Cataract Extraction in High Myopic Eyes

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Background: According to the high prevalence of myopia in Taiwan, we analyze the adopted cataract extractions, identify predicting factors for postoperative vision, and to assess the incidence of retinal complications after Nd: YAG laser capsulotomy in high myopic eyes.

Methods: One hundred and twenty-five eyes, which the axial lengths were longer than 26 mm, following cataract extraction were enrolled. Surgeries adopted included phacoemulsification with intraocular lens implantation, extracapsular cataract extraction with intraocular lens implantation, phacoemulsification, and extracapsular cataract extraction. Logistic regression was utilized to assess predictive factors for postoperative vision.

Results: Postoperative vision of 41 eyes (32.8%) of the 125 high myopic eyes improved at least 4 lines of Snellen acuity. Thirty-two eyes (25.6%) achieved good postoperative vision (BCVA≥20/40), and 26 eyes (20.8%) demonstrated poor postoperative vision (BCVA<20/200). Younger age and shorter axial length were appreciated for better visual outcome ($p<0.05$). Nd: YAG laser capsulotomy is required for posterior capsular opacity. Three in 125 eyes (2.4%) developed retinal complications and 2 of them had retinal detachment subsequently within one month after Nd: YAG laser capsulotomy.

Conclusion: Most high myopic patients achieved visual improvement after cataract surgeries. Age and axial length are the predictive factors in high myopic patients. It is crucial to examine retina prior to Nd: YAG laser capsulotomy to prevent retinal complication.

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Key words: high myopia, cataract, Nd: YAG laser capsulotomy, retinal detachment.

Taiwan currently displays one of the highest rates of myopisation in the world. The myopia rate increases from 12 % of the population aged 6 years to 84% of 16 to 18-year-old, myopia, thus constituting an important issue before cataract surgery.[1] Vitreoretinal manifestations associated with high myopia, such as lattice degeneration, posterior staphyloma, macular degeneration, and even undetected retinal breaks may potentially result in retinal complications to affect the outcome of cataract extraction.[1-5]

Posterior capsular opacity is very common following cataract surgery and Nd: YAG laser posterior capsulotomy is the current treatment to improve visual acuity. It has been demonstrated that the risk of retinal complication following extracapsular

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cataract extraction with Nd: YAG laser capsulotomy increased 3.9 folds as compared to those without Nd: YAG laser capsulotomy in general population. The rate of retinal complications varied from 0.08 to 3.6% also reported in other studies.[6-10] In addition, recent studies focusing upon high myopia have rarely disclosed the associated risk of retinal detachment subsequent to laser capsulotomy, zero to 2 % for pseudophakia with phacoemulsification and 6% for aphakia with extracapsular cataract extraction.[2,3,5,11]

Due to the trend of transition for cataract surgery from conventional extracapsular cataract extraction (ECCE) to phacoemulsification (P) with intraocular lens (IOL) implantation, we would like to evaluate the relative success of these two techniques for high myopia. The predicting factors of good postoperative vision in variable density of cataract were also investigated. We would also present the incidence of postoperative retinal complications and the correlation with the Nd: YAG laser posterior capsulotomy for high myopia.

METHODS

We retrospectively reviewed high myopic patients, exhibiting axial length of 26 mm or longer, and undergoing cataract extraction from 1990 to 1999 in the Chang Gung Memorial Hospital Keelung (CGMHK) and followed up these patients for more than 6 months. Patient details pertaining to gender, age, and any previous ocular or systemic disease were recorded. The axial length was estimated by A/B scan (Allergan Humphrey, San Leandro, Californea). Corneal curvatures were measured by use of an auto-keratorefractometer (Topcon, Cortland, New York), and intraocular lens power was determined by use of the Sanders Retzlaff Kraff II (SRK II) formula. The cataract extraction was performed with either extracapsular cataract extraction or phacoemulsification, with or without IOL implantation. They were all carried out by appropriately experienced staff in the CGMHK. The timing and power delivery during the Nd: YAG laser posterior capsulotomy were also recorded.

The participants were divided into three groups according to postoperative visual acuity: (1) good postoperative visual acuity with best corrected visual acuity (BCVA) of 20/40 or better, (2) fair postoperative visual acuity with BCVA between 20/40 and 20/200, (3) poor postoperative visual acuity with BCVA worse than 20/200.

Furthermore, all patients were divided to group A (defined as postopertive BCVA≥20/200) and group B (postoperative BCVA<20/200) for comparison and to identify the predisposing factors of postoperative vision. The comparable clinical data were analyzed utilizing student-t test and logistic regression, and $p < 0.05$ was considered a statistically significant level of difference.

RESULTS

The results of total 131 eyes of 97 patients were reviewed. One eye of diabetic retinopathy, one eye of primary open angle glaucoma, and 4 eyes of intraoperative complications due to posterior capsule tear or vitreous loss were excluded, consecutive 125 eyes of 91 patients were enrolled for this study.

The mean age of patients was 61.58 ¡ 12.27 years, and the mean follow-up period was 20.84 months (ranging from 6 to 82 months). All eyes exhibited variable density of cataract obscuring the fundus thus contributing to the deterioration of the examination. The majority of these cases revealed a variable degree of vitreoretinal degeneration but no preexisting retinal break. The cataract surgery procedure performed included ECCE with IOL implantation (E+L): 59 eyes (47.2%), Phacoemulsification with IOL implantation (P+L): 60 eyes (48%), ECCE: 4 eyes (3.2%), and P: 2 eyes (1.6%). In this study group, the mean of axial length was 28.58 mm, ranging from 26 to 34.79 mm. Demographic data of E+L

Table 1. Demographic Data of Extracapsular Cataract Extraction and Phacoemulsification with Intraocular Lens Implantation

	E+L (N = 59)	P+L (N = 60)	*p*
Age (years)	64.02 ¡ 12.39	59.52 ¡ 11.62	0.02*
Axial length (mm)	28.45 ¡ 3.41	28.45 ¡ 3.93	0.49
Keratometry (D)	43.80 ¡ 2.93	44.89 ¡ 2.05	0.0002*
Follow-up (months)	28.20 ¡ 7.95	12.77 ¡ 3.54	0.001*

The numbers means: mean ¡ standard deviation

Abbreviations: E+L: extracapsular cataract extraction with intraocular lens implantation; P+L: phacoemulsification with intraocular lens implantation

*: $p<0.05$, statistically different with student-*t* test. mm: millimeter; D: diopter

Table 2. Predicting Factors for Postoperative Vision

		Group A	Group B	*p*	Odds Ratio	95% CI for Odds Ratio	
						Lower	Upper
Age *(years)	Mean	55.77	67.32				
	SD	12.17	9.10	0.004*	1.097	1.030	1.170
Axial length*(mm)	Mean	28.06	29.18				
	SD	1.89	3.6	0.021*	0.954	0.711	1.280
Keratometry (D)	Mean	43.75	44.38				
	SD	3.09	3.8	0.754	1.342	1.046	1.722

Group A: postoperative best corrected visual acuity ≥ 20/200

Group B: postoperative best corrected visual acuity < 20/200

*: $p<0.05$, statistically different with logistic regression

Abbreviations: SD: standard deviation; mm: millimeter; D: diopter; CI: confidence interval.

and P+L, the mean of patient age, keratometry result, and follow-up period were listed (Table 1). In the total 125 eyes of this study, 41 eyes (32.8%) visual acuity improved at least four lines of the Snellen acuity chart, 36 eyes (60%) of P+L and 36 eyes (61.02%) of E+L achieved refractive target within ¡ 1.0 Diopter.

Following cataract surgeries incorporating the following procedure categories, E+L, P+L, ECCE, or P, 32 of the 125 eyes (25.6%) achieved good postoperative visual acuity (BCVA≥20/40) and 26 of 125 eyes (20.8%) demonstrated poor postoperative visual acuity (BCVA<20/200). To assess the potential factors contributing to postoperative visual acuity, we utilized logistic regression, and the results suggesting significant difference for age (55.77 vs 67.32 years; $p=0.004$, odds ratio equals 1.097) and axial length (28.06 vs 29.18 mm; $p=0.021$, odds ratio equals 0.954) for comparing group A (BCVA≥20/200) and group B (BCVA<20/200) (Table 2). Therefore, elder age in high myopia associated with prominent chorioreatinal atrophy is the major cause of poor postoperative vision in our study.

The overall rates of posterior capsular opacity and Nd: YAG laser capsulotomy were 36.8% and 26.4% respectively. The incidence of posterior capsular opacity in E+L group was 45.8% and in P+L group was 23.3%. However, follow-up period of two groups was different (Table 3).

Three of 125 eyes (2.4%) developed retinal complications and two of them developed retinal detachment within one month after the Nd: YAG laser capsulotomy. The energy of laser in the first case was 28.8 mJ, and the capsulotomy was done seven months after E+L. The energy of laser of second case was 38.4 mJ, and the capsulotomy was performed two years after P+L respectively. Both of the cases did not receive any further surgery after retinal detachment. The other patient who didn't receive Nd:YAG laser capsulotomy also developed two retinal breaks 7 months after E+L. This patient was

Table 3. Incidence of Posterior Capsular Opacity (PCO) and Nd:YAG Laser Posterior Capsulotomy

	PCO	Nd: YAG laser	Follow-up period (months)
E+L	27/59 (45.8%)	17/59(28.8%)	28.20
P+L	14/60(23.3%)	13/60(21.7%)	12.77

Abbreviations: E+L: extracapsular cataract extraction with intraocular lens implantation; P+L: phacoemulsification with intraocular lens implantation

Table 4. Retinal Complications

Age/Sex	Surgery	Laser energy	Time after YAG	Time after surgery	Complication
53/F	E+L	28.8 mJ	20 days	8 months	RRD
69/F	P+L	38.4 mJ	14 days	25 months	total RD
56/M	E+L	-	-	7 months	RB

Abbreviations: F: female; M: male; E+L: extracapsular cataract extraction with intraocular lens implantation; P+L: phacoemulsification with intraocualr lens implantation; RRD: rhegmatogenous retinal detachment; RD: retinal detachment; RB: retinal breaks; mJ: minijoules

treated with focal retinal photocoagulation. Despite such follow-up treatment, vitreous hemorrhage resulted four years later in this case (Table 4).

DISCUSSION

In 1980, Hoffer reviewed the biometry of 7,500 cataractous eyes which the mean axial length was 23.65 mm, the author cited a mean axial length of longer than 25.5 mm occurring only 3 % of the general population.[12] The definition of high myopia have been redefined as axial length being greater than 25.5 mm or 26 mm recently.[13-15] Strikingly, a recent series of Taiwanese youth has suggested an increasing incidence of high myopia (over-6.0 D), the incidence was 20 % for girls and 12 % for boys in the age of 18 years.[1] This frequencies were much higher than an analogous figure of 2.5% of Swedish teenagers.[16] It is an important issue of concern in the future that the cases of retinal complications will increase following cataract extraction due to the more high myopic eyes.[1-5]

Acknowledging to obscurity of viewing that may result from the variable opacity of cataract, the detailed and comprehensive retinal examination to identify the peripheral retinal degeneration associated with high myopia is a challenge for clinicians. In this study, most cataracts of high myopia were treated by extracapsular cataract extraction or phacoemulsification with IOL implantation over the past decade. The mean age of patients undergoing P+L was less than that for E+L patients. It was due to difficulty to perform phacoemulsification for mature cataract of elder patient and most ophthalmologist prefer E+L for these cases.

We compared group A (BCVA≥20/200) and group B (BCVA<20/200) the mean age was lower and axial length was shorter in the better resultant visual acuity group. According to our study, age and axial length are the predicting factors of postoperative vision for uncomplicated cataract extraction for high myopia eyes. These factors were identified in previous report as preoperative factors in high myopia as well.[17]

The overall incidence of retinal complications such as retinal breaks or retinal detachment after the surgery, with or without Nd: YAG laser capsulotomy, is 2.4% in this study. This figure appears higher than the literature reported data for the general population following cataract extraction, in which the rates ranged from 0.41% to 1.4%.[18-20] Therefore, the high myopia should be considered a risk factor for cataract surgery.

Since posterior capsular opacity is very common after the cataract surgery, it will decrease the satisfaction of the postoperative vision. Nd: YAG laser posterior capsulotomy is considered as the first principle to improve postoperative vision. Despite a number of studies focus upon high myopia patients having advocated retinal detachment following Nd: YAG laser capsulotomy since 1980, few have demonstrated increasing risk of retinal detachment which correlated to laser capsulotomy.[2-5,19] It is interesting that our two cases developed retinal detachment following Nd: YAG laser capsulotomy within one month. This short duration revealed the strong relationship between retinal detachment and the laser capsulotomy. The incidence of retinal complication following Nd: YAG posterior capsulotomy for high myopia was greater than that reported in previous studies.[2,3,5]

Furthermore, the power delivered, the dimension of the laser pulse, and the total energy for both cases which developed retinal complications following Nd: YAG posterior capsulotomy were lower than those levels reported for several other series.[7,10,11] As reflected by the observed timing of postoperative retinal detachment, this sight-threatening complication is not correlated to the technique of capsulotomy, neither option being associated with cataract surgery. Lerman et al. (1984) and Krause et al. (1986) have both referred to the existence of an acoustic shock wave during Nd: YAG laser capsulotomy including chemical and physical change to the vitreous may lead to retinal detachment.[21,22] Despite a preliminary comprehensive peripheral retinal examination prior to Nd: YAG laser capsulotomy may be limited due to variable contraction of anterior capsule, currently Nd: YAG laser posterior capsulotomy is still recommended for treatment of posterior capsular opacity following cataract extraction.

In conclusion, variable density of cataract obscuring view of the fundus for preoperative evaluation is the challenge for physicians. High myopia associated with prominent chorioretinal atrophy , maculopathy, or staphyloma is the major cause for

poor postoperative vision. Nevertheless, age and axial length of patients are the predisposing factors of postoperative vision for cataract extraction in high myopic patients. Currently Nd: YAG laser capsulotomy is the standard procedure for treating posterior capsular opacity which is the most common cause to compromise the postoperative vision. Although the number in our report is limited, the rate of retinal complications following Nd: YAG posterior capsulotomy is higher than previous literature.[1,3,5] Therefore, a thorough and comprehensive preliminary retinal examination is critical before performing cataract extraction and subsequent Nd: YAG laser capsulotomy for high myopic eyes.

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高度近視眼之白內障摘除術

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背 景： 鑑於近視在台灣之高盛行率，我們因而分析高度近視眼接受白內障摘除術之方法，影響術後視力之因素，及雅鉻鐳射後囊切開術後產生視網膜併發症之比率。

方 法： 收集125隻眼軸大於26毫米之高度近眼接受白內障手術。手術方法包括晶體乳化術併人工水晶體植入，囊外白內障摘除併人工水晶體植入，晶體乳化術，及囊外白內障摘除。記錄術前及術後最佳矯正視力及視網膜併發症的時間。以logistic regression探討影響術後視力之因素。

結 果： 41眼 (32.8%) 術後增加四行之視力。32眼 (25.6%) 可達滿意的術後視力，即最佳矯正視力大於等於0.5，26眼 (20.8%) 爲較差之術後視力，即最佳矯正視力小於0.1。在術後視力較佳這組中 (最佳矯正視力大於0.1)，發現年齡較輕及眼軸較短。後囊混濁爲白內障術後最常見之併發症，而雅鉻鐳射後囊切開術爲其治療方式。然而125隻眼中3隻眼睛 (2.4%) 產生視網膜併發症，其中2隻眼睛於雅鉻鐳射後囊切開術施行一個月內發生視網膜剝離。

結 論： 在此報告中大部分高度近視白內障術後視力皆有所進步。老年性高度近視又具明顯脈絡膜視網膜退化是術後視力無明顯進步之主要因素。雖術前介質混濁致眼底檢查不易，年齡及眼軸爲高度近視術後視力之預期因素。既然雅鉻鐳射後囊切開術是術後後囊混濁主要治療方式，鐳射前詳細眼底檢查避免視網膜併發症是非常重要的。
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關鍵字： 高度近視，白內障，雅鉻鐳射後囊切開術，視網膜剝離。

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