.1±2.3 (6-18)	0.020
Tarsal height	7.2±0.7 (6-9)	7.3±0.6 (6-9)	7.3±0.7 (6-9)	0.400

eyelid crease, if it joins the medial upper lid fold or the medial canthal angle; it is classified as a nasally-tapered without merging crease. If it lies distance from the medial canthal angle; it is classified as a parallel crease. Recognizing the differences between these two types of the eyelid crease is important, particularly when patients had asymmetrical eyelid creases and request for a correction on one side to resemble the other side which they are already pleased with.

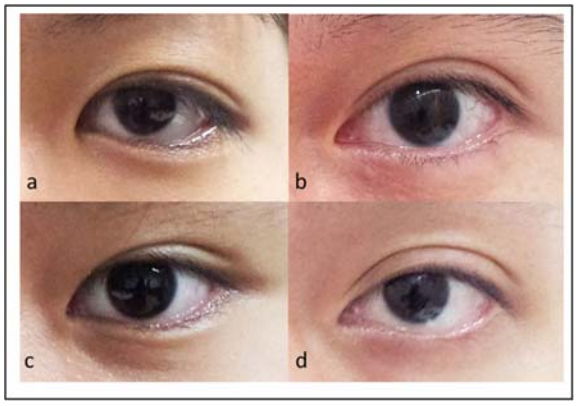

Fig. 1 Variations of the Asian double eyelid. Asian double eyelid was categorized into four types: A) Nasally tapered with merging into medial skin fold, B) Nasally tapered without merging into medial skin fold, C) Laterally flare, and D) Parallel crease.

For upper tarsus morphology, the study found the average upper tarsal height was 7.3 mm and was not significantly different between the genders (*p*-value = 0.4) and which are lower than Caucasians (10-12 mm)[6]. The result is in agreement with previous studies by Camara[14] of 7.49 mm and Goold[15] of 8.2 mm. Both studies found that the tarsal height was not associated with gender. Sickle type was most commonly found (45.5%), then trapezoid (32.7%) and triangular type (21.8%). The first study of tarsus morphology in Asians cadavers by Nagasao[4], found that sickle type of tarsus was most frequently observed, however, followed by triangular and trapezoid type.

It has been demonstrated, microscopically, that the orbital septum fuses to the levator aponeurosis near the upper tarsal border, with extending fibers to the orbicularis and skin to form an eyelid crease[2,16-18]. Regarding the anatomy of skin-orbicularis-levator-tarsus complex, might explain the clinical association between the eyelid shapes and the tarsal shapes in the present study (*p*-value = 0.008). The author believes the key point is the level of the complex insertion onto the skin in relation to medial skin fold, as observed from past results of Asian blepharoplasty. If the medial incision lies above the medial upper lid fold, the crease appears parallel, whereas the incision below the medial

Fig. 2 Variations of the tarsus morphology. The tarsus morphology was categorized into three types: A) Sickle, B) Trapezoid, and C) Triangular.

Table 2. Distribution of the eyelid shapes and the tarsal shapes in n (%)

	Eyelid shapes		
	Nasally tapered	Parallel	Flare
Tarsal shapes			
Sickle	21 (20.8)	8 (7.9)	17 (16.8)
Triangular	8 (7.9)	5 (5)	9 (8.9)
Trapezoid	17 (16.8)	14 (13.9)	2 (2.0)
Total	46 (45.5)	27 (26.7)	28 (27.7)

skin fold would appear as a nasally taper crease. For parallel crease, it is more associated with trapezoid-type tarsus. With trapezoid-type; the upper tarsal border is flat, longer in height and width, and parallel to the lid margin, therefore, the eyelid crease complex is inserted onto the skin higher than medial skin fold and appears parallel. Whereas the nasally taper crease and its variations (with or without merging, lateral flare) seem to have an association with the sickle-type tarsus, due to the tarsal plate are vertically smaller, thus the complex may insert onto the skin lower than the medial skin fold and appear as a nasally taper crease. However, this cannot be concluded as the causative factor as it might be a coincident association. Morphology of the upper eyelids tarsus in Caucasian populations is further needed as the eyelid shapes are typically parallel or semilunar crease. However, further investigations with more advanced techniques are required, with regards to presence of morphologic variations of the eyelid crease and the tarsus in Asians, to permit better analysis of the anatomy of the upper eyelid components.

The values found in the present study may contribute to surgical planning for Asian blepharoplasty in terms of eyelid heights and shapes. The lower skin incision should lie approximately 8-10 mm from the eyelid margin and keep the crease height lower in males to avoid unfavorable feminization. The upper skin incision is usually 2-3 mm from the lower incision. In case of redundant skin which higher incision is needed, the distance from the eyebrow should not be less than 9 mm in men and 12 mm in women. The most natural result of Asian blepharoplasty is approximately 2-3 mm of pretarsal skin height. Post-operative eyelid crease appearance can be estimated regarding the consistent findings observed in the study. The formula is as follows: incisional height (mm) = 6 + desired pretarsal skin height (mm). This formula is true for 48% which can be applied in buried suture technique or incisional technique if minimal skin is resected.

The most natural eyelid crease shape is nasally tapered with merging into the medial skin fold which runs laterally leveled. While a parallel crease gives a more modern look. Shapes of the variable eyelid creases can be achieved by different surgical techniques. For nasally tapered crease without merging, the skin incision is designed to converge down to the medial canthal angle, which ends above the medial punctum. For a "merging type", the incision should converge further beneath the medial skin fold to merge into it. This can be checked by pressing a toothpick or a blunt metallic wire on the skin marking medially and asking the patient to open their eyes to observe the potential crease. For a parallel crease, the medial skin incision lies above the medial skin fold and parallel to the eyelid margin to the lateral end. The medial crease usually terminates above the medial punctum, as performed in conventional blepharoplasty. However, if the patient requests for a more pronounce crease, the crease can extend beyond the punctum but should not go vertically past the medial canthal angle to avoid epicanthal webbing or unnecessary scar. For a lateral flare crease, the lower incision is marked above the lateral canthal angle 1-2 mm higher than the central height, in which a gentle flare of 1 mm is more preferable. Nevertheless, specific height and shape of the new double eyelid crease should be well-defined preoperatively according to individual patient's desire. Also, the ethnic differences and anatomic variations should be accounted for when performing aesthetic eyelid surgery as to maintain a natural ethnic appearance after surgery.

Conclusion

The double eyelids and tarsus present morphologic variations among Asians. Nasally-taper crease with merging into medial skin fold is the most natural. However, specific desire of the new double eyelid fold should be well-defined preoperatively according to individual patient.

What is already known on this topic ?

The normal values and variations in shapes of the double eyelid crease.

What this study adds ?

Tarsal shapes in Asian, in vivo.

The association between the double eyelid shapes and the tarsal shapes.

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Potential conflicts of interest

None.

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รูปแบบต่าง ๆ ของตาสองชั้นและรูปร่าง tarsus ในคนเอเชีย

วรัทพร จันทร์ลลิต

วัตถุประสงค์: *เพื่อศึกษาลักษณะรูปแบบต่าง ๆ ของตาสองชั้นและรูปร่างของ tarsus และหาความสัมพันธ์ระหว่างชั้นตาและ tarsus ในประชากรตาสองชั้น*

วัสดุและวิธีการ: *ทำการประเมินลักษณะรูปแบบต่าง ๆ ของชั้นตาและรูปร่างของ tarsus ในกลุ่มประชากรตาสองชั้นอายุระหว่าง 20-40 ปี*

ผลการศึกษา: *กลุ่มประชากร 101 คน เป็นเพศชาย 50 คนและ เพศหญิง 51 คน ลักษณะชั้นตาที่พบมากที่สุดคือ ด้านในโค้งลงและผสานกับหัวตา (39.6%), รองลงมาเป็นหางตาชี้ขึ้น (27.7%), แบบขนาน (26.7%) และด้านในโค้งลงแต่ไม่ผสานกับหัวตา (5.9%) รูปร่างของ tarsus พบบ่อยที่สุดคือชนิด icklesickle (45.5%) รองลงมาคือชนิด ickletrapezoid (32.7%) และ ickletriangular (21.8%) และพบมีสัมพันธ์ระหว่างรูปแบบของชั้นตาและรูปร่างของ tarsus*

สรุป: *ในกลุ่มประชากรเอเชียตาสองชั้น พบว่าชั้นตาและ tarsus มีรูปร่างหลายลักษณะ การคำนึงถึงลักษณะเฉพาะของแต่ละเชื้อชาติเป็นสิ่งสำคัญในการผ่าตัดศัลยกรรมความงามของเปลือกตา เพื่อให้ผลการผ่าตัดออกมาเป็นธรรมชาติ*