ported in this study can have very poor vision often compounded by chronic ocular discomfort.[5] A small improvement in vision, even in 1 eye, which allows them to navigate independently in their immediate indoor and outdoor environment, can make a big difference to their lifestyle and confidence. The NEI-VFQ-25 allows a comprehensive assessment of the effect of interventions on the QOL related to vision. Our study has shown that QOL, as a combined measure of visual acuity, cosmesis, and ocular discomfort, does improve after limbal transplantation, allowing patients to undertake at least some of their life activities. This makes limbal transplantation worthwhile despite the multiple interventions and associated medical therapy that is required to maintain graft survival.

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References

1. Dua HS, Azuara-Blanco A. Limbal stem cells of the corneal epithelium. Surv Ophthalmol 2000;44:415–25.
2. Mangione CM, Lee PP, Gutierrez PR, et al. Development of the 25-item National Eye Institute Visual Function Questionnaire. Arch Ophthalmol 2001;119:1050–8.
3. McKean-Cowdin R, Wang Y, Wu J, et al. Impact of visual field loss on health-related quality of life in glaucoma: the Los Angeles Latino Eye Study. Ophthalmology 2008;115:941–8.
4. Schiffman RM, Walt JG, Jacobsen G, et al. Utility assessment among patients with dry eye disease. Ophthalmology 2003;110:1412–9.
5. Dua HS, Joseph A, Shanmuganathan VA, Jones RE. Stem cell differentiation and the effects of deficiency. Eye 2003;17:877–85.

DSAEK Graft Evaluation Using C:P Ratio

Dear Editor:
We read with interest the study by Scorcia et al[1] that evaluates the change in posterior curvature of the cornea as a possible cause of the hyperopic shift observed after Descemet's stripping automated endothelial keratoplasty (DSAEK). The authors' results indicate that the shape of the donor graft, thinner in the center and thicker in the periphery, is the cause of the hyperopic shift due to the negative corneal power added in the posterior surface.

In the discussion section, the authors state that in a previous study, Holz et al[2] evaluated the graft morphology with anterior segment optical coherence tomography (AS-OCT) and reported the difference in the thickness. However, the authors fail to report that in a previous study by Yoo et al[3] the profile of the graft have been evaluated by AS-OCT and an index representative of the thickness difference between the center and the periphery has been introduced. This index was calculated as the ratio of the central graft thickness to the peripheral (C:P ratio), and it is shown to be highly correlated to the hyperopic shift. The C:P ratio is calculated from the central measurement and the mean of 4 peripheral button measurements in 2 perpendicular axes. Given that the accuracy of the AS-OCT measurements of the button thickness is high, the C:P ratio is a reliable index for the evaluation of the button morphology.

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References

1. Scorcia V, Matteoni S, Scorcia GB, et al. Pentacam assessment of posterior lamellar grafts to explain hyperopization after Descemet's stripping automated endothelial keratoplasty. Ophthalmology 2009;116:1651–5.
2. Holz HA, Meyer JJ, Espandar L, et al. Corneal profile analysis after Descemet stripping endothelial keratoplasty and its relationship to postoperative hyperopic shift. J Cataract Refract Surg 2008;34:211–4.
3. Yoo SH, Kymionis GD, Deobhakta AA, et al. One-year results and anterior segment optical coherence tomography findings of Descemet stripping automated endothelial keratoplasty combined with phacoemulsification. Arch Ophthalmol 2008;126:1052–5.

Author reply

Dear Editor:
We thank Kymionis et al for their comments. We have also reviewed the previous study performed by Yoo et al[1] who used the anterior segment optical coherence tomography (AS-OCT) to describe the Descemet's stripping with automated endothelial keratoplasty graft shape and to calculate an index (C:P ratio) to represent the thickness discrepancy between the center and the periphery. Although the AS-OCT is probably one of the most accurate tools to analyze the corneal layers there are some limits to this.

AS-OCT produces excellent representations of corneal morphology allowing fine measurements of corneal thickness at different positions; nevertheless, it does not give information about the possible modification of the posterior corneal curvature in terms of optical power and refraction.

The Pentacam Scheimpflug imaging system (Oculus, Wetzlar, Germany) provides topographic data for both anterior and posterior corneal surfaces; it also determines the mean radius of posterior curvature (Rm), which allows one to describe the optical properties of the whole posterior surface, overcoming the limits of a single or limited number of measurements.[2]

Moreover, Yoo et al in their study obtained the C:P ratio from a central graft thickness measurement and the mean of 4 peripheral ones that were located within 3 mm of the center. However, the highest thickness value is usually reached on the peripheral edge of the graft where its meniscus shape, induced by the microkeratome dissection, is more pronounced and where early after surgery, aqueous could easily permeate through the exposed stroma. For this reason, simply considering the thickness of the inner 3 mm of the graft could lead to misinterpretation of its real shape by missing the area where the most significant modifications occur.

Finally, we agree with Kymionis et al on the accuracy and reliability of the AS-OCT for the evaluation of the

button morphology, even if the Pentacam is a more useful device to allow a more complete understanding of the refractive properties of the entire cornea.

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References

1. Yoo SH, Kymionis GD, Deobhakta AA, et al. One-year results and anterior segment optical coherence tomography findings of Descemet stripping automated endothelial keratoplasty combined with phacoemulsification. Arch Ophthalmol 2008;126:1052–5.
2. Scorcia V, Matteoni S, Scorcia GB, et al. Pentacam assessment of posterior lamellar grafts to explain hyperopization after Descemet's stripping automated endothelial keratoplasty. Ophthalmology 2009;116:1651–5.

Normal-Tension Glaucoma or PVL?

Dear Editor:
In their recent article, Leung et al[1] analyzed a cohort of 286 patients with normal tension glaucoma and report silent cerebral infarcts on magnetic resonance imaging in 64 patients (22.4%). The most common sites for the observed silent infarct were the basal ganglia (48.4%) followed by the periventricular area (20.3%). One potential confounding variable in the latter group is prematurity, which is associated with periventricular leukomalacia (PVL) in up to 25% of cases.[2]

PVL is known to cause pseudoglaucomatous cupping due to transsynaptic degeneration of optic axons following late intrauterine injury to the optic radiations.[3,4] Unlike in glaucoma, the cupping of PVL is round or horizontally oval, and affected patients tend to have bilateral inferior visual field defects. In the study protocol, patients were not evaluated for a history of prematurity, and only the vertical dimensions of the cup-to-disc ratio were assessed, so it is unclear whether the vertical cupping was necessarily present in patients diagnosed as having normal-tension glaucoma.

PVL selectively involves the optic radiations adjacent to the trigone of the lateral ventricle and the anterior corticospinal fibers adjacent to the intraventricular foramen.[2–4] Correlative neuroimaging signs include a reduction in the amount of periventricular white matter, a compensatory ventricular dilation, an irregular outline of the lateral ventricle, and an abnormally high signal intensity of the periventricular white matter on T2-weighted images.[2–4] As the nature of the periventricular lesions were not characterized in this study, it is impossible to ascertain how often injury to the developing visual system associated with prematurity may have simulated the association of normal tension glaucoma with silent cerebral infarct. However, it is important to be aware of this causal relationship, to ask about a history of prematurity, and to consider the possibility of PVL when assigning the diagnosis of normal-tension glaucoma in patients with periventricular lesions.

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References

1. Leung DYL, Tham CCY, Li FCH, et al. Silent cerebral infarct and visual field progression in newly diagnosed normal-tension glaucoma: a cohort study. Ophthalmology 2009;116:1250–6.
2. Olsén P, Paako E, Vainonpaa L, et al. Magnetic resonance imaging of periventricular leukomalacia and its clinical correlation in children. Ann Neurol 1997;41:754–61.
3. Jacobson L, Hellström A, Flodmark O. Large cups in normal-sized optic discs: a variant of optic nerve hypoplasia in children with periventricular leukomalacia. Arch Ophthalmol 1997;115:1263–9.
4. Brodsky MC. Periventricular leukomalacia: an intracranial cause of pseudoglaucomatous cupping. Arch Ophthalmol 2001;119:626–7.

Author reply

Dear Editor:
We sincerely thank Dr. Brodsky for his interest in our article,[1] and for sharing his expertise on periventricular leukomalacia (PVL) with us.

In 1995, Jacobson et al[2] recognized that PVL may produce a unique form of bilateral segmental optic nerve hypoplasia/congenital optic atrophy, characterized by abnormally large optic cup and a thin neuroretinal rim contained within a normal-sized optic disc. Brodsky proposed that the large optic cups can simulate glaucoma and a history of prematurity, normal intraocular pressure, and characteristic symmetrical inferior visual field defects serves to distinguish PVL from glaucomatous optic atrophy.[3]

In our present study, 13 subjects had periventricular silent cerebral infarcts (SCI). It was very likely that their optic neuropathy represented genuine glaucoma, rather than a confounding PVL, for the following reasons: First, we reviewed the visual fields of our 13 subjects and none of them had the classical symmetrical inferior field defects as described in Dr. Brodsky's publications.[3] Second, despite that we used only vertical cup-to-disc ratios in our statistics, the horizontal cup-to-disc ratios were in fact evaluated, as, those with horizontally oval cup would typically have fallen into a group of "non-glaucomatous optic neuropathy" and would not have been included into our study. These 13 subjects had typical glaucomatous-type optic neuropathy affecting the vertical meridian[4] more than the horizontal meridian and documented correlation of disc-field-retinal nerve fiber layer (RNFL) defects (on optical coherence tomography). The correlation was not only on location of the damage but the severity of field defect would need to be commensurate with the degree of RNFL loss and cupping. Suspicious correlations or functional loss out of proportion to structural deficits would have suggested a non-glaucoma process and would not have been recruited. Third, 10 of