

# Cataract May Affect the Axial Length of High Myopes in Adults

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## Abstract

**Aim:** We report retrospectively on the change of the axial length of three high myopia patients who accept bilateral phacoemulsification, but delayed their second eye operation more than 25 months.

**Methods:** All the three observed patients delayed their second eye operation over 25month. The follow up time was more than 24 months after the second eye surgery. The measurements such as axial length and lens opacity were assessed.

**Results:** The second eye operation was delayed 25, 33 and 48 months. The clinical observation showed the exacerbation of the cataract as the time going on. The axial length of delayed surgery eye was changed from 26.09, 26.28, 26.21mm to 27.05, 26.85, 26.72 mm, but the fellow eyes was changed from 25.81, 31.48, 26.05mm to 25.76, 31.63, 26.16mm. The axial length was almost unchanged after the next follow up.

**Conclusion:** Cataract may affect the axial length of high myopes in the adults. Physicians should be aware of the possible development of axial length in cataract patients with myopia.

**Keyword:** Cataract; Axial length of the eye; Myopia

## Introduction

High myopia is known to be associated with cataract, and a relationship between myopia and cataract has been suggested [1,2]. Although the deprivation of form vision due to cataracts in childhood leads to increase in axial length and myopia had been reported [3] but if cataract may affect the axial length in adults is still unknown.

Here, we report retrospectively on the change of the axial length of three high myopia patients who accept bilateral phacoemulsification, but delayed their second eye operation more than 25 months. We are surprise to find this delay lead the worse results to the high myopia patients, because the axial length of delay surgery eyes were elongated with the cataract progresses while the patient is waiting the surgery. These data could add further epidemiologic evidence to the debate about whether an association exists between cataract and myopia and may serve to guide laboratory-based studies in the search for biological explanations of myopia risk factors in adults.

## Patients

Three patients were inpatient at the Eye Center, Affiliated Second Hospital, School of Medicine, Zhejiang University, China. This study had obtained prior approval of the study protocol by the Ethics Committee of the School of Medicine, Zhejiang University of China. Patients underwent complete ophthalmologic examination including visual acuity testing, biomicroscopy, A and B scan ultrasonography, optometry, and other pre-operation preparation for cataract.

Cataract was determined clinically using the Lens Opacity Classification System (LOCS) III system. After dilation of pupils with Mydrin-p (tropicamide 0.5% and phenylephrine hydrochloride 0.5% ophthalmic solution, Alcon, Belgium), and the presence and severity of a specific lens opacity were compared and documented according to LOCS III standard photographs.

Measurements of axial length (AL), anterior chamber depth (ACD), lens thickness (LT) and vitreous chamber depth (VCD) were obtained using a 10-MHz A-mode ultrasound device (B-scan-s, France). The mean of 10 separate readings was recorded, together with the standard deviation (SD) of each parameter. An SD for axial length measurement less than or equal to 0.13 mm was required. If the SD was greater, the reading was repeated up to another two times.

## Results

The data of patients observed were depicted in Table 1. The second eye surgery was delayed 25, 33 and 48 months. The clinical observation showed the exacerbation of the cataract as the time going on. Compare the two measurements we found the axial length of delayed surgery eye was changed from 26.09, 26.28, 26.21 mm to 27.05, 26.85, 26.72 mm, but the fellow eyes was changed from 25.81, 31.48, 26.05mm to 25.76, 31.63, 26.16mm. The axial lengths of delay surgery eye were elongated more than 0.5mm with the cataract progresses while the patient is waiting the surgery.

The follow up time was more than 24 months after the second eye surgery. The axial length was almost unchanged after the next follow up.

## Discussion

The relationship between myopia and age-related cataracts is not clear, despite several clinic-based [1-8] and population-based investigations [9,10]. The aetiology, pathogenesis, and treatment of myopia have been hotly debated in the ophthalmic community for decades. Many factors can affect the axial length and lead to myopia. Lid closure in early ocular and visual development is well recognized to cause ocular developmental abnormalities [11,12]. Central dense corneal opacities in early childhood may lead to visual deprivation and amblyopia and was shown to increase the ocular axial length [13]. Most researchers agree that people's myopia is in large part genetically determined, a growing body of evidence shows that visual experiences early in life may affect ocular growth

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Cases	Sex	Age	Eye	First measurements		Second measurements		Last measurements	Delayed eye		Follow up time
				Axial length	Cataract grades	Axial length	Cataract grades	Axial length	eye	time	
1	Male	52	OD	26.09	C1N2P1	27.05	C3N3P2	27.02	OD	48	24
			OS	25.81	C2N3P1	25.76	IOL	25.68			
2	Male	69	OD	31.48	C1N3P3	31.63	IOL	31.56	OS	33	26
			OS	26.28	C1N2P2	26.85	C2N3P2	26.77			
3	Female	70	OD	26.05	C2N3P2	26.16	IOL	26.11	OS	25	31
			OS	26.21	C1N2P1	26.72	C3N3P2	26.70			

Table 1: The Demographics of the study patients.

and eventual myopia. But there are no data about the definite impact factors on ocular axial growth in adults beside myopia.

Here we report that cataract increased the length of myopes in three adult Chinese people. The most typical case was a 52-old man whose axial length increased from 26.09 mm to 27.05 mm in 48 months, while the operation eye almost unchanged. Numerous observations support the conclusion that alterations of visual input in early life may affect axial growth of the eye in experimental animals [14,15]. Patients with unilateral congenital cataracts can affect the development of axial length in humans [16]. The opaque lens deprives the eye presumably from birth of patterned vision by restricting retinal stimulation to that occurring from unpatterned diffuse light. But from our cases we can deduce that cataract might cause elongation of the axial length in humans with myopia even in adult. This result has challenged the general accepted rule that the axial length is stable in adult. We all know that the two basic mechanisms by which animal myopia may be induced are form deprivation and optical defocus. The cataract can cause both form deprivation and optical defocus, so the reasons for the axial length are exist. But why it happened in myopia eyes? The most possible reason may be the instability of the axial length of the pathological myopia. Our results conflict with that of the Lin [17] who reported the axial length between the affected lenticular myopic eye and the fellow unaffected eye are not significantly different. But the average axial length observed by Lin was about 25 mm, while the average axial length we studied was over 26 mm.

One concern has been raised if the measuring error or the opaque lens can affect the result of axial length measurement. However based on the below reasons this influence is very limited. First, this research is the retrospective analysis, therefore axial length measurements had no subjective tendency and human factor disturbance; Next, axial length measurement results direct decide the intraocular lens computation, therefore in order to reduce the measuring error, the mean of 10 separate readings was recorded, with the SD less than 0.13mm was required. The results of the axial length were also confirmed by comparing the refraction difference between target sphere and actual sphere; once more, the opaque lens may influence the measuring result, theoretically the supersonic pass through opaque lens need more time than pass through the transparent lens and the intraocular lens, therefore obtains the axial length should be long. But in the fellow eye this influence was also exist; therefore the influence of the opaque lens to the axial length is extremely limited. Giansanti et al. [18] also showed that the incision of phacoemulsification may not affect the corneal curvatures.

The results indicate that the axial length of axial myopia eyes may increased at certain conditions in adult. We would like to remind that cataract patients with myopia can not be ignored. In view of their significance for the etiology of refractive errors, these findings deserve further exploration by a multicenter collaborative study that is based on a larger patient sample.

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