Original Article

Preoperative Eyelid and Eyebrow Asymmetry: A Potential Pre-Operation Inform Consent Option: A Descriptive Cross-Sectional Study

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ABSTRACT

Background: We aimed to determine the prevalence of pre-existing asymmetry in our patients and investigate the impact of age and sex on upper facial asymmetry.

Methods: We collected images from 155 patients who were undergoing upper eyelid blepharoplasty and MRD1 (marginal reflex distance 1), TPS (tarsal plate show), and BFS (brow fat span) measurements were extracted by ImageJ software. The relationship between asymmetry and age and gender was assessed by comparing the mean differences of these metrics. A generalized linear model (GLM) was used to compare the outcomes of the study. P-value < 0.05 was considered significantly different in all tests.

Results: Pre-operative asymmetry was present in 112 (72%) patients. Among the cases, 61 (39%), 40 (26%), and 24 (15.5%) patients had more than 1mm of asymmetry in BFS, TPS, and MRD1, respectively. Males under 50 years old had the most asymmetry in the preorbital area. Comparing men under 50 years old with the other groups showed that the mean ± SD of absolute differences of TPS was significantly higher in this group (all P< 0.00), but pairwise comparison for MRD1 and BFS indicated no significant correlation between age, gender, and the mean asymmetry of these parameters (overall test P = 0.70 for MDR1 and P = 0.45 for BFS).

Conclusion: Most patients have asymmetry before surgery without being aware of it. Awareness of this asymmetry and the relationship between facial asymmetry and age and gender is essential to prevent dissatisfaction due to the probable post-operative asymmetry and unrealistic expectations.

KEYWORDS
Asymmetry; Blepharoptosis; Blepharoplasty

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INTRODUCTION

Upper eyelid blepharoplasty is a surgical procedure that is performed on the upper eyelid when acquired or congenital etiologies make it fall on the cornea and cause blepharoptosis[1]. An accurate evaluation of eyelid and eyebrow position can offer valuable guidance for blepharoplasty surgical strategizing and monitoring of postoperative outcomes.

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Marginal reflex distance is the most commonly used metric for these purposes[2].

Marginal reflex distance 1 (MRD1) is the distance between the corneal light reflex and the center of the upper eyelid margin. Moreover, it is imperative to incorporate eyebrow findings during the preoperative assessment as eyebrows and eyelids possess an interconnected relationship, and interventions targeting one of them can affect the other one[3]. Tarsal plate show (TPS), the upper eyelid margin-to-crease distance, and brow fat span (BFS), the distance between the upper eyelid crease and the upper border of the brow, are two upper facial parameters that are useful for a more precise examination of this area (Figure 1).

Although the relationship between beauty and symmetry is not established yet[4], post-operative asymmetry is a common complication of blepharoplasty that may require additional procedures[5]. Therefore, preventive measures should be taken to avoid this unsatisfactory outcome. Preoperative asymmetry may contribute to this complication. However, hardly any articles recommend informing patients of their pre-existing asymmetry before the surgery[6-8]. In addition, age and gender related changes in the soft tissues of the face lead to the occurrence and change of facial asymmetry. Although there have been studies on the association of aging and gender on the facial asymmetry, these studies are limited and inconclusive[9-12].

In this study, we conducted preoperative measurements of MRD1, TPS, and BFS and evaluated the asymmetry of each criterion between the right and the left sides. Furthermore, we compared the severity of asymmetry between different groups of participants based on gender and age category to address the effect of these variables on asymmetry.

MATERIALS AND METHOD

This cross-sectional study was conducted among all patients who were referred to the Plastic Surgery Department of Namazi Hospital, Shiraz, Iran between October 2020 and March 2022 for aesthetic upper eyelid blepharoplasty due to a documented diagnosis of blepharoptosis. The patients' data including age, and sex were recorded. The exclusion criteria were if they had obvious eyelid inflammation and swelling, previous eyelid surgery, eyelid trauma, and deformity due to systemic diseases such as thyroid disorders.

Informed consent forms were filled out by all the patients who participated in our study. This study has been reviewed and approved by the Medical Ethics Committee of Shiraz University of Medical Sciences (approval number: IR.SUMS.MED.REC.1398.018).

Standard frontal plane primary gaze photographs of patients were collected and scanned before the surgery, then with Photoshop 7 software (Adobe

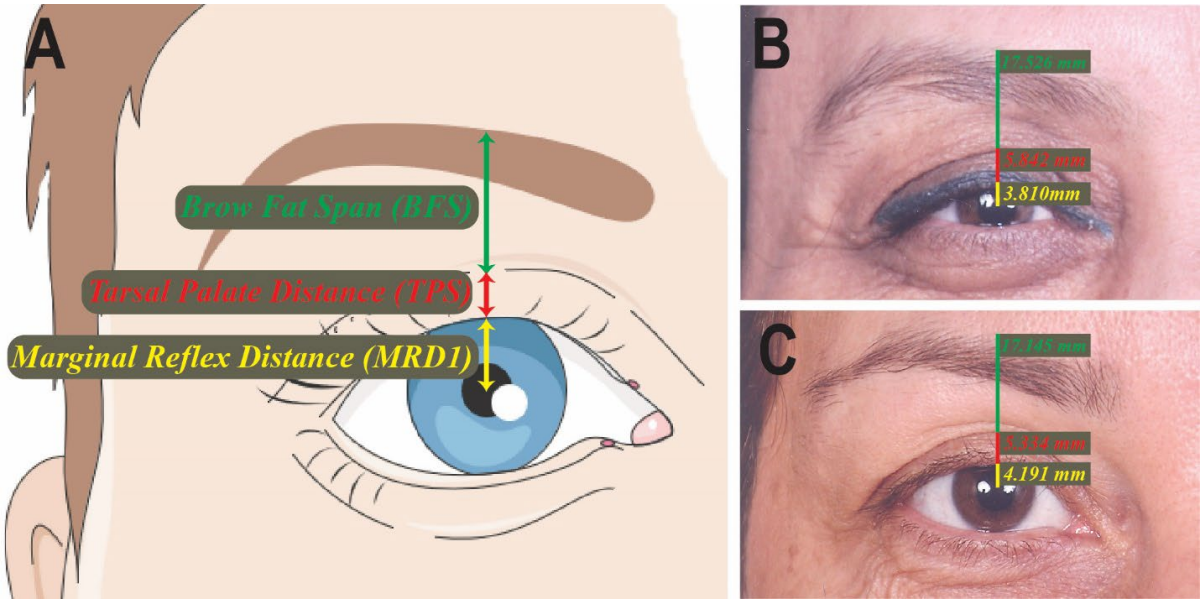


Figure 1: Marginal reflex distance (MRD), tarsal palate distance (TPS), and brow fat span (BFS) are displayed in two cases and a graphical illustration

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Photoshop Cs. Berkeley, CA: Peachpit Press, 2004. Print); all photos were converted to the same size. Afterward, MRD1, TPS, and BFS measurements were extracted by ImageJ software (U.S. National Institutes of Health, Bethesda, MD, USA). The primary outcome measures were the measurement of the right and the left sides absolute difference for each parameter in all participants and the averages of these metrics for each side in both genders. MRD1, TPS, and BFS absolute differences between the right and the left sides were considered significant if they exceeded 1 mm.

Additionally, the severity of ptosis asymmetry and its correlation with age and gender were assessed by calculating and comparing the mean difference, reported as the mean ± standard deviation in millimeters, of MRD1, TPS, and BFS measurements between the right and the left sides in 4 distinct subgroups regarding sex and age category: males under 50 years old, males over 50 years old, females under 50 years of age, and females over 50 years of age.

Statistical analysis

Kolmogorov- Smirnov test was used to determine if the data are normally distributed. Normally distributed data were reported as mean ± standard deviation, and not normal distributed data were reported as median (IQR). Generalized linear model (GLM) was used to compare the outcomes of the study. All analyses were performed using IBM SPSS 24 software (IBM Corp., Armonk, NY, USA) and *P*-values less than 0.05 was considered as statistically significant.

RESULTS

Overall, 155 patients were included. We had 27 (17.4%) male and 128 (82.6%) female participants. The mean ± standard deviation age was 47.6 ± 11.7 years old, and 46.5% of patients were more than 50 years of age.

Among our participants, 43 (28%) patients did not exhibit any asymmetry in the aimed metrics, while 112 (72%) cases had asymmetry in at least one of them. Sixty-one (39%), 40 (26%), and 24 (15.5%) cases had more than 1mm of asymmetry in BFS, TPS, and MRD1, respectively. MRD1, TPS, and BFS median (IQR) of both sides for males and females are presented in Table 1. In both genders, MRD1 had larger values on the right side while TPS measures were greater on the left side, while BFS was greater on the right side for males and on the left side for females.

The mean asymmetry for each criterion is measured and reported in 4 different gender-age category groups (Table 2). The highest values of mean differences for TPS, BFS, and MRD1 were observed in the group of men under 50 years of age and were 2.43 ± 4.02 mm, 1.87 ± 1.42 mm, and 0.67 ± 0.85 mm respectively. The pairwise comparison between the group of men under 50 years old and 3 other groups showed that the mean TPS difference was significantly higher in this group (all $P < 0.001$), while the other groups were not statistically different in terms of TPS difference ($P = 0.33$ and 0.43 respectively). Moreover, pairwise comparison between groups for MRD1 difference and BFS difference indicated no significant statistical correlation between gender, age, and the mean asymmetry of these parameters (overall test $P = 0.70$ for MDR1 and $P = 0.45$ for BFS).

DISCUSSION

Each person has some degree of facial morphological asymmetry[13], although the majority are not aware of it. In this study, we found that 72%

Table 1: The median (IQR) of each surface anatomy feature in male and female gender

Variable		Male	Female
MRD1	Right	2.85 (1.65)	3.17 (1.78)
	Left	2.54 (1.49)	3.04 (1.65)
TPS	Right	0 (2.83)	2.54 (4.45)
	Left	0 (5.37)	2.92 (4.7)
BFS	Right	17.78 (5.08)	18.16 (4.45)
	Left	17.65 (6.6)	18.28 (4.19)

MRD1: Marginal Reflex Distance; TPS: Tarsal Palate Span; BFS: Brow Fat Span; IQR: interquartile range

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Table 2: Comparison of the different age and sex groups in eyelid and eyebrow asymmetry criteria differences by using a generalized linear model (GLM)

Variable	(1) Male under 50 N=12	(2) Male above 50 N=15	(3) Female under 50 N=71	(4) Female above 50 N=57	P-value
TPS difference	2.43 ± 4.02	0.22 ± 0.52	0.78 ± 0.93	0.59 ± 0.67	P < 0.001 P12 < 0.001 P13< 0.001 P14< 0.001 P23 = 0.138 P24 = 0.331 P34 = 0.431
BFS difference	1.87 ± 1.42	1.74 ± 1.91	1.41 ± 0.97	1.44 ± 0.99	P = 0.459
MRD1 difference	0.67 ± 0.85	0.50 ± 0.73	0.50 ± 0.41	0.55 ± 0.38	P = 0.704

MRD1: Marginal Reflex Distance; TPS: Tarsal Palate Span; BFS: Brow Fat Span; P12: P-value for correlation between the males under 50 years and males above 50 years group; P13: P-value for correlation between the males under 50 years and females under 50 years of age; P14: P-value for correlation between the males under 50 years and females above 50 years of age; P23: P-value for correlation between males above 50 years old and females under 50 years old; P24: P-value for correlation between males above 50 years old and females above 50 years old; P34: P-value for correlation between females under 50 years old and females above 50 years old: values are presented as mean ± standard deviation

of our participants had noticeable eyelid and eyebrow asymmetry. Furthermore, comparing the different subgroups of our participants revealed that asymmetry was more pronounced in men younger than 50 years of age. In a retrospective study conducted by Macdonald et al. 93% of patients who were evaluated for upper eyelid blepharoplasty had preoperative upper facial asymmetry that went unnoticed by them until then[6]. Interestingly, our patients were not aware of their existing asymmetry either, while some of them complained of it post-operatively. Another study by Zhou et al. demonstrated that young Chinese women have asymmetric upper eyelid thickness with thicker eyelids on the right side[14]. Moreover, analysis of preoperative photographs of 365 Caucasians showed that 52.3% and 13.4 % of them had ≥ 1mm asymmetry in eyebrow and eyelid fissure height, respectively[8]. Similarly, the present study shows that preoperative asymmetry is a common phenomenon.

Although we could not find any article that determines the relationship between age and gender with the metrics we assessed, except for the results of a review article that reported a significant positive correlation between preoperative MRD1 and the age of patients[15], a few studies have addressed gender and age related changes in facial asymmetry with inconsistent results. 3-dimensional (3D) analysis of 300 adult cases for facial directional asymmetry showed that the difference between males and females was noticeable under the age of 40 and the youngest male participants aged between 20-40 years had the most asymmetry compared to other groups[10]. The more significant asymmetrical areas in younger men can be attributed to develop more dramatic facial morphological changes during the period of growth and puberty than females[16]. Additionally, it seems that facial asymmetrical changes are related to androgens[17]. Therefore, men, especially at younger ages, have larger degree of asymmetry, and with increasing age and the decrease of androgens, the facial asymmetry in both sexes becomes closer[10]. However, some studies exhibited opposite results, revealing a positive relationship between facial asymmetry and age. The degenrative skeletal resorption processes and the decresed skin and soft tissues quality due to lifestyle, sun exposure, genetics, and gravity adjustment can contribute to the age-related changes in facial asymmetry in older adults[11]. Another 3D evaluation of soft and hard tissue asymmetry among 270 Chinese individuals demonstrated that males have more degrees of asymmetry in both tissues[12]. Meanwhile, there are articles reporting no gender or age-related difference in facial asymmetry[9].

Eyelid asymmetry after blepharoplasty can lead to dissatisfaction with the surgery and litigation against

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plastic surgeons. Plastic surgery is responsible for 3.1% of all reported legal compliments in the United States[18]. Since preoperative asymmetry contributes to asymmetry after surgery, informing patients of it can prevent unrealistic expectations and lawsuits[6]. Additionally, the majority of patients who present with blepharoptosis may have some degree of brow ptosis which often happens asymmetrically. Blepharoptosis repairment without addressing eyebrow ptosis can compromise achieving the desired outcomes[7]. Therefore, it is recommended to factor eyebrow observations into surgical planning.

LIMITATIONS

We should note several limitations in our study. First, there are other metrics that can provide a detailed assessment of ptosis which not mentioned in this study. Second, our study investigated facial asymmetry in a cross-sectional limited sample by employing 2D images which is a less precise tool in comparison with new 3D analysis methods.

CONCLUSION

Most patients had eyelids and eyebrows asymmetry preoperatively, therefore we recommend informing patients of preoperative and probable postoperative asymmetry to increase satisfaction and avoid legal problems. Moreover, the relationship between facial asymmetry and age and gender can be used as a guidance in the field of plastic surgery for surgical planning and creating age-matched features.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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