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Research Article

Posterior Capsular Opacification in High Myopic Eyes Post Cataract Surgery: A Single Centre Experience from Western India

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ABSTRACT

Background: Posterior capsular opacification (PCO) is common delayed complication following cataract surgery. High myopia is a recognized risk factor for PCO ,yet the incidence of PCO specifically in this population remains underexplored.

Aims: To study PCO rate in high myopic patients operated for cataract surgery and relationship of axial length with grade of PCO.

Setting and Design: Prospective observational study at a tertiary care hospital.

Materials and Methods: This study included 40 high myopic eyes (spherical equivalent ≥ –6.0 D or axial length ≥ 26.5 mm) who underwent SICS with rigid PCIOL implantation at tertiary care center. PCO was diagnosed by slit-lamp biomicroscopy.

Statistical Analysis: Data were analyzed using SPSS v27.0 with Chi-square test, t-test,pearson correlation,logistic regression. A p-value <0.05 was considered statistically significant.

Results: PCO occurred in 72.5% (29/40) of patients (p=0.0044), with a mean onset of 10.34 ± 4.01 months. Central PCO was predominant (89.7%), and Grade 2 was most common (57.7%). Mean axial length was 27.39 ± 1.15 mm, significantly higher in PCO cases. Axial length correlated positively with PCO grade (p=0.0476) and negatively with time to PCO (r=-0.746, p<0.0001). Lower IOL power (3-8 D) was associated with higher PCO incidence (p=0.0089) Spherical equivalent showed a non-significant trend toward higher PCO (p=0.0781).

Conclusion: Posterior capsular opacification is an under-recognized complication after cataract surgery in high myopes. Awareness of its incidence and risk factors is important for surgical planning, postoperative counseling, and timely management.

Keywords: *Posterior capsular opacification, High myopia, Axial length, Cataract surgery.*

INTRODUCTION

Cataract remains the leading cause of preventable blindness worldwide, accounting for nearly half of all blindness cases[1] In India, cataract is responsible for 50–80% of bilateral blindness, and cataract surgery is one of the most commonly

performed ophthalmic procedures[2]. Advances in surgical techniques and intraocular lens (IOL) technology have led to excellent postoperative outcomes; however, delayed complications continue to challenge long-term visual rehabilitation. Posterior capsular opacification (PCO) is the most frequent late sequelae following extracapsular cataract extraction and phacoemulsification[3]. It results from proliferation and migration of residual lens epithelial cells onto the posterior capsule[4]. Depending on morphology, it may present as fibrotic PCO or as Elschnig pearls. Although Nd:YAG laser capsulotomy remains an effective treatment, it carries potential risks including intraocular pressure spikes, cystoid macular edema, and retinal detachment[5].

High myopia, defined as spherical equivalent ≤ –6.0 D or axial length ≥ 26.5 mm, is increasingly prevalent worldwide[6]. Structural changes in myopic eyes, including large capsular bags, altered lens epithelial cell behavior and low posterior capsule IOL adhesion are associated with higher rates of PCO. The exact mechanism of PCO in this subgroup, however, remains unclear. Previous studies have suggested that myopic eyes implanted with low-powered, high posterior-radius IOLs may exhibit weaker capsular adhesion, predisposing to PCO.[6,7]

With the global burden of myopia projected to rise significantly, and with increasing numbers of high myopes undergoing cataract surgery at younger ages, it is important to establish the incidence and risk factors for PCO in this population. [8] This study was undertaken to evaluate the rate of posterior capsular opacification in high myopic eyes operated for cataract at a tertiary care center and to explore its relationship with axial length.

MATERIALS AND METHODS

Study design and setting:
This prospective observational study was conducted over a two-year period at a tertiary healthcare centre in Western India.

Sample size and selection:
The study included 40 high myopic eyes(spherical equivalent ≥ –6.0 D or axial length ≥ 26.5 mm)
who had undergone uncomplicated small incision cataract surgery (SICS) with in-the-bag implantation of round-bodied PMMA intraocular lenses (IOLs). All surgeries were performed by one of three senior surgeons (each with over 10 years of experience). Patients were selected using simple random sampling. Exclusion criteria included Patients below 50 years, operated by surgeons other than the three designated study surgeons, posterior staphyloma, Preexisting/Primary PCO, Post uveitis eyes ,Post vitrectomy ,Immune diseases, Extended CCC ,PCR ,Other than in bag IOL implants (like ACIOL, IOL in sulcus, SFIOL),Aphakia.

Follow-up protocol:
Patient were examined at 1 week, 1 month, 3 months initially followed by 3 monthly review. At each visit including Snellen visual acuity (VA), retinoscopy, slit-lamp bio microscopy, Perkins applanation tonometry, and dilated fundus examination. PCO identified by slit-lamp retroillumination and images were taken at each follow up visit.

Outcome measures:
Rate of PCO and its relation with axial length

Statistical analysis:
Data were analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5) . Continuous variables were expressed as mean ± SD, and categorical variables as proportions. Chi-square test was used for categorical comparisons. Logistic regression was applied to identify independent predictors of PCO. A p-value <0.05 was considered statistically significant.

RESULTS

1.Distribution of PCO

PCO (YES/NO)	Frequency	Percent
NO	11	27.5%
YES	29	72.5%
Total	40	100.0%

Posterior capsule opacification (PCO) was observed in 29 (72.5%) cases, while 11 (27.5%) had no PCO. The value of Z is 2.8460. The value of p is 0.0044. The result is significant at $p < .05$.

Table 2: Axial Length (in Group)

Axial Length (in Group)	Frequency	Percent
24.5-26.5	4	10.0%
26.5-28.5	28	70.0%
28.5-30.5	8	20.0%
Total	40	100.0%

In our study, axial length measurements were grouped and analyzed across 40 patients. The majority of patients (28 out of 40, 70%) had axial lengths in the range of 26.5–28.5 mm. This was followed by 8 patients (20%) with axial lengths between 28.5–30.5 mm. Only 4 patients (10%) had axial lengths in the lower range of 24.5–26.5 mm
The value of z is 5.4772. The value of p is < .00001. The result is significant at p < .05.

Table 3: Distribution of mean Time of PCO (months)

	Number	Mean	SD	Minimum	Maximum	Median
Time of PCO (months)	29	10.3448	4.0114	4.0000	21.0000	10.0000

In our study, among the 29 patients who developed posterior capsular opacification (PCO), the mean time of PCO occurrence was 10.3448 ± 4.0114 months. The minimum time of onset was 4.0000 months and the maximum was 21.0000 months, with a median time of 10.0000 months, indicating that most cases developed within the first year following surgery.

Table 4: Distribution of mean Axial length mm: Grade of central PCO

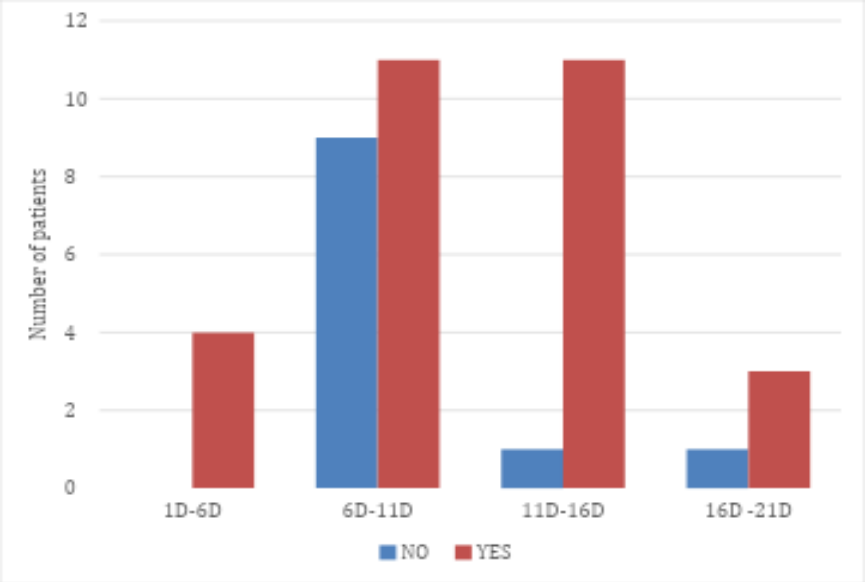
		Number	Mean	SD	Minimum	Maximum	Median	p-value
Axial length mm	Grade 1	10	26.6750	1.0055	25.5600	28.3100	26.6600	0.0476
	Grade 2	15	27.6280	.8697	26.5000	29.1100	27.2900	
	Grade 3	1	27.9800	.0000	27.9800	27.9800	27.9800	

The axial length showed a statistically significant difference across the three grades of PCO (p = 0.0476). In Grade 1, the mean axial length was 26.6750 ± 1.0055 mm. Grade 2 patients had a higher mean axial length of 27.6280 ± 0.8697 mm, and Grade 3, which included only one patient, had the highest value of 27.9800 ± 0.0000 mm. This trend indicates that axial length increased progressively with the severity of PCO, supporting a significant association between greater axial length and higher PCO grade.

Table 5: Association between Spherical equivalent on retinoscopy and PCO

Spherical equivalent on Retinoscopic		NO	YES	TOTAL
1D-6D		0	4	4
Row	%	0.0	100.0	100.0
Col %		0.0	13.8	10.0
6D-11D		9	11	20
Row	%	45.0	55.0	100.0
Col %		81.8	37.9	50.0
11D-16D		1	11	12
Row	%	8.3	91.7	100.0
Col %		9.1	37.9	30.0
16D	**-21D**	1	3	4
Row	%	25.0	75.0	100.0
Col %		9.1	10.3	10.0
TOTAL		11	29	40
Row	%	27.5	72.5	100.0
Col %		100.0	100.0	100.0

Chi-square value: 6.8130; df: 3 p-value: 0.0781

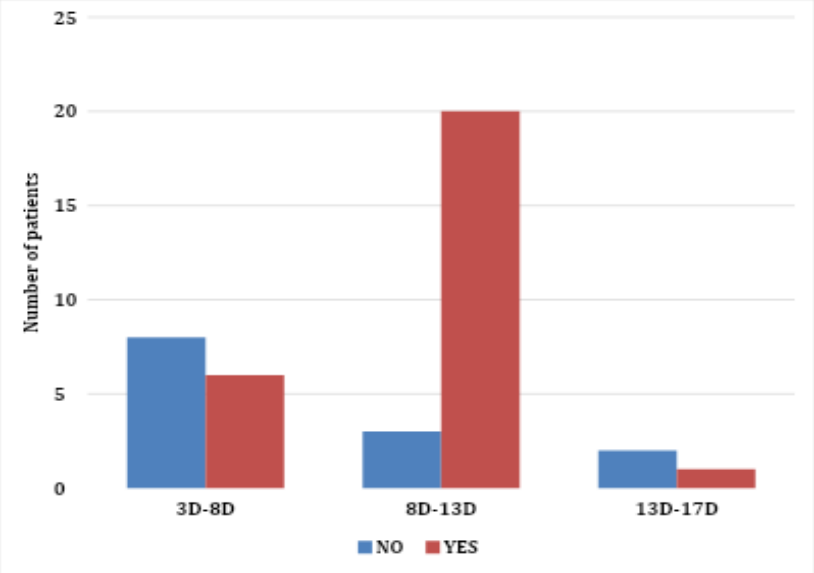


An analysis of the association between the spherical equivalent on retinoscopy and the presence of PCO showed a notable trend, although not statistically significant (p = 0.0781). Among patients with a spherical equivalent of 1D - 6D, all 4 patients (13.8%) were in the "YES" group, with none in the "NO" group. In the 6D–11D category, 9 patients (81.8%) were from the "NO" group and 11 patients (37.9%) were from the "YES" group. For the 11D–16D group, 1 patient (9.1%) belonged to the "NO" group while 11 patients (37.9%) belonged to the "YES" group. In the highest range (16D–21D), 1 patient (9.1%) was from the "NO" group and 3 patients (10.3%) were from the "YES" group. Although a higher proportion of patients with more severe refractive errors (especially ≥11D) were in the "YES" group, this association did not reach statistical significance.

Table 6: Association between Power of IOL Group (D) and PCO

Power of IOL Group (D)		**NO**	**YES**	**TOTAL**
3D-8D		8	6	14
Row	%	57.1	42.9	100.0
Col %		61.5	22.2	35.0
8D-13D		3	20	23
Row	%	13.0	87.0	100.0
Col %		23.1	74.1	57.5
13D-17D		2	1	3
Row	%	66.7	33.3	100.0
Col %		15.4	3.7	7.5
TOTAL		13	27	40
Row	%	32.5	67.5	100.0
Col %		100.0	100.0	100.0

Chi-square value: 9.4408; df: 2 p-value: 0.0089



Among the 27 patients who developed posterior capsular opacification (PCO), 6 patients (22.2%) had intraocular lens (IOL) power between 3D –8 D, 20 patients (74.1%) had IOL power between 8D –13 D, and only 1 patient (3.7%) had IOL power between 13D –17 D. This distribution indicates that lower IOL power was significantly associated with a higher incidence of PCO, suggesting that eyes receiving lower-power IOLs—commonly seen in high myopes with longer axial lengths—were more prone to developing PCO (p = 0.0089).

Table 7: Distribution of Mean axial length (mm) and PCO

	PCO	Number	Mean	SD	Minimum	Maximum	Median	p-value
Axial length (mm)	NO	11	26.8109	3.7749	25.0000	28.4600	26.8000	0.0372
	YES	29	27.6828	4.4497	25.0000	29.8100	27.2900	

The mean axial length in the PCO "NO" group was 26.8109 ± 3.7749 mm (n = 11), while in the PCO "YES" group, it was 27.6828 ± 4.4497 mm (n = 29). This difference was statistically significant with a p-value of 0.0372

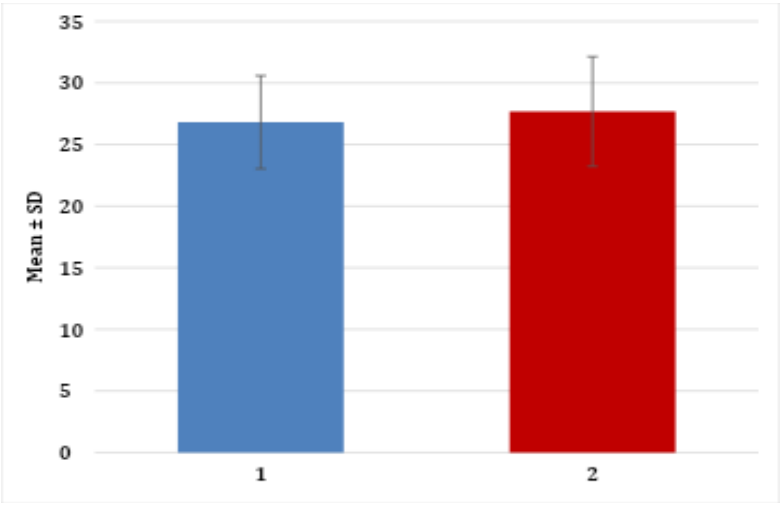
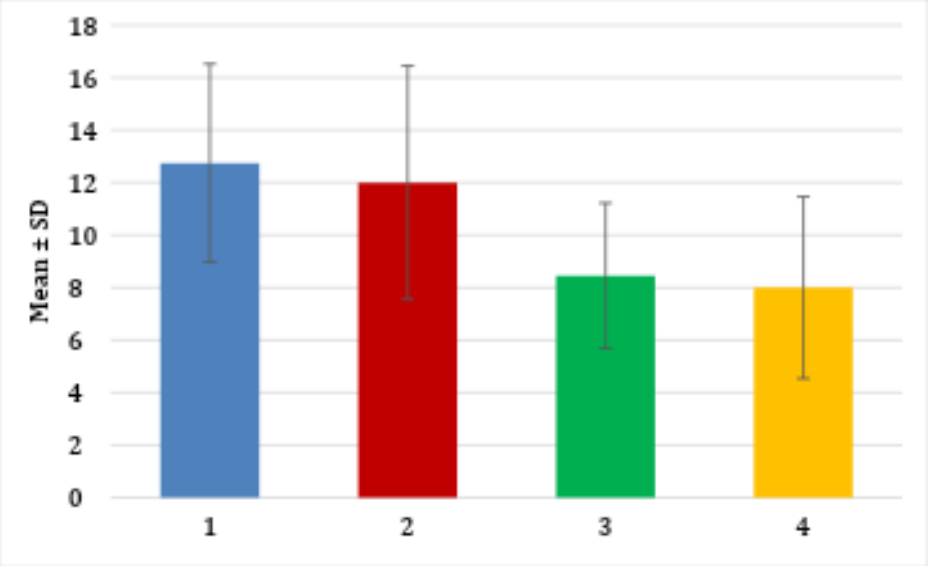


Table 8: Association between Time of PCO (months): Spherical equivalent on Retinoscopy

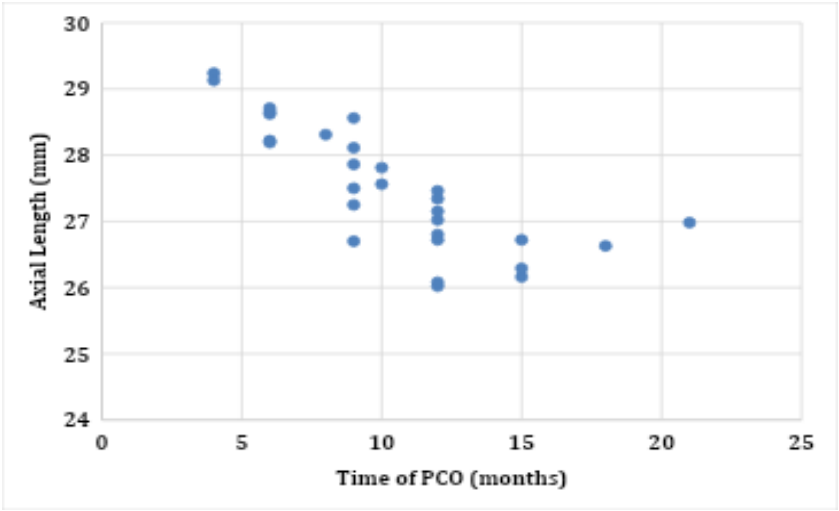
		Number	Mean	SD	Minimum	Maximum	Median	p-value
Time of PCO	1D-6D	4	12.7500	3.7749	9.0000	18.0000	12.0000	
	6D-11D	11	12.0000	4.4497	6.0000	21.0000	12.0000	0.0699
	11D-16D	11	8.4545	2.7700	4.0000	12.0000	9.0000	
	16D -21D	3	8.0000	3.4641	4.0000	10.0000	10.0000	



In our study, the mean time of posterior capsular opacification (PCO) onset varied across different ranges of spherical equivalent measured by retinoscopy. For patients with a spherical equivalent of 1D - 6D (4 patients), the mean time of PCO was 12.7500 ± 3.7749 months. In the 6D to 11D group (11 patients), the mean time was 12.0000 ± 4.4497 months. For those in the 11D to 16D range (11 patients), the mean time was shorter, at 8.4545 ± 2.7700 months. In the 16D to 21D group (3 patients), the mean time was 8.0000 ± 3.4641 months. Although there was a trend toward earlier onset of PCO with higher spherical equivalents, this difference was not statistically significant (p = 0.0699).

Table 9: Correlation of Time of PCO (months): Axial length(mm)

Case		Axial length(mm)	**Remarks**
Time of PCO (months)	Pearson Correlation Coefficient (r)	-.746	Negative correlation
	P-value	<.0001	Significant
	Number	29	



The value of Pearson Correlation Coefficient (r) was -.746. A Negative correlation was found between Axial Length and Time of PCO (months). The P-value was <0.0001, indicating that the result was statistically significant.

DISCUSSION

Posterior capsular opacification (PCO) is common delayed complication following cataract surgery. High myopia is a recognized risk factor for PCO ,yet the incidence of PCO specifically in this population remains underexplored. This observational study evaluated 40 post-cataract high myopic patients, with most aged 61–70 years (mean age 64.2 ± 7.07 years), and a male predominance (67.5%, p=0.0269), consistent with trends reported by Saxena et al.[9]

Nuclear sclerosis grade 2 (NS2) was the most common cataract morphology (27.5%, p<0.00001), aligning with findings by Cetinkaya et al. and Kanthan et al., who linked high myopia to increased nuclear cataract prevalence due to elevated oxygen exposure in elongated eyes accelerating protein denaturation and nuclear opacification.[10,11]

Preoperatively, a BCVA of 0.6 logMAR was most prevalent (25.0%, p<0.00001), corroborating the observation by Pessoa et al. that patients with BCVA worse than 0.5 logMAR were more likely to develop posterior capsular opacification (PCO) postoperatively .

Most patients had axial lengths between 26.5–28.5 mm (70.0%, mean 27.39 ± 1.15 mm, p<0.00001), with spherical equivalents of 6.5–8.5 D (27.5%, p=0.00174).

Visual outcomes were favorable: by day 21 post-op, 47.5% had BCVA of 0 logMAR (p<0.00001). However, PCO incidence was high at 72.5% (p=0.0044), with most (60%) developing it within one year (mean time 10.34 ± 4.01 months). Central PCO predominated (89.7%, p<0.00001), consistent with Chang et al., who linked longer axial lengths to increased central PCO via altered capsular dynamics and lens epithelial cell (LEC) behavior.[12]

Grade 2 PCO was most common (57.7%, p=0.0001), and patients with higher axial lengths had more severe PCO (mean AL 27.63 ± 0.87 mm, p=0.0476). This supports Zhao and Hovanesian's hypothesis that larger capsular bags and lower IOL power in high myopes contribute to more pronounced PCO due to reduced IOL–capsular contact and mechanical stretch.[13,14]

Patients developing PCO had significantly higher mean axial lengths (27.68 ± 4.45 mm vs 26.81 ± 3.77 mm; p=0.0372). A significant negative correlation (r = –0.746, p<0.0001) between axial length and time to PCO onset further confirms axial elongation as a key risk factor, as also noted by He et al. and Donachie et al .[15]This result was consistent with opinion that high myopic eyes have poor barrier effect against LEC migration and also proposed role of proinflammatory status in the aqueous humor of highly myopic eyes that facilitates PCO formation.While the correlation between spherical equivalent and PCO was not statistically significant (p = 0.0699), a trend toward earlier and more severe PCO was observed in high myopes, echoing findings by Tong N et al.[16]

We found that the highest number of patients with Grade 3 central PCO were between 3D–8D power of IOL, (100.0%, n = 1), highest number of patients with Grade 2 central PCO were between 8D-13D and with Grade 1 central PCO were between 13D-17D.Although the difference among groups was not statistically significant (p = 0.1618), this trend suggests that lower IOL power, often implanted in highly myopic eyes, may be associated with higher grades of posterior capsular opacification. Wang et al. reported a similar trend, where patients with IOL power <10D showed a higher incidence of central PCO, possibly due to poor IOL–capsular bag contact in large eyes [17]. Hecht I et al. also noted that in patients with lower IOL power, PCO developed later but was more likely to be central and visually significant .This could be due to various factors including the way in which IOL interacts with capsular bag and subsequent cellular changes that lead to PCO. [18]

Clinical Implications

1. High axial length is confirmed as significant predictor of PCO.
2. Highly myopic patients may benefit from closer and longer postoperative follow-up.
3. IOL design innovations aimed at improving posterior capsule adhesion in long eyes may help reduce PCO incidence.

CONCLUSION

Our study strengthens the growing body of evidence indicating that axial length and low IOL power are major contributors to the incidence and severity of PCO in myopic eyes. These findings support the need for tailored surgical strategies and closer monitoring in such patients.

REFERENCES

1. Resnikoff S, Pascolini D, Etya'Ale D, Kocur I, Pararajasegaram R, Pokharel GP, Mariotti SP. Global data on visual impairment in the year 2002. Bulletin of the world health organization. 2004 Nov;82(11):844-51.
2. World Health Organization. Global Initiative for the Elimination of Avoidable Blindness: Action Plan 2006–2011. Geneva: WHO Press; 2007. Available from: https://apps.who.int/iris/handle/10665/43754
3. Schaumberg DA, Dana MR, Christen WG, Glynn RJ. A systematic overview of the incidence of posterior capsule opacification. Ophthalmology. 1998 Jul 1;105(7):1213-21.
4. Marcantonio JM, Vrensen GF. Cell biology of posterior capsular opacification. Eye. 1999 May;13(3):484-8.
5. Aslam TM, Devlin H, Dhillon B. Use of Nd: YAG laser capsulotomy. Survey of ophthalmology. 2003 Nov 1;48(6):594-612.
6. Wong TY, Ferreira A, Hughes R, Carter G, Mitchell P. Epidemiology and disease burden of pathologic myopia and myopic choroidal neovascularization: an evidence-based systematic review. American journal of ophthalmology. 2014 Jan 1;157(1):9-25.

7. Yamada K, Nagamoto T, Yozawa H, Kato K, Kurosaka D, Miyajima HB, Kimura C. Effect of intraocular lens design on posterior capsule opacification after continuous curvilinear capsulorhexis. Journal of Cataract & Refractive Surgery. 1995 Nov 1;21(6):697-700.
8. Xu L, Ma Y, Yuan J, Zhang Y, Wang H, Zhang G, Tu C, Lu X, Li J, Xiong Y, Chen F. COVID-19 quarantine reveals that behavioral changes have an effect on myopia progression. Ophthalmology. 2021 Nov 1;128(11):1652-4.
9. Saxena A, Prakash M, Rathi A, Kumar A. Clinical profile of patients presenting with posterior capsular opacification following cataract surgery. Indian J Ophthalmol. 2019;67(1):65–69.
10. Zhang J, Zhang SS, Yu Q, Wu JX, Lian JC. Comparison of corneal flap thickness using a FS200 femtosecond laser and a moria SBK microkeratome. International journal of ophthalmology. 2014 Apr 18;7(2):273.
11. Kanthan GL, Mitchell P, Rochtchina E, Cumming RG, Wang JJ. Myopia and the long-term incidence of cataract and cataract surgery: the B lue M ountains E ye S tudy. Clinical & experimental ophthalmology. 2014 May;42(4):347-53.
12. Chang SW, Su TY, Chen YL. Influence of ocular features and incision width on surgically induced astigmatism after cataract surgery. Journal of Refractive Surgery. 2015 Feb 1;31(2):82-8.
13. Zhao Y, Li J, Lu W, Chang P, Lu P, Yu F, Xing X, Ding X, Lu F, Zhao Y. Capsular adhesion to intraocular lens in highly myopic eyes evaluated in vivo using ultralong-scan-depth optical coherence tomography. American journal of ophthalmology. 2013 Mar 1;155(3):484-91.
14. Hovanesian JA, Sharma V, Zhang J, et al. Posterior capsule–intraocular lens adhesion and capsular bend morphology in highly myopic versus emmetropic eyes: A prospective study. J Cataract Refract Surg. 2024;50(3):345–352. doi:10.1016/j.jcrs.2024.01.005.
15. Donachie PH, Johnston RL, Jaycock P, James S, Boland K, Egan M, et al. Posterior capsule opacification rates and risk factors: an analysis of 500,872 cataract operations from the UK National Ophthalmology Database. Eye (Lond). 2023;37(5):975–83.
16. Tong N, Guo J, Chen X, Zhang H, Tian X, Xu X. Risk factors for posterior capsule opacification after cataract surgery: A retrospective clinical study. Medicine (Baltimore). 2018;97(28):e11381.
17. Wang X, Xue S, Yu Z, Wang F, Wang L, Wang Y, Wang L. Changes in IOL power after laser peripheral iridotomy based on multivariate analysis. BMC ophthalmology. 2024 Oct 14;24(1):448.
18. Hecht I, Dubinsky-Pertzov B, Karesvuo P, Achiron A, Tuuminen R. Association between intraocular lens diopter and posterior capsular opacification. Clin Exp Ophthalmol. 2020 Sep;48(7):889-894. doi: 10.1111/ceo.13821. Epub 2020 Aug 6. PMID: 32639048.