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Revisiting Anchor Epicanthoplasty in Mild to Moderate Asian Epicanthal Folds: A Clinicopathological Study

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Abstract

Background To assess the epicanthal fold (EF), eyelid, eyebrow, scar, and patients' satisfaction after anchor epicanthoplasty and upper blepharoplasty and histopathologically compare Asian epicanthal fold skin with non-Asian counterpart.

Methods Asian Iranians with grade 2 and 3 EF were included. Photographs were taken before and at least 12 months after the surgery. Photoanalysis included EF grade, inter-canthal distance (ICD), margin reflex distance 1 (MRD1), tarsal plate show (TPS), brow fat span (BFS), and eyebrow height. Manchester scar scale score (5–28) and patients' satisfaction score (0–100) were documented. The most medial skin of 5 Asian and 5 non-Asian subjects was histologically compared for the thickness and elastic fiber density and morphology.

Results Included were 89 patients (178 eyelids) with a mean age of 31.6 years and follow-up of 13.1 months. Mean ICD significantly decreased by 3.5 mm (shortening ratio of 9.7%). All grade 2 and almost half of the grade 3 EF disappeared. Significant postoperative increase in mean MRD1 (0.3 mm) and TPS (1.1–1.4 mm) and decrease in BFS (3.3–3.6 mm) and eyebrow height (1.7–3.4 mm) were

observed. Revision rate of epicanthoplasty was 7.3%. Mean satisfaction and scar scores were 97.1 and 5.4, respectively. Histopathologically, Asian and non-Asian medial upper eyelid skin was not significantly different.

Conclusion Anchor epicanthoplasty eliminated grade 2 and improved grade 3 EF with a high satisfaction and negligible scar. Simultaneous upper blepharoplasty significantly increased MRD1 and TPS and decreased eyebrow height. EF skin was not histologically different from non-Asians.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

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Introduction

In comparison with Caucasians, Asian upper eyelids are characterized by the lack of an upper eyelid crease, more preaponeurotic fat, laxity of pretarsal skin, the extension of preaponeurotic fat into pretarsal space, and a medial epicanthal fold [1]. Severity of the epicanthal fold could be categorized as grade 1 (no epicanthal fold), grade 2 (partially covering the caruncle), grade 3 (totally covering the caruncle), and grade 4 (reverse epicanthal fold with congruent upper and lower lid connection) (Fig. 1) [2]. Asian double eyelid plasty (crease formation and upper blepharoplasty) and epicanthoplasty procedures are mostly performed simultaneously [3].
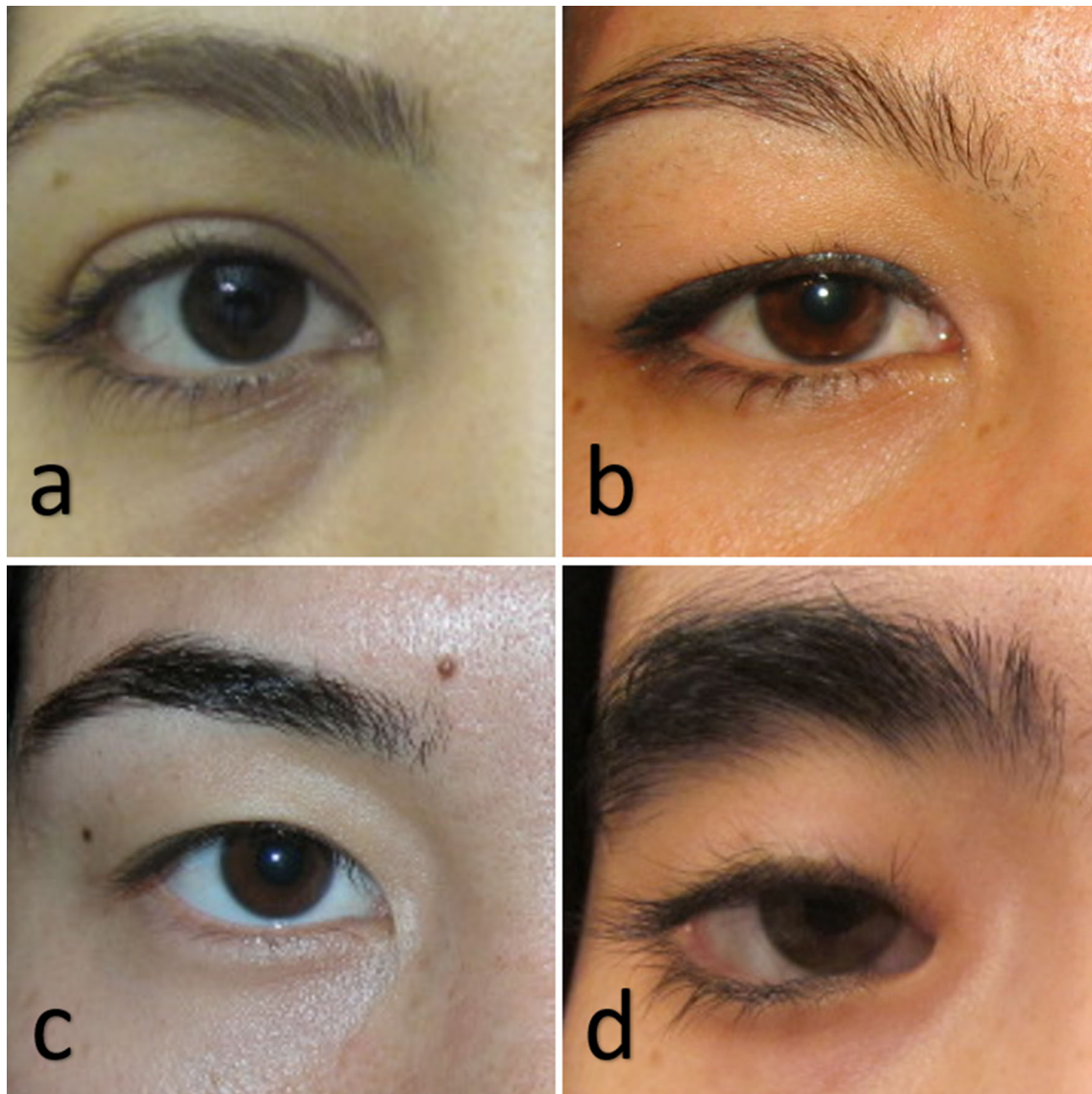
Fig. 1 Different severity grades of medial epicanthal fold which was used in this study. **a** No epicanthal fold (grade 1), **b** caruncle is partially covered by epicanthal fold (grade 2), **c** caruncle is entirely covered by epicanthal fold (grade 3), **d** reverse epicanthal fold with congruent upper and lower lid connection (grade 4)

Different techniques for medial epicanthoplasty generally fall into two groups of external and internal. External epicanthoplasty [3–5] is performed through different forms of skin incisions on the side of the nose which mostly results in disappearance of the epicanthal fold and skin scar. On the other hand, internal epicanthoplasty [6–9] is addressing the epicanthal fold through medially extended upper blepharoplasty incision which leads to improvement in the epicanthal fold with no skin scar. The anchor type of epicanthoplasty was introduced by Lee et al. [6] in 2000 which included re-draping of the skin, removal of preseptal orbicularis oculi muscle and superficial part of medial canthal ligament, tight anchoring the medial skin to the deep tissue, and augmented rhinoplasty in some of the patients.

Most of the Asian Iranians are living in the east and northeast part of the country. They have a mixed genetic background of Persian with either central Asian population (Turkish tribes, the Seljuk) or the Mongols. Since Western Asian subjects (e.g., Asian Iranian) have milder form of Asian facial characteristics than Eastern Asians [3–5, 10, 11], anchor epicanthoplasty has been our preferred technique in all grade 2 and majority of grade 3 epicanthal folds even though none of our patients required and had augmented rhinoplasty. The first aim of this study was to report the results of anchor epicanthoplasty and upper blepharoplasty in Asian Iranian subjects based on

photoanalysis changes in the grade of epicanthal fold, intercanthal distance (ICD), tarsal plate show (TPS), brow fat span (BFS), eyebrow height, eyelid skin scar score, and patients' satisfaction score. To the best of our knowledge, this is the first study assessing all the medial canthal, eyelid, eyebrow, skin scar, and satisfaction parameters simultaneously.

Furthermore, looking for the underlying presumed causes of epicanthal fold, a few studies on cadaver specimens from the medial upper eyelid myocutaneous tissue have reported the role of preseptal orbicularis oculi muscle, subcutaneous fibrous tissue, and superficial fibers of medial canthal ligament in development of epicanthal fold [5, 6, 12, 13]. On the other hand, Kakizaki and associates [14] assessed the elastic fiber density and morphology in Asian upper eyelid and concluded that thinner eyelid skin comprised of small amount of normal elastic fibers which multiplied and fragmented in the area with thicker skin. Such an observation raises a question if the epicanthal fold skin (medial upper eyelid) thickness and elastic fiber density and morphology are different from their age-matched non-Asian counterparts. This has not been studied previously and was the second aim of this study.

Patients and Methods

The clinical part of this study was a retrospective interventional case series (January 2007–January 2017) of Asian Iranian subjects with grade 2 and 3 epicanthal folds who had undergone anchor epicanthoplasty and Asian upper blepharoplasty procedure by one surgeon (MBK) with at least 12-month follow-up time. Participants with systemic diseases interfering with a normal healing process, previous facial trauma and surgery, simultaneous eyebrow lifting, prior ptosis repair, and incomplete follow-up were excluded.

Informed consent (for the procedure and publishing the face photos) and ethic committee approval (IUMS.1395.9311216028) were obtained and the study adhered to the tenets of the Declaration of Helsinki.

Anchor epicanthoplasty and radiofrequency-assisted upper blepharoplasty [15, 16] were performed under local anesthesia by the senior author (MBK). After crease (based on tarsal plate height) and excess skin marking, the medial marking was extended 5–6 mm medial to the upper punctum into the epicanthal fold bridge (see Video, Supplemental Digital Content 1, which demonstrates how to mark the new crease). After injection local anesthesia (lidocaine + marcaine + adrenalin 1/200,000), radiofrequency tip (Surgitron Dual Frequency 120 Watts, Ellman International Inc., Hewlett, NY, USA) was used to remove the myocutaneous flap (5–7 mm) up to the upper punctum

where Westcott scissor was used in order to avoid possible heat injury to the canaliculus (see Video, Supplemental Digital Content 1, which demonstrates flap excision by radiofrequency needle and then Westcott scissor). A 2-mm strip of pretarsal orbicularis oculi muscle was horizontally removed at the superior tarsal border in order to expose the levator aponeurosis (see Video, Supplemental Digital Content 1, which demonstrates how to expose the superior tarsal levator aponeurosis). Medial and preaponeurotic fat was partially removed. Medial epicanthal fold skin was pulled up by a skin hook, and preseptal orbicularis oculi fibers as well as superficial fibers of medial canthal tendon were gently dissected and excised underneath the fold (see Video, Supplemental Digital Content 1, which demonstrates deep tissue removal beneath the epicanthal fold). Intraoperative probing of the upper canaliculus was occasionally performed to avoid upper lacrimal canalicular damage during the tissue dissection. Anchoring of medial skin to the deeper tissue and eyelid crease formation were performed using 6–0 nylon suture (see Video, Supplemental Digital Content 1, which demonstrates medial anchoring and crease reformation). Small lagophthalmos was aimed at the end of the procedure (see Video, Supplemental Digital Content 1, which demonstrates the amount of lagophthalmos at the end).

No eyelid dressing was used. Postoperative medications and instructions included cold compress (first 2–3 days), warm compress (next 2–3 days), topical antibiotic and steroid ointments (5–7 days), and scar healing (Stratpharma, Basel, Switzerland) silicone gel (after suture removal for 6 months). Follow-up visits were one day after surgery for the eye examination and assessment of the hematoma, 5–7 days to remove the skin sutures and examine the ocular surface, 6–8 weeks to assess wound healing, and at least 12 months to take the photographs, score the scar, and obtain the subjects' satisfaction.

Postoperative complications, Manchester scar scale score (MSSS, 5–28) [17] of the incision site, and patients' satisfaction score (0–100) [18] on just epicanthoplasty procedure were documented. MSSS was recorded by the surgeon based on the wound color, surface, contour, distortion, texture, and visual analog score at the last follow-up time (Table 1). At the same time, subjects were asked to put a cross-mark on a ruler of 0–10 scale (visual analog score, VAS) expressing their satisfaction toward the epicanthoplasty (0: lowest, 10: highest). Each unit was divided into ten subunits, and the VAS was recorded in a 100 scale score.

All the photographs were taken by the surgeon before and at least 12 months after the surgery. The images were captured with the patient's head oriented to Frankfort horizontal plane, eyes fully opened, pupils in midline gaze, no smile, and lips gently closed using the same camera

Table 1 Manchester scar scale score for assessment of the epicanthoplasty and eyelid scar

Scar features	Grading	Score
Color	Perfect	1
	Slight mismatch	2
	Obvious mismatch	3
	Gross mismatch	4
Surface	Matte	1
	Shiny	2
Contour	Flush with surrounding skin	1
	Slightly proud/indented	2
	Hypertrophy	3
	Keloid	4
Distortion	None	1
	Mild	2
	Moderate	3
	Severe	4
Texture	Normal	1
	Just palpable	2
	Firm	3
	Hard	4
Visual analogue scale	–	$0 \leq score \leq 10$

Each scar feature is assessed and assigned a score. A global assessment of the scar is also made by placing a vertical mark on a 10-cm visual analogue scale line to represent the scar (0; excellent- 10; worst). The summation of these scores (range: 5–28) then forms the overall scar score

(Canon Power Shot G11, Melville, New York). Photo-analysis was performed by a masked observer (HE). The images were firstly made uniform in terms of the resolution and size using Adobe Photoshop CC software (Adobe System Inc., Mountain View, Calif. 2017). In order to make the photographs comparable, white-to-white corneal diameter of an individual image was measured by counting the number of pixels and a value of 11.65 mm was assigned to the pixel length according to the average white-to-white diameter of the Iranian population [19] (Fig. 2a). Next, 11 landmarks (Fig. 2b) on the preoperative (Fig. 2c) and postoperative (Fig. 2d) photographs were measured in millimeter (mm). Tarsal plate show (TPS), brow fat span (BFS), and upper eyelid margin to superior brow distance were measured at three sites (lateral, mid, medial) (Fig. 2b). Margin reflex distance 1 (MRD1) was also recorded. Central eyebrow height was defined as sum of the MRD1 and eyelid to superior eyebrow distance in order to adjust for possible postoperative MRD1 change. Lateral and medial eyebrow height were considered as upper eyelid margin to superior brow distance at the lateral and medial canthal angle (Fig. 2b). Inter-canthal distance (ICD) and epicanthal fold grade were documented, and the "decreasing ratio" was calculated as (*preoperative ICD— postoperative ICD) preoperative ICD × 100*). Each parameter was measured three times, and the average was recorded.

Histopathology

This was a prospective comparative study in which the most medial right upper eyelid skin (epicanthal fold) of five Asian Iranian, non-smokers, females (18–40 years old) with grade 3 epicanthal fold was compared to five non-Asian age-matched counterparts. Excluded were prior trauma or surgery, systemic disease, and being on medications.

Medial section of the upper eyelid flap (medial limbus to medial canthal angle) was marked before the local anesthetic injection (Fig. 3a). After excision of the upper eyelid skin, the medial section was separated, marked (medially by 6–0 nylon and inferiorly by 6–0 vicryl suture), pinned flat on a sterile wooden applicator (Fig. 3b), put in a formaldehyde 10% solution bottle, coded, and submitted for histological examination by a masked pathologist. The most medial part of the flap was histopathologically assessed in the superior, mid-, and inferior margins (Fig. 3c). Epidermal, dermal, and total skin thicknesses (in micrometers) were recorded using hematoxylin–eosin (H&E) staining and light microscopy (Nikon, Japan). Elastic fiber density was measured by counting the number of elastin fibrils per 20 collagen fibers in Verhoff Von Gieson stained sections. The average of 3 measurements was recorded. Elastic fiber morphology was also assessed and recorded.

Fig. 2 a White-to-white horizontal corneal diameter, **b** eyelid margin to superior brow distance at lateral canthal angle (1), mid-pupil (2), and medial canthal angle (3). Brow fat span at the point between LCA and lateral limbus (4), mid-pupil (5), and lateral to caruncle (6). Tarsal plate show (TPS) at the point between LCA and lateral limbus (7), mid-pupil (8), and lateral to caruncle (9). Margin reflex distance 1 or MRD1 (10). Inter-canthal distance (11). Measurements were performed before (**c**) and after (**d**) anchor epicanthoplasty and upper blepharoplasty procedure in 89 Asian Iranian subjects
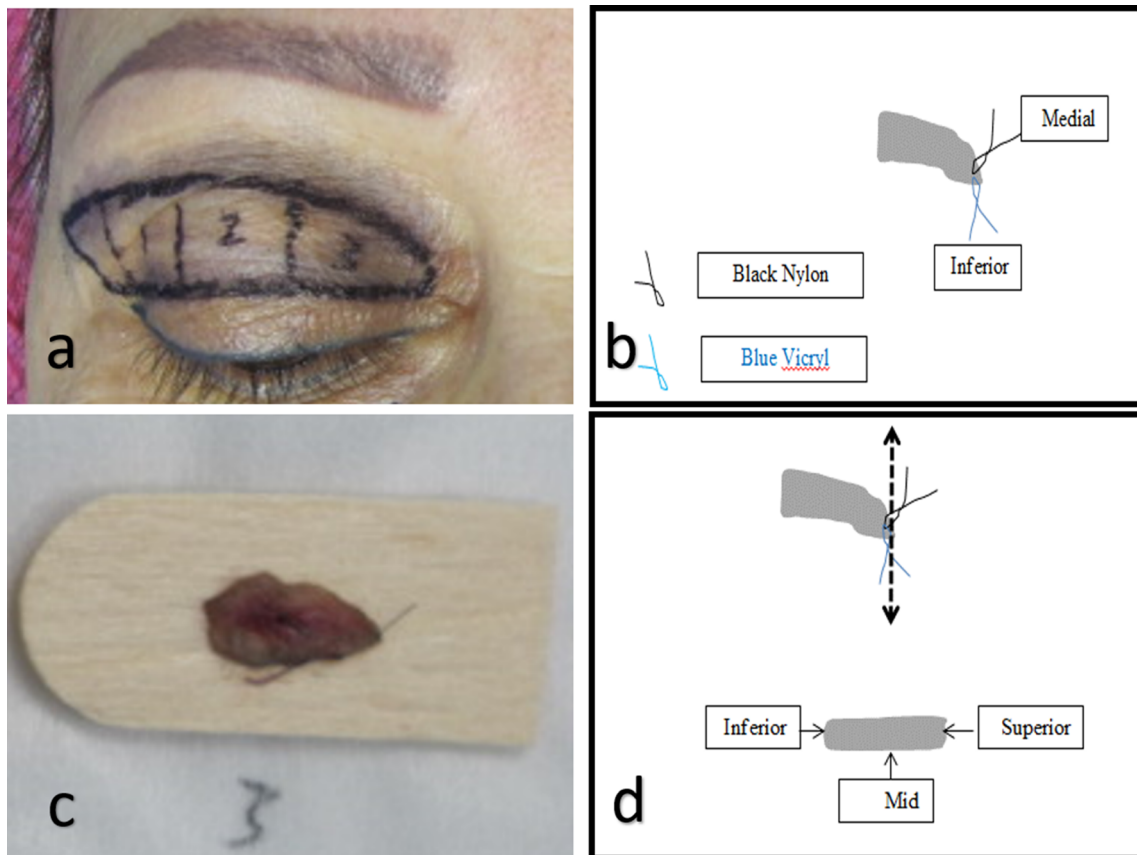

Fig. 3 Upper eyelid marking (**a**), excision of the medial segment of the upper eyelid skin, and marking with different sutures at 3 points (**b**), and pinning the specimen flat on a sterile wooden applicator (**c**) before sending for histopathological examination. The most medial part of the specimen at three margins (superior, mid, inferior) was histologically examined (**d**) in five Asian and five non-Asian Iranian subjects

Primary outcome measures were the postoperative change in epicanthal fold, eyelid, and eyebrow as well as histopathological comparison of the two groups. The secondary outcome measures were the final incision scar and patients' satisfaction.

Statistical Analysis

All the data were entered with the SPSS for window version 25 (IBM corporation, Armonk, New York, USA). Wilcoxon signed-rank test was used to assess the changes in MRD1, TPS, BFS, eyebrow height, ICD, and the grade of epicanthal fold. At the eyelid level, patients' satisfaction score was evaluated using generalized estimating equation (GEE) linear models to adjust for the inter-correlation between two eyelids from the same patient. Two-way repeated measure mixed model ANOVA was used to analyze the postoperative ICD changes between two grades of epicanthal folds. Mann–Whitney for intergroup comparison and Friedman test for intragroup comparison were performed for the histopathological analysis. Results were considered significant at $P < 0.05$.

Results

Initially, 118 patients were enrolled. After excluding 12 patients with incomplete follow-up, 11 with simultaneous eyebrow lift, and 6 patients with simultaneous ptosis repair, 89 patients (178 eyelids) with a mean age of 31.6 years (SD = 5.4, range: 22–45) and mean follow-up time of 13.1 (SD = 2.4, range: 12–25) months were included. The majority were females (77/89, 86.5%).

Significant postoperative increase in TPS and decrease in BFS and eyebrow height were observed in all 3 sites, especially at the medial site (Table 2). Mean ICD was significantly decreased by 3.5 mm (SD = 2.3) (Table 2). The mean ICD shortening ratio was 9.7% (SD = 6.04) with a range of 1.2% to 24.7%. A significant increase in mean MRD1 was also observed (Table 2).

Preoperative grade 2 and 3 epicanthal fold was observed in 74.2% (132/178) and 25.8% (46/178) of the eyelids, respectively (Table 2). They were changed into grade 1 in 86% (153/178) and grade 2 in 14% (25/178) (Table 2). All grade 2 epicanthal fold disappeared postoperatively (Fig. 4a, b). Anchor epicanthoplasty, however, resulted in disappearance of grade 3 epicanthal fold (Fig. 4c, d) in almost half of them (21/46, 45.6%) and improvement in the rest (Fig. 4e, f). The preoperative ICD of patients with preoperative grade 3 and 2 was 35.50 (SD = 5.18) and 34.43 (SD = 3.11), respectively, which decreased to 31.89 (SD = 4.87) and 31.16 (SD = 2.41). The difference was not significant (P = 0.5). Remained epicanthal fold was the concern in 7.3% (13/178) of the subjects which was repaired using z-epicanthoplasty. Otherwise, no complications were observed. The mean eyelid scar score was (5.4, SD = 0.7, range = 5–8). There was a high mean satisfaction score (97.1, SD = 4.6) toward the epicanthoplasty procedure. Multivariate analysis of all the postoperative changes in the eyelid, eyebrow, and epicanthal fold showed that the change in epicanthal fold grade (B coefficient: -8.23; 95% CI: −11.68 to −4.78, $P < 0.001$) was the only significant factor affecting the satisfaction score.

Histopathology

Asian and non-Asian groups were not significantly different in all the histological examinations (Table 3). The variables were not significantly different within each group either (Table 3).

Discussion

Exact origin of epicanthal fold is not clear. However, some [5–7] has shown that insertion of superficial fibers of medial canthal ligament and preseptal orbicularis oculi muscle fibers running through the fold is responsible for development of the epicanthal fold. This is the foundation for internal epicanthoplasty procedure. There have been 4 publications on internal epicanthoplasty procedure since 1989. It was firstly introduced as "deep tissue approach epicanthoplasty" (1989) [9] which led to a good result in 9 out of 10 patients. "Anchor epicanthoplasty" (2000) [6] included extending the medial upper blepharoplasty incisions over the epicanthal fold bridge, removal of preseptal orbicularis oculi and superficial fibers of the medial canthal ligament, and tight anchoring the skin to the deeper tissue as well as augmented rhinoplasty in almost half of the cases. It was performed on 67 subjects in whom a revision epicanthoplasty was required in 11 patients [16]. "Subcutaneous epicanthoplasty" (2002) [7] was the same as anchor epicanthoplasty without extending the blepharoplasty incisions medially. It was performed on 38 patients and resulted in some undercorrection but no request for revision [7]. "Scarless epicanthoplasty" (2016) [8], with almost the same technique as previous three publications, was performed on 252 patients with and without blepharoplasty which led to a significant decrease in ICD as well as high satisfaction with no complication and revision. None of prior four studies have quantitatively assessed postoperative change in eyelid, eyebrow, epicanthal fold grade, ICD, scar, and satisfaction simultaneously. We believe that all the four previous publications and our technique have been following the same principles of sub-epicanthal fold tissue removal and deep tissue anchoring of

Table 2 Changes in eyelid and eyebrow parameters after upper blepharoplasty and anchor epicanthoplasty in 89 (178 eyelids) Asian Iranian subjects

		Preoperative mean (SD)	Postoperative mean (SD)	Postoperative change mean (SD)	P-value[a]
Tarsal plate Show[b]	Lateral	3.13 (1.01)	4.25 (0.91)	1.11 (1.16)	< 0.001
	Central	1.93 (0.88)	3.17 (0.74)	1.24 (0.98)	< 0.001
	Medial	1.69 (1.38)	3.17 (0.74)	1.48 (1.44)	< 0.001
Brow fat Span[b]	Lateral	19.75 (2.65)	16.39 (2.68)	−3.36 (2.80)	< 0.001
	Central	17.41 (2.75)	13.89 (2.49)	−3.52 (2.98)	< 0.001
	Medial	19.62 (3.52)	15.98 (3.13)	−3.64 (3.57)	< 0.001
Eyebrow height[c]	Lateral	25.81 (3.16)	23.91 (3.59)	−1.90 (3.92)	< 0.001
	Central	23.01 (3.24)	21.27 (3.01)	−1.74 (4.13)	< 0.001
	Medial	26.73 (4.08)	23.33 (3.45)	−3.40 (4.83)	< 0.001
Margin reflex distance 1 (MRD1)		3.92 (1.07)	4.21 (0.94)	0.29 (1.13)	< 0.001
Inter canthal distance		35.22 (4.74)	31.70 (4.37)	−3.52 (2.36)	< 0.001
Epicanthal fold grade	Mean (SD)	2.56 (0.44)	1.14 (0.35)	−1.11 (0.32)	< 0.001
	1	–	86.0% (153/178)	–	< 0.001
	2	74.2% (132/178)	14.0% (25/178)	–	
	3	25.8% (46/178)	–	–	

[a]Wilcoxon signed-rank test

[b]The point between lateral canthal angle and lateral limbus (lateral), mid-pupil (central), and lateral to caruncle (medial)

[c]Eyelid margin to superior brow distance at lateral canthal angle (lateral) and medial angle (medial). Eyelid margin to superior brow distance + MRD1 (central)

Fig. 4 Anchor epicanthoplasty and upper blepharoplasty resulted in the disappearance of grade 2 (**a**, **b**) epicanthal fold. Grade 3 epicanthal fold, however, either disappeared (**c**, **d**) or improved to grade 2 (**e**, **f**)

Table 3 Histopathological Comparison between 5 Asians and 5 non-Asians medial upper eyelid skin after upper blepharoplasty and anchor epicanthoplasty (in Asian eyelids)

Variables	Asian		Non-Asian		P-value for intergroup comparison[b]
	Median (range)	P-value for intragroup comparison[a]	Median (range)	P-value for intragroup comparison	
Age (year)	24 (20–35)	–	34 (30–38)	–	0.1
Epidermal thickness (μm)					
Inferior	53.5 (27–66)	1.00	60 (38–79)	0.4[b]	0.3
Middle	47.6 (44–48)		56 (42–80)		0.9
Superior	51.3 (39–64)		61 (44–94)		0.1
Dermal thickness (μm)					
Inferior	416 (302–663)	0.8	570 (425–612)	0.5[b]	0.3
Middle	442 (283–600)		492 (210–697)		0.6
Superior	470 (358–664)		467 (229–650)		0.8
Skin thickness (μm)					
Inferior	481 (355–728)	0.8	625 (473–672)	0.5[b]	0.3
Middle	489 (328–680)		543 (253–776)		0.6
Superior	523 (396–710)		528 (273–706)		1.00
Elastic fiber density					
Inferior	20 (10–25)	0.8	11 (7–19)	0.8[b]	0.1
Middle	13 (9–22)		14 (7–20)		0.7
Superior	15 (8–22)		13 (6–20)		0.2
Elastic fiber morphology (% of normal fibers)					
Inferior	60% (3/5)	–	8% (4/5)	–	1.00[c]
Middle	60% (3/5)		60% (3/5)		1.00[c]
Superior	80% (4/5)		60% (3/5)		1.00[c]

[a]Friedman test

[b]Mann–Whitney U test

[c]Fisher's exact test

the epicanthal skin. Such a technique (see Video, Supplemental Digital Content 1, which demonstrates the technique in four steps) resulted in significant improvement in epicanthal fold (at least one grade) and shortening of ICD (Table 2) with a high satisfaction, negligible scar, and revision rate of 7.3% in our series of 89 patients. Therefore, it could be recommended as the preferred technique in all grade 2 epicanthal folds. It could also be recommended to the subjects with grade 3 epicanthal folds who are concerned about the incision and scar of external epicanthoplasty or do not request complete disappearance of the epicanthal fold. In fact, since Asian Iranians are living as minority in Iran, they mostly compare themselves with the majority of Iranians who do not have Asian facial characteristics and therefore seek for improvement or disappearance of epicanthal fold. However, change in facial appearance after removing the epicanthal fold should be preoperatively counseled properly in order to find out who

would like to keep the epicanthal fold during the upper blepharoplasty procedure.

Although subjects had been asked to score their satisfaction on just epicanthoplasty procedure, other postoperative eyelid and eyebrow changes could have potentially affected the satisfaction. Therefore, multivariate analysis was performed in which epicanthal fold grade improvement was, in fact, the only significant variable affecting the satisfaction score. Disadvantages of anchor epicanthoplasty could be inability to eliminate grade ≥ 3 of epicanthal fold, possible damage to the lacrimal canaliculus during the tissue removal, and steep learning curve for proper anchoring of the skin into the deep tissue.

Furthermore, simultaneous Asian upper blepharoplasty procedure resulted in a significant increase in TPS and consequently decrease in BFS (Table 2). MRD1 was also significantly increased by mean 0.29 mm (Table 2). Similarly, Nakra et al. [20] reported an 0.7 mm increase in MRD1 after upper blepharoplasty. Effect of upper

blepharoplasty procedure (Asian or non-Asian) on the eyebrow position has been controversial. Kim et al. [21] reported that Asian upper blepharoplasty led to decreased frontalis muscle activity on electromyography record, even though eyebrow height did not clinically change. On the other hand, a study on younger Korean patients with Asian upper blepharoplasty showed a postoperative eyebrow descend [22]. Kashkouli et al. [23] did a literature review on eyebrow position after upper blepharoplasty and concluded that controversy on postoperative eyebrow change is mainly rooting from the type of procedure, amount of skin excision, frontalis muscle function, associated blepharoptosis, and age. Therefore, it is very difficult to predict the eyebrow change after upper blepharoplasty procedure. Asian upper blepharoplasty on 89 patients led to a postoperative descend of eyebrow in our series (Table 2).

Histopathology

Preseptal orbicularis oculi muscle and superficial fibers of medial canthal ligament attachments as well as fibrous core are the main reasons for development of epicanthal fold in different cadaver dissections and histological examinations [5, 6, 12, 13]. On the other hand, Kakizaki et al. [9] reported a different elastic fiber density and morphology in different skin thicknesses of Asian eyelids. Such an observation raised a question if Asian medial canthal skin thickness and elastic fiber density and morphology are different from their non-Asian counterparts. Therefore, we histopathologically compared five Asian and five age-matched non-Asian female medial canthal skin and found no significant difference in skin thickness, elastic fiber density, and morphology. Such an observation shows that skin thickness and elastic composition do not play role in development of epicanthal fold. Although this is the first study on comparing elastic fiber density and morphology as well as skin thickness of the Asian epicanthal fold skin with non-Asian counterparts, a strong conclusion cannot be made due to low number of histopathological specimens.

In conclusion, anchor epicanthoplasty procedure eliminated grade 2 and improved grade 3 epicanthal fold in Asian Iranian subjects with a high patients' satisfaction, negligible scar, and revision rate of 7.3%. Simultaneous Asian upper blepharoplasty procedure significantly increased mean postoperative MRD1 by 0.3 mm and TPS by 1.1–1.4 mm (more at the medial site). It also resulted in a mean postoperative eyebrow descent of 1.7–3.4 mm (more at the medial site). The most medial upper eyelid skin elastic fiber density, elastic fiber morphology, and skin thickness were not significantly different between the Asian and non-Asian subjects on histopathological examination.

References

1. Jeong S, Lemke BN, Dortzbach RK, Park YG, Kang HK (1999) The asian upper eyelid: an anatomical study with comparison to the caucasian eyelid. Arch Ophthalmol 117:907–912
2. Lai C-S, Lai C-H, Wu Y-C, Chang KP, Lee SS, Lin SD (2012) Medial epicanthoplasty based on anatomic variations. J Plast Reconstructive Aesth Surg 65:1182–1187
3. Wu S, Guo K, Xiao P, Sun J (2018) Modifications of Z-epicanthoplasty combined with double-eyelid blepharoplasty in Asians. Aesth Plast Surg 42:226–233
4. Zhang S, Xue HY (2018) Adjustable V-flap epicanthoplasty based on desired eyelid morphology. Aesth Plast Surg 42:1571–1575
5. Liu Y, Lei M, Wang Y, Mu X (2012) Lazy S-curve epicanthoplasty in Asian blepharoplasty. Aesth Plastic Surg 36:254–260
6. Lee Y, Lee E, Park WJ (2000) Anchor epicanthoplasty combined with out-fold type double eyelidplasty for Asians: do we have to make an additional scar to correct the Asian epicanthal fold? Plast Reconstr Surg 105:1872–1880
7. Yen MT, Jordan DR, Anderson RL (2002) No-scar Asian epicanthoplasty: a subcutaneous approach. Ophthalmic Plast Reconstr Surg 18:40–44
8. Ni F, Luo S, Yu D, Zhu Y, Shang Y, Chen Y, Xu Y, Wang Q, Hao L (2016) Scarless epicanthoplasty and concomitant double eyelidplasty in Chinese eyelids. Aesth Plastic Surg 40:840–845
9. Jordan DR, Anderson RL (1989) Epicanthal folds. A deep tissue approach Arch Ophthalmol 107:1532–1535
10. Farkas LG, Katic MJ, Forrest CR, lt KW, Bagic I, Baltadjiev G, Cunha E, Cvicelová M, Davies S, Erasmus I, Gillett-Netting R, Hajnis K, Kemkes-Grottenthaler A, Khomyakova I, Kumi A, Kgamphe JS, Kayo-daigo N, Le T, Malinowski A, Negasheva M, Manolis S, Ogetürk M, Parvizrad R, Rösing F, Sahu P, Sforza C, Sivkov S, Sultanova N, Tomazo-Ravnik T, Tóth G, Uzun A, Yahia E, (2005) International anthropometric study of facial morphology in various ethnic groups/races. J Craniofac Surg 16:615–646
11. Kashkouli MB, Abdolalizadeh P, Abolfathzadeh N, Sianati H, Sharepour M, Hadi Y (2017) Periorbital facial rejuvenation; applied anatomy and pre-operative assessment. J Curr Ophthalmol 29:154–168
12. Park JW, Hwang K (2016) Anatomy and histology of an epicanthal fold. J Craniofac Surg 27:1101–1103
13. Yamamoto H, Morikawa K, Uchinuma E, Yamashina S (2001) An anatomical study of the medial canthus using a three-dimensional model. Aesth Plast Surg 25:189–193
14. Kakizaki H, Takahashi Y, Nakano T, Ikeda H, Selva D, Leibovitch I (2011) The distribution of elastic fibers in the Asian upper eyelid skin. Ophthal Plast Reconstr Surg 27:201–203

15. Kashkouli MB, Jamshidian-Tehrani M, Sharzad S, Sanjari MS (2015) Upper blepharoplasty and lateral wound dehiscence. Middle East Afr J Ophthalmol 22:452–456

16. Kashkouli MB, Kaghazkanai R, Mirzaie AZ, Hashemi M, Parvaresh MM, Sasani L (2008) Clinicopathologic comparison of radiofrequency versus scalpel incision for upper blepharoplasty. Ophthal Plast Reconstr Surg 24:450–453

17. Beausang E, Floyd H, Dunn KW, Orton CI, Ferguson MW (1998) A new quantitative scale for clinical scar assessment. Plast Reconstr Surg 102:1954–1961

18. Kashkouli MB, Pakdel F, Kiavash V, Ghiasian L, Heirati A, Jamshidian-Tehrani M (2013) Transconjunctival lower blepharoplasty: a 2-sided assessment of results and subjects' satisfaction. Ophthalmic Plastic Reconstructive Surg 29:249–255

19. Gharaee H, Abrishami M, Shafiee M, Ehsaei A (2014) White-to-white corneal diameter: normal values in healthy Iranian population obtained with the Orbscan II. Int J Ophthalmol 7:309–312

20. Nakra T, Modjtahedi S, Vrcek I, Mancini R, Saulny S, Goldberg RA (2016) The effect of upper eyelid blepharoplasty on eyelid and brow position. Orbit 35:324–327

21. Kim D, Son D, Kim M, Harijan A, Yang S, Lee S (2015) Does upper blepharoplasty affect frontalis tonicity? J Plast Reconstr Aesthet Surg 68:638–644

22. Kim SS (2013) Effects in the upper face of far east Asians after Oriental blepharoplasty: a scientific perspective on why Oriental blepharoplasty is essential. Aesth Plast Surg 37:863–868

23. Kashkouli MB, AbolfathZadeh N, Abdolalizadeh P, Sianati H, Karimi N (2017) Upper blepharoplasty and eyebrow position. Expert Rev Ophthalmol 12:251–259