

Effects of epiblepharon surgery on higher-order aberrations

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PURPOSE	To quantify and compare higher-order aberrations (HOAs) in children after epiblepharon surgery.
METHODS	The medical records of children (mean age, 7.3 years [range, 2-13 years]) who underwent surgery for epiblepharon were reviewed retrospectively. Aberrometry was conducted before surgery and at 1 month's and 3 months' follow-up using the Wavefront Analyzer KR-1W. Corneal HOAs in the 4 mm and 6 mm optical zones were compared. Classification of the severity of epiblepharon was based on the degree of cilia touching the cornea and corneal erosion.
RESULTS	A total of 120 eyes of 60 patients were included. Corneal total HOAs in the 4 mm and 6 mm optical zone decreased significantly at 1 and 3 months after surgery ($P = 0.001$ and 0.000 , resp. in the 4 mm zone; $P = 0.006$ and 0.006 in the 6 mm zone). Surgery induced a significant reduction of fourth-order aberrations, with decrease of tetrafoil in the 4 mm zone and coma, tetrafoil, and secondary astigmatism in the 6 mm zone 3 months after surgery; the differences were statistically significant ($P = 0.038$ and 0.006 in the 4 mm zone; $P = 0.018$ and 0.000 in the 6 mm zone). Although there was no significant association between epiblepharon severity and total HOAs, reduction of corneal staining grade and decrease of total HOAs at 3 months were significantly correlated ($P = 0.03$ in the 6 mm zone).
CONCLUSIONS	In this patient cohort, total HOAs decreased significantly after epiblepharon surgery. The correlation of reduction of corneal staining grade and decrease of total HOAs may be helpful in deciding the timing of surgery in children who have no specific visual symptoms. (J AAPOS 2016;20:226-231)

Epiblepharon is a congenital eyelid anomaly that more commonly affects Asian infants and children than non-Asians.¹ It is characterized by a horizontal fold of redundant skin and pretarsal orbicularis muscle near the eyelid margin that causes the eyelashes to turn inward.² The eyelid position and tarsal plate remain normal. Epiblepharon is thereby differentiated from congenital entropion, which is characterized by an inward rotation of the tarsus and lid margin.^{3,4}

The redundant skin fold and inverted eyelashes cause corneal irritation. Patients with epiblepharon suffer from tearing, photophobia, a foreign body sensation and visual

disturbance caused by corneal injury.⁵ It is thought that the corneal curvature may be changed in epiblepharon due to the mechanical force created by squeezing of the eyelids in response to corneal irritation and abnormal eyelid tension from the redundant skin fold. Several studies have reported that the higher prevalence of astigmatism in epiblepharon patients and the changes in astigmatism after the surgery.⁶⁻⁹

Higher-order aberrations (HOAs) are an index of visual quality.¹⁰ When ocular aberrations increase during development, visual symptoms including glare, halo, and distortion can occur. Correction of HOAs improves contrast sensitivity and visual acuity.¹¹ To our knowledge, whereas changes of lower order aberrations (sphere and cylinder) after surgery have been investigated, few studies on the changes in HOAs have been published. The purpose of this study is to compare HOAs in children with epiblepharon after surgery.

Subjects and Methods

Approval for retrospective review of patient data was obtained from the Korea University Ansan Hospital Institutional Review Board, Kyeonggi, Korea. All research and data collection followed the tenets of the Declaration of Helsinki. The medical records of patients diagnosed with epiblepharon that underwent

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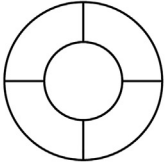
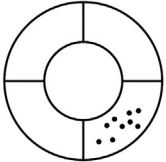
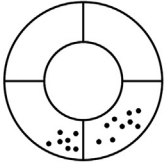
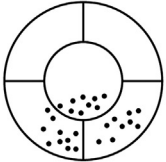
Grade of ciliary touch	1	2	3	
Right eye				
Severity of keratopathy	0	1	2	3
Right eye				

FIG 1. Classification of ciliary touch and severity of keratopathy.

surgery at the Korea University Hospital from August 2012 to July 2014 were retrospectively reviewed. All surgeries were performed by a single surgeon (SHB), who had also been involved in the clinical assessment of patients. Surgical indications included severe corneal erosions and chronic irritating symptoms, such as photophobia, epiphora, or frequent rubbing. Patients with follow-up of >3 months after surgery were included. Patients with congenital entropion, distichiasis, amblyopia, anisometropia, or a past history of ocular and eyelid surgery were excluded.

All patients underwent preoperative slit-lamp biomicroscopy, autorefractometry, and best-corrected distance visual acuity assessment. Classification of epiblepharon severity was based on degree of corneal erosion and cilia touching the cornea. Cilia touching the cornea was graded from 1 to 3 as follows: grade 1, cilia touched less than the medial one-third of the cornea; grade 2, cilia touched less than the medial two-thirds of the cornea; grade 3, cilia touched more than two-thirds of the cornea.¹² Severity of keratopathy was graded from 0 to 3 based on fluorescein staining of the cornea preoperatively and 3 months after the surgery. Staining of peripheral cornea in medial portion was graded as 1 and staining beyond the center line toward temporal portion was graded as 2. Grade 3 was defined when center cornea inside the pupil was stained (Figure 1).¹³

Ocular aberrations were measured at 4 mm and 6 mm pupil sizes using the KR-1W Wavefront Analyzer (Topcon, Tokyo, Japan) at baseline and at 1 and 3 months after surgery. The wavefront examination usually requires 3 minutes for each eye. The examination was performed with patients watching the shining lights, with their heads immobilized by the headrest. HOAs were measured from three compartments: ocular, corneal, and internal. Total HOAs, third-order, fourth-order, trefoil, coma, tetrafoil, second astigmatism, and spherical aberration were obtained from each compartment with a 4 mm and 6 mm pupil. All measurements were taken by a single experienced technician.

Surgical Technique

Surgery was performed under general anesthesia. The lower eyelid was infiltrated with a mixture of lidocaine 2% and epinephrine 1:200,000. The excess skin of the lower eyelid was gently grasped with forceps to cause mild ectropion, after which the lid was marked. The upper skin incisional line was just below the eyelash line, and the delineated ellipse was closer to just lateral to the punctum. The width of the ellipse was extended laterally to the site of lash inversion.

Dissection was carried out between the tarsal plate and orbital septum, and the skin-pretarsal and preseptal orbicularis oculi muscle flap, exposing the tarsal plate and orbital septum. Care was taken not to damage the cilia root or orbital septum. Using a Bovie monopolar needle cautery instrument (Colorado Biomedical Inc, Evergreen, CO), thermal cauterization was applied to the septum to create adhesions between the preseptal orbicularis oculi muscle and septum. The purpose of these adhesions was to minimize vertical overriding of the orbicularis oculi muscle. Three interrupted 7-0 nylon sutures were placed in the subcutaneous tissue of the upper skin flap and the inferior tarsus. Lash eversion developed when the anterior lamella was repositioned near the lower tarsal border through anastomosis of the tarsal border and subcutaneous tissue of the skin flap. The dog-ears at the medial and lateral ends of the incision were removed by triangular skin excision. Small amounts of pretarsal orbicularis oculi muscle and redundant skin overlying the lower lid margin were marked and removed. The skin was then closed in a continuous manner with 6-0 fast-absorbing plain gut suture. Postoperatively, tobramycin antibiotic ointment was applied to the skin wound for 2 weeks.

Statistical Analysis

Mann-Whitney U test was used to compare pre- and postoperative changes in HOAs. Spearman correlation analysis was performed to investigate whether there was any association between

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