·Opinion·

Preoperative phenylephrine testing as a predictor of postoperative eyebrow position

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Dear Sir,

Eyebrow position and contour strongly influences overall facial cosmesis [1-3] and depends on many factors, including age, gender, ethnicity, superior sulcus depth, frontal sinus pneumatization, prior surgery, and cultural trends [3-9]. Repair of blepharoptosis or dermatochalasis may diminish compensatory eyebrow elevation, thereby lowering eyebrow position postoperatively[10-11]. The preoperative blepharoptosis discussion with a patient should include possible effects on eyebrow position [10]. However, to our knowledge, no method exists to predict the amount of eyebrow descent that may occur in order to guide this discussion. We commonly employ preoperative phenylephrine testing in cases of conjunctival-Müllerectomy with or without tarsectomy (CM± T) blepharoptosis repair to determine the appropriate amount of tissue resection [12]. In our experience, the ipsilateral eyebrow often descends following a positive phenylephrine test. Given that phenylephrine testing may predict final eyelid position using our algorithm for CM ±T blepharoptosis repair [13], we sought to determine whether such testing predicts postoperative eyebrow position.

We retrospectively reviewed the charts of all patients undergoing unilateral CM ±T blepharoptosis repair at the Cole Eye Institute between July 2012 and October 2013. Exclusion criteria included concurrent or previous upper eyelid/eyebrow surgery or trauma; inadequate or missing photographs; known history of Graves' disease, Horner's syndrome, Myasthenia Gravis, 3rd nerve palsy, 7th nerve palsy, or infiltrative blepharoptosis; history of topical alpha-agonist use; concurrent periocular neurotoxin injection; and follow-up interval of less than 6-week duration.

All surgeries were performed according to a previously published tissue resection algorithm and technique by one surgeon (Perry JD)[12]. Preoperative, post-phenylephrine, and postoperative digital photographs were analyzed for each patient. ImageJ software (National Institute of Health, Bethesda, MD, USA) was used to measure distances in pixels, and these measurements were converted to millimeters using a previously published technique [13]. Measurements included marginal-reflex distance (MRD1), lateral brow height (LBH), central brow height (CBH), and medial brow height (MBH; Figure 1). Follow-up interval was measured between date of surgery and date of last postoperative photograph used for analysis. Two-tailed paired Student's *t*-test and Pearson product correlation were used for data analysis.

Seventy patients underwent unilateral CM±T blepharoptosis repair during the study period; 61 patients were excluded, mostly for inadequate or incomplete photographs (41 patients) and concurrent or prior upper eyelid or brow surgery (15 patients), leaving 9 patients for inclusion in the study. There were 8 female patients and 1 male patient. Average patient age was 58y (range 34-85y). Average follow-up time between preoperative and postoperative photographs was 2.8mo (range 1.3-9.5mo). Table 1 summarizes the average ipsilateral and contralateral MRD1, LBH, CBH and MBH preoperatively, after phenylephrine testing, and after surgery. Linear regression plots between the change in ipsilateral MRD1, LBH, CBH, and MBH after phenylephrine testing and following surgery with respective linear equations are demonstrated in Figure 2.

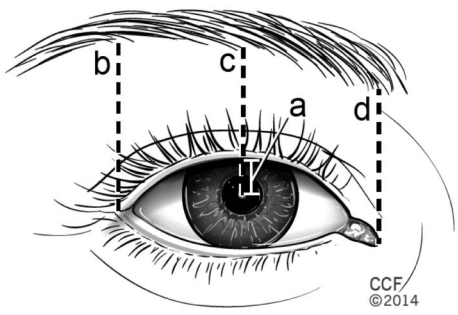

Figure 1 Image measurements a: MRD1; b: LBH; c: CBH; d: MBH.

Table 1 Preoperative, post-phenylephrine, and postoperative eyelid and brow heights mm

Eyelid	MRD1 mean (range)	LBH mean (range)	CBH mean (range)	MBH mean (range)
Ipsilateral (surgical) side				
Preoperative value	1.56 (0.25-3.26)	19.3 (10.21-25.4)	15.0 (6.69-20.9)	15.3 (7.71-20.1)
Post-phenylephrine value	3.00 (0.61-5.16)[a]	17.5 (9.17-25.5)[a]	13.9 (6.44-18.5)	14.1 (8.19-18.8)[a]
Postoperative value	3.13 (1.11-5.44)[a]	18.2 (9.69-25.7)[a]	14.4 (6.92-18.9)	14.8 (8.44-18.4)
Pearson product correlation	0.69	0.26	0.64	0.66
Contralateral (nonsurgical) side				
Preoperative value	3.04 (1.77-4.36)	17.2 (6.80-26.8)	14.4 (6.01-19.6)	14.8 (7.48-17.0)
Post-phenylephrine value	3.13 (1.07-4.04)	17.3 (6.22-27.8)	14.5 (7.21-19.3)	14.7 (8.41-17.0)
Postoperative value	3.02 (2.21-4.62)	18.1 (8.86-27.6)[a]	14.4 (5.40-18.3)	15.1 (8.72-18.0)
Pearson product correlation	0.42	0.15	0.66	0.57

[a]Statistically significant (P<0.05) by Student's paired t-test compared to preoperative value. Pearson product correlations are between the change in each value after phenylephrine testing (preoperative, post-phenylephrine) and postoperatively (preoperative-postoperative). MRD1: Margin-to-reflex distance; LBH: Lateral brow height; CBH: Central brow height; MBH: Medial brow height.

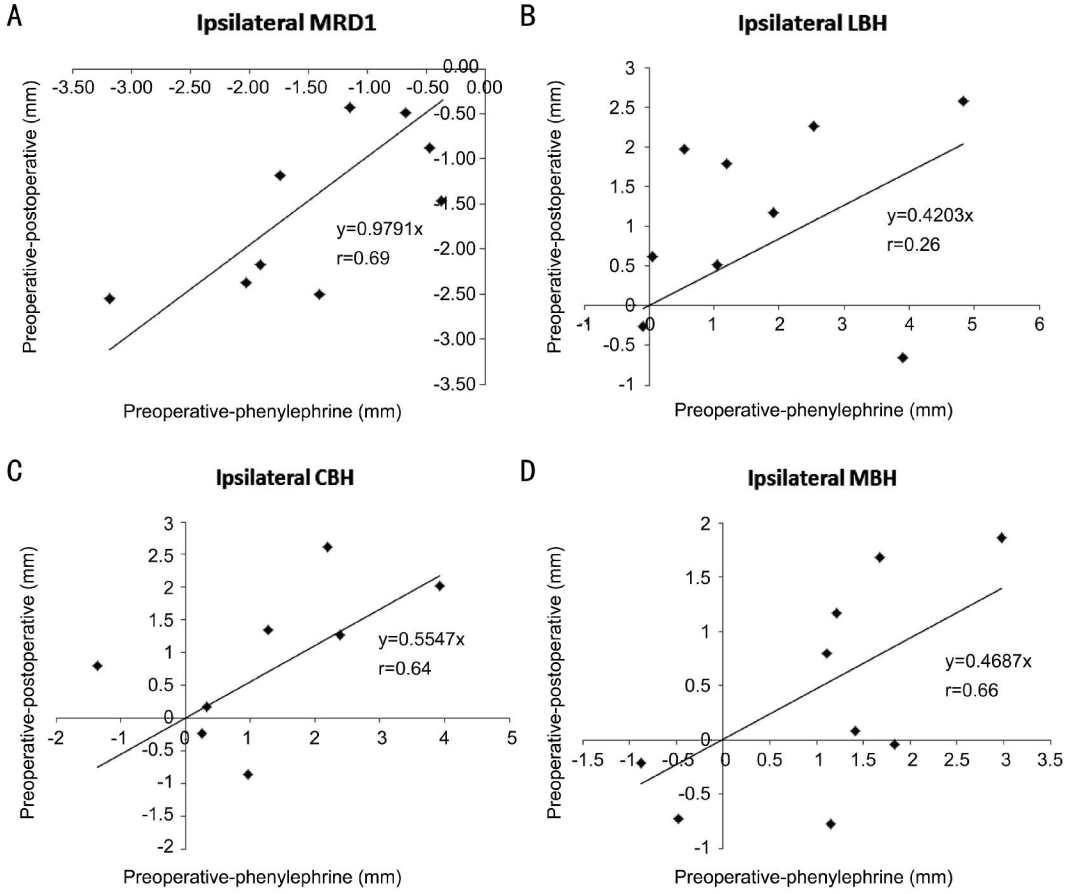

Figure 2 Linear regression plots of change in ipsilateral eyelid and eyebrow heights Linear regression for change in ipsilateral MRD1 (A), LBH (B), CBH (C) and MBH (D). Y-intercept set at (0,0).

Predicting postoperative brow descent is critical, especially in cases of longstanding blepharoptosis where significant frontalis muscle compensation may exist. In this study, we found clinically modest, but statistically significant, changes in ipsilateral and contralateral eyebrow position after both phenylephrine testing and surgery. We found a moderate to high correlation between post-phenylephrine and postoperative central and medial eyebrow height, suggesting that phenylephrine testing helps predict postoperative eyebrow position in cases of unilateral blepharoptosis repair. Linear regression showed that the ipsilateral eyebrows relax approximately twice as much following phenylephrine testing than after surgery. Revealing this exaggerated eyebrow descent in the mirror to the patient after phenylephrine testing plainly demonstrates this possible unwanted effect of surgery to the patient.

We studied unilateral cases of blepharoptosis repair with no history of previous or concurrent surgery, trauma or topical

therapy in order to attempt to isolate the variables of post-phenylephrine testing and postoperative measurements as best as possible. We used digital measurements to objectively measure the eyelid and eyebrow position. Digital photography may not best capture true eyelid or eyebrow positions, which are dynamic in nature, but we do not routinely measure brow position in clinic, and no standard yet exists for clinical brow position measurement. Using digital photographs reduced the *n* of this study; however, several variables still achieved statistical significance.

While eyebrow position lowered on average only 1-2 mm after phenylephrine testing in any given position, the resultant resolution of brow compensation may be expected to be somewhat modest in this group of patients who underwent relatively mild blepharoptosis correction. Indeed, the average preoperative MRD1 was over 1.5 mm. It seems likely that phenylephrine testing would demonstrate even greater amounts of eyebrow descent in patients with more severe blepharoptosis and frontalis muscle compensation.

We did not routinely measure ocular dominance, which may affect the presence of unilateral frontalis muscle compensation [14]. It is possible that treating blepharoptosis ipsilateral to the dominant eye may affect eyebrow height differently compared to treating blepharoptosis contralateral to the dominant eye. It is also unclear whether phenylephrine testing may accurately predict eyebrow position after bilateral blepharoptosis repair.

Phenylephrine testing may help predict postoperative eyebrow position in cases of unilateral CM±T blepharoptosis repair. This information can guide the patient discussion and surgical plan. Further studies may determine its usefulness in cases of levator advancement ptosis repair, bilateral cases, and cases undergoing concomitant surgery.

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REFERENCES

1 Knoll BI, Attkiss KJ, Persing JA. The influence of forehead, brow, and periorbital aesthetics on perceived expression in the youthful face. *Plast Reconstr Surg* 2008;121(5):1793-1802.

2 Griffin GR, Kim JC. Ideal female brow aesthetics. *Clin Plast Surg* 2013; 40(1):147-155.

3 Lam VB, Czyz CN, Wulc AE. The brow-eyelid continuum: an anatomic perspective. *Clin Plast Surg* 2013;40(1):1-19.

4 Lemke BN, Stasior OG. The anatomy of eyebrow ptosis. *Arch Ophthalmol* 1982;100(6):981-986.

5 Gunter JP, Antrobus SD. Aesthetic analysis of the eyebrows. *Plast Reconstr Surg* 1997;99(7):1808-1816.

6 Goldstein SM, Katowitz JA. The male eyebrow: a topographic anatomic analysis. *Ophthal Plast Reconstr Surg* 2005;21(4):285-291.

7 Price KM, Gupta PK, Woodward JA, Stinnett SS, Murchison AP. Eyebrow and eyelid dimensions: an anthropometric analysis of african americans and caucasians. *Plast Reconstr Surg* 2009;124(2):615-623.

8 van den Bosch WA, Leenders I, Mulder P. Topographic anatomy of the eyelids, and the effects of sex and age. *Br J Ophthalmol* 1999;83 (3): 347-352.

9 Cole EA, Winn BJ, Putterman AM. Measurement of eyebrow position from inferior corneal limbus to brow: a new technique. *Ophthal Plast Reconstr Surg* 2010;26(6):443-447.

10 Lee JM, Lee TE, Lee H, Park M, Baek S. Change in brow position after upper blepharoplasty or levator advancement. *J Craniofac Surg* 2012;23(2): 434-436.

11 Fagien S. Eyebrow analysis after blepharoplasty in patients with brow ptosis. *Ophthal Plast Reconstr Surg*1992;8(3):210-214.

12 Perry JD, Kadakia A, Foster JA. A new algorithm for ptosis repair using conjunctival mullerectomy with or without tarsectomy. *Ophthal Plast Reconstr Surg* 2002;18(6):426-429.

13 Taban M, Taban M, Perry JD. Lower eyelid position after transconjunctival lower blepharoplasty with versus without a skin pinch. *Ophthal Plast Reconstr Surg* 2008;24(1):7-9.

14 Shah CT, Nguyen EV, Hassan AS. Asymmetric eyebrow elevation and its association with ocular dominance. *Ophthal Plast Reconstr Surg* 2012; 28(1):50-53.