Pseudophakic adult with progressive optic disc tilt and axial length elongation

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ABSTRACT
Purpose: To describe a case of progressive optic disc tilt in a pseudophakic Asian adult associated with an increase in axial length.
Observations: A 28-year-old man presented with high myopia in the right eye with an axial length of 30.4 mm and refraction of −13.75 diopters (D) spherical equivalent (SE). The refraction was plano sphere after LASIK and LASIK enhancement. The left eye was blinded by retinal detachment after phacoemulsification. Six years later, the right eye axial length was 31.65 mm when he underwent phacoemulsification with intraocular lens placement for nuclear sclerosis, after which the refraction was −0.50 D SE. The right eye refraction changed progressively over 13 years after cataract surgery to −4.00 D SE, at which time the axial length was 33.69 mm. A notable increase in optic disc tilt and peripapillary atrophy was evident on comparison of fundus photographs taken 11 years apart.
Conclusions: Although progressive optic disc tilt in conjunction with increasing axial myopia in pediatric populations has been documented, it has not been reported in adults but may occur. Scleral stretching due to axial length elongation associated with loss of accommodation after cataract surgery and worsening peripapillary atrophy are possible causes of this finding.

1. Introduction

Myopia is reaching epidemic proportions globally and is particularly pervasive among Asians.1 Within the heterogeneous American population, over 9.6 million Americans are burdened with high myopia.2 Complications of high myopia, such as retinal detachment, myopic choroidal neovascularization, and glaucoma, can cause irreversible blindness.

In pediatric populations, progressive myopia results in recognizable changes, including elongation of axial length and increased optic nerve head (ONH) tilting.3 However, while several studies have reported on increasing axial myopia and its sequelae in adults, progressive increases in ONH tilt with axial length elongation are not reported.4–6 Herein, we present an adult Asian male with progressive optic disc tilt and concurrent axial length elongation.

2. Case report

A 28-year-old Asian man presented with high myopia in the right eye. Optic nerve tilt and peripapillary atrophy were noted. The right eye had a cup-disc ratio of 0.1, intraocular pressure (IOP) of 14 mm Hg, and central corneal thickness of 574 μm. No glaucomatous visual field defects were seen on standard automated perimetry. On examination, the patient had signs of pathologic myopia in the right eye, including a large area of peripapillary atrophy, a temporally tilted optic disc, and macular retinal pigment epithelium changes, as well as lattice degeneration of the retina. His corrected visual acuity was 20/40 in the right eye with pinhole vision of 20/25. Two weeks later, he underwent LASIK in his right eye and his refraction improved from −13.75 diopters (D) spherical equivalent (SE) to −1.50D SE. Six months after LASIK, the right eye underwent LASIK enhancement and his refraction improved from −13.75 diopters (D) spherical equivalent (SE) to −1.50D SE. Immersion ultrasound biometry of the right eye revealed an axial length of 30.4 mm and manual keratometry (K) of 41.50/42.50x092. Six months after LASIK, the right eye underwent LASIK enhancement and his refraction improved to plano sphere; however, 1 year after the initial LASIK surgery, his refraction was −1.00D SE. His left eye underwent cataract extraction but subsequent retinal detachment and glaucoma resulted in counting fingers visual acuity. At age 34, 6 years after initial presentation, the patient’s right eye

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3. Discussion

developed a nuclear sclerotic cataract and underwent phacoemulsification. Preoperative immersion ultrasound biometry showed axial length of 31.65 mm. His refraction 3 months after phacoemulsification was −0.50D SE. At age 38, four years after cataract surgery, his refraction was −1.00D SE; at age 41 it was −2.75D SE; and at age 44 it was −4.00D SE, after which it has remained stable for 3 years. Partial coherence interferometry (IOLMaster, Carl Zeiss Meditec AG, Jena, Germany) performed at age 46, 12 years after phacoemulsification, showed an axial length of 33.69 mm. Comparison of fundus photographs from 2, 12, and 13 years after cataract surgery revealed a notable increase in ONH tilt, vascular displacement, and peripapillary atrophy (PPA) (Fig. 1). Macular myopic degeneration with retinal pigment epithelial changes were also observed at 13 years post-cataract surgery (Fig. 2). The IOP ranged from 9 to 16 mm Hg (mean 11.6 mm Hg) during the follow-up period, and no glaucomatous visual field defects developed.

4. Conclusions

Our pseudophakic Asian adult patient demonstrates progressive optic disc tilt and a 3 mm axial length elongation over 18 years. Although several studies have found axial length elongation in adult myopic eyes over years of follow-up, none specifically report optic disc tilt progression in these patients. One cohort study of 39 Danish adults documented a 0.8 mm mean axial length elongation after 38 years of follow-up, from age 16 to 54. The authors noted optic disc tilt in many participants, but did not describe changes in ONH appearance, and reported tilt as a disc characteristic that was “stable over time.” Another retrospective observational case series documented the progression of myopic maculopathy in 810 eyes of 432 Japanese adults with high or pathologic myopia over an 18 year span. Significantly longer axial lengths were observed in subjects with pathologic myopia than those without (p < 0.001) and ONH tilt was observed, but neither baseline ONH appearance or changes over time were described. Another study noted a +1.55 mm median axial length elongation in 31% of 184 myopic adult eyes from worsening posterior staphyloma, again without mention of optic disc changes.

Tilted optic discs have been attributed to congenital and acquired events. Congenitally, improper closure of the embryonic ocular fissure precipitates an oblique insertion of the optic nerve. In acquired cases, scleral stretching, deformation of the lamina cribrosa, and tractional displacement of the optic disc temporally to the deepest point of the eye may promote optic disc tilt. Therefore, greater tilting can be observed over time with worsening staphyloma, PPA, or tractional displacement posteriorly. The typically circular optic disc thus appears rotated temporally, appearing as an increasingly oval-shaped optic disc. Gupta et al. have demonstrated that alterations in optic disc morphology may occur due to glaucomatous changes, but our patient did not have any baseline signs of glaucoma in the right eye, including intraocular pressure of 14 mm Hg, abnormal pachymetry values, or visual field deficits. Our patient underwent periodic examinations and testing for glaucoma because of glaucoma after retinal detachment surgery in his fellow eye; in the right eye, no evidence of glaucoma was seen during follow-up.

Our patient’s increase in axial length over time may have been triggered by strong accommodative drive after LASIK and cataract surgery, which could stimulate scleral stretching and subsequent increase in axial length, resulting in a progressively tilted optic disc. We postulate his accommodative drive may have been increased due to his monocular status and his desire to read without glasses, as he was able to prior to surgery. Although partial coherence interferometry typically measures a slightly longer axial length than ultrasound biometry, one study reported a mean interdevice difference of <0.25 mm. Therefore, the 3 mm axial length difference seen in our patient is likely indicative of true axial length elongation.

Park et al. suggest that worsening optic disc tilt in children may serve as a prognostic factor for further myopic progression. Our patient’s findings suggest that increasing optic disc tilt could similarly indicate axial myopia progression in adults.

3. Discussion

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

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