Visual Rehabilitation After Complex Cataract Surgery in Bilateral Nanophthalmos with Extremely Short Axial Length

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Abstract
The manifestation of nanophthalmos entails a significantly short axial length and a crowded anterior segment, which is extremely dangerous when performing cataract surgery. We describe visual and anatomical results of sequential cataract removal by phacoemulsification performed under topical anesthesia and intraocular lens implantation of high-power intraocular lenses in a patient with bilateral nanophthalmos (axial length of about 16 mm). Visual acuity preoperatively was 20/400 in the right eye and 20/200 in the left eye, with a hyperopic refractive error of more than +14.00 D. Deterioration of the axial length was found to be 16.2 mm (right eye) and 16.0 mm (left eye), and shallow anterior chamber depths were 2.1 mm and 2.0 mm, respectively. Similar results were obtained with the calculation of IOL power with Hoffer Q, Haigis, and Holladay 1 formula, which resulted in the implantation of high-power intraocular lenses (+47 diopter in the right eye and +48 diopter in the left eye; Medicontour). Surgical interventions were involving temporal procedure, poor dilation with iris hooks, trypan blue staining, controlled capsulorrhexis and cystotome use, and controlled intraoperative fluidics to reduce the effects of pressure fluctuations. The patient had left eye early postoperative choroidal effusion and extreme anterior segment inflammation with hypopyon, which improved with intensive topical corticosteroids and cycloplegic therapy. On the right eye, final corrected visual acuity improved to 20/30, and on the left eye, the visual acuity was 20/40. This case emphasizes the significance of careful preoperative evaluation, stability in the intraoperative chamber, and vigorous postoperative treatment in bringing positive visual restoration in extremely short eyes.

Introduction

Nanophthalmos is an infrequent developmental eye disorder, where the axial length is significantly shorter than the standard size of lenses, which leads to a crammed anterior segment. Axial length of the eyes below 20 mm in eyes and especially those less than 16 mm are associated with a significantly high-risk during cataract surgery. The possible complications are shallow anterior chamber instability, iris prolapse, choroidal effusion, uveal effusion syndrome, and inflammatory reactions after the surgery. Also, prediction of refraction is difficult because of constraints of the intraocular lens (IOL) power calculation formula and possible change in effective lens position.

There are further issues with manufacturing tolerances and refractive accuracy with the implantation of very high-power IOLs (>+40 D). The current report outlines surgical treatment, post operation, and visual restoration in a patient with bilateral nanophthalmos who is undergoing +47 D and +48 D IOLs implantation.

Case Report

One of the patients came with a history of progressive visual impairment, which is more severe in the right eye. The density of the cataracts in both eyes was the same.

The preoperative corrected distance visual acuity (CDVA) was 20/ 400 in the right eye (OD) and 20 / 200 in the left eye (OS). Hyperopic refractive error of +14.25 D OD and + 14.00 D OS. Intraocular pressure (IOP), measured by Goldmann applanation tonometry, was 19 mmHg in the right eye and 17 mmHg in the left eye.

The results on biometric parameters are presented in Table 1.

Table 1: Preoperative biometric measurements

Parameter	Right Eye (OD)	Left Eye (OS)
Axial Length (mm)	16.2	16.0
Anterior Chamber Depth (mm)	2.1	2.0

The preoperative anterior segment optical coherence tomography (AS-OCT) was performed to measure the scleral thickness and determine the risk of uveal effusion. Scleral thickness was assessed 3 mm posterior to the scleral spur and measured 1.3 mm, consistent with scleral thickening seen in nanophthalmos. There was no sign of preoperative choroidal or supraciliary effusion.

The value of IOL power was calculated by Hoffer Q, Haigis, and Holladay 1 formulae with the same results. An implant of +47.0 D IOL was placed in the right eye and +48.0 D IOL in the left eye (Medicontour).

Topical corneal temporary anesthesia was used to perform sequential phacoemulsification cataract surgery by a temporal clear approach. The lack of pupillary dilation required the use of iris hooks. The anterior capsule could be visualized using Trypan blue staining. A cystotome was used to initiate capsulorrhexis to enable controlled extension in the shallow anterior chamber. The fluidic processes during the operation were being effectively adjusted to prevent the rapid changes in the intraacceleration levels and to minimize the chance of choroidal bloat.

The right eye had a smooth postoperative period with a final CDVA of 20/ 30. In the case of the patient, the left eye vision was limited to that of light perception on the first day after the surgery because of choroidal effusion with severe anterior chamber inflammation and a layered inflammatory hypopyon.

Intensive topical corticosteroids and cycloplegic agents were used. There was a gradual improvement in inflammation and choroidal effusion, and the end result was an improvement in CDVA to 20/40.

Discussion

Surgery on cataracts in the eyes of nanophthalmic patients is associated with anatomical and physiological difficulties. The short axial length and shallow anterior chamber make the patients vulnerable to uveal effusion, misdirected aqueous, and overstated inflammation during the postoperative period. Even small changes in the intraoperative pressure could trigger choroidal expansion of such eyes.

Proper calculation of the IOL power in very short eyes is a challenge. Even though it is common to prefer modern formulas, like Hoffer Q and Haigis, because they are easier to compute, the prediction error grows at extreme axial lengths. Moreover, residual refractive error in IOLs can be caused by manufacturing tolerances in very high-power IOLs.

The early postoperative choroidal effusion in the presented case brings out the importance of close observation and timely anti-inflammatory treatment. Topical corticosteroids and cycloplegic agents were associated with the resolution of the inflammatory and effusive reactions, as proven by the positive results of vision recovery in this patient.

This example confirms the idea that the achievement of successful results in nanophthalmos will be less related to the technical difficulty of implanting high-power IOLs and more closely linked to the overall perioperative risk assessment, careful fluidics, and vigorous approach to postoperative inflammation treatment.

References

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