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QUARTERLY PUBLISHED

- **Editorial: The Myopia Tsunami: A Looming Public Health Crisis**
- **Effect of Pupil Dilatation on AL-Scan Biometry**
- **Contrast Sensitivity in β -Thalassemia Major**
- **Myopia Progression Across Age Groups**
- **High-Order Aberrations after Near Work in Myopic Students**
- **Eye Rubbing and Keratoconus Correlation**
- **Complications of Manual SICS Cataract Surgery**
- **Presbyopia Challenges in Free Eye Camps**

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Al-Shifa Journal of Ophthalmology

A Journal of Al-Shifa Trust Eye Hospital, Rawalpindi

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Editorial: The Myopia Tsunami: A Looming Public Health Crisis

Saif Ullah

Introduction:

Myopia has emerged as one of the most serious public health problems in eye care around the globe. It was formerly believed to be a harmless refractive error, but is now known to be a progressive disorder that can be sight threatening. However, the situation of myopia has been transformed in recent decades, particularly in east and south Asian countries, with more than 80% of school aged children affected. It is estimated that by 2050, almost half of the world's population will be myopic and that 10% will develop high myopia and its complications such as retinal detachment, glaucoma, cataract and myopic maculopathy¹.

This epidemic is a result of multiple factors. Urban lifestyles, less time spent outdoors, to longer use of digital devices and increased near work are factors that have accelerated onset and progression². The influence of the environment is now known to be dominant and genetic predisposition is of importance. The key point is that each 1 diopter of myopia has an increment risk of developing permanent vision threatening diseases. A risk of Macular Degeneration is increased by approximately 67% for every diopter³, a risk of retinal detachment is increased by nearly 30% for each diopter and a risk of open angle glaucoma is increased by approximately 20% for every diopter^{4,5}.

This “myopia tsunami” not only threatens the individual vision, but the performance of healthcare systems, economies and educational results on a global scale.

Conclusion:

There is a need for urgent action by clinicians, researchers, educators and

policymakers due to the increasing burden of myopia. There are a few evidence-based interventions with great potential such as low dose atropine⁶, orthokeratology and myopia control lenses that are not readily available or economical. Organized programmes of outdoor activity and public health announcements to parents and schools are also of paramount importance in the field of preventive interventions.

The conversation needs to be with a strong leadership from the Ophthalmology and Optometry profession, and in support of the inclusion of myopia as a health priority for the world. The crisis must be handled in an interdisciplinary way. Without intervention, this myopia tsunami will begin to change the whole face of vision care, and make it a silent pandemic of blindness.

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Comparing Effect of Pre and Post Pupil Dilatation on Biometry Obtained by AL-Scan

Mehvash Hussain¹, Fizzah Farooq², Madiha Waseem²

Abstract:

To assess the effect of pharmacologic pupil dilation on ocular biometric measurements and to determine whether dilation influences intraocular lens (IOL) power calculations or not.

Methods: A cross-sectional study, was conducted at the Department of Ophthalmology, Civil Hospital Karachi. Data was collected in designed questionnaire via non probability consecutive sampling technique. Biometric assessments including axial length (AL), anterior chamber depth (ACD), kerato-metric values (K) and central corneal thickness (CCT) were obtained using the AL-Scan device. All parameters were recorded twice, first under un dilated conditions and then after dilation with 1% tropicamide. The power of the intraocular lens (IOL) was determined with the SRK/T formula, keeping target of an emmetropic postoperative refraction. SPSS 26 was used for analysis. Paired t-test was applied to examine relationships between variables. A p-value of ≤ 0.05 was considered statistically significant.

Results: 100 eyes were examined, with twice as many male participants as female. The average age of participants was 66.1 years. The mean intraocular lens (IOL) power measured was 19.9 D both before and after pupil dilation, showing no significant change following mydriasis. No clinically significant difference was evaluated for parameters like AL, Avg K readings, CCT and IOL power in pre and post dilated phase ($p > 0.01$). Whereas a mean increase of 0.09mm was noted in ACD ($p > 0.01$).

Conclusion: Biometric values recorded via AL-Scan showed pupil size has no significant effect on measurement accuracy. This support's device's consistency and effectiveness and hence helping in reducing unnecessary follow-up, time, and cost. *Al-Shifa Journal of Ophthalmology* 2026; 22(1): 9-16.

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Introduction:

Among eye surgeries, cataract extraction is performed more often than most other procedures worldwide. In addition to restoring vision impaired by cataracts, it is also classified as a form of refractive surgery, as it aims to correct pre-existing refractive errors to the greatest extent possible, thereby improving the patient's overall visual outcome¹. In modern day Cataract extraction is referred as cataract refractive surgery². The effectiveness and overall success of cataract surgery are influenced by several important factors, including the patient's pre-existing refractive condition, the skill and experience of the surgeon, as well as the precision of intraocular lens (IOL) power calculations performed before the operation³. Visual expectations after cataract surgery are the prime concern of all

patients. With the recent advancement in Femto laser, these expectations have been met to a large extent. Yet accurate calculations and measurements is a need to be encountered for satisfying results. Thomas Olsen in a review in 2007 concluded that Axial Length (AL) contributes to 36% in rate of errors of IOL calculations while anterior chamber depth (ACD) and keratometry (k) lead to 42 and 22% respectively⁴. Thus concluding ACD, AL and K are primary parameters of IOL measurements. Sanders–Retzlaf f–Kraf f (SRK II), second generation formula uses same parameters. Whereas some fourth-generation formulae like Holladay 2 and SRK/T also call for lens thickness (LT) and white-to-white thickness⁵. Over time, optical biometry has largely replaced ultrasound biometry due to its superior accuracy in measuring axial length (AL), a key factor in selecting the correct intraocular lens power for cataract surgery. Its non-contact approach avoids errors caused by corneal compression, which often occur with applanation A-scan ultrasound. While immersion A-scan is more accurate than applanation, it involves a more complex process and can still introduce variability. Optical biometry offers a faster, more comfortable and operator-independent method, improving both efficiency and patient experience. Additionally, it carries a lower risk of infection since the procedure does not involve direct contact with the eye⁶. These advantages make optical biometry a preferred and reliable tool for preoperative evaluation in cataract surgery.

Presently practiced optical techniques encompass, the IOL Master 500© (Carl Zeiss Meditec AG, Jena, Germany), the LENSTAR900© (Haag-Streit AG, Koeniz, Switzerland), AL-Scan Optical Biometer (Nidek CO., Gamagori, Japan) and the recently evolved IOL Master 700© (Carl Zeiss Meditec AG, Jena, Germany) built upon on swept-source optical coherence tomography technology⁷. The AL-Scan (Nidek Co., Gamagori, Japan)

optical biometer operates using a non-invasive method and incorporates a three-dimensional automated ocular surveillance detection integrated with an automatic capture feature⁸. It can determine axial length (AL), anterior chamber depth (ACD), keratometry (K), central corneal thickness (CCT), and the white-to-white distance. The AL-Scan functions are based on optical low-coherence interferometry, utilizing the low-coherence interference of light waves generated by an 830 nm super luminescent diode are used to assess the axial length (AL) of the eye within a span of 14 to 40 mm. Keratometry is assessed using concentric mire rings projected onto the cornea within zones of 2.4 mm and 3.3 mm in diameter. The ACD is measured following the Scheimpflug imaging principle, by gauging the space between the reflective points on the anterior corneal surface and the front surface of the lens⁹. The intraocular lens (IOL) power is computed using the Sanders–Retzlaff–Kraff/theoretical (SRK/T) formula, aiming for a postoperative refraction of 0 diopters (D)¹⁰.

Tropicamide is a commonly used parasympathetic antagonist mydriatic that relaxes pupillary sphincter muscle. But radial muscles of iris are innervated by sympathetic nervous system hence remain unaffected, contract and therefore cause pupillary dilation¹¹. In clinical settings, pupils of patients are dilated before performing biometry to save time. Sometimes surgeons forget to perform biometry before dilating the pupil for fundus examination¹². If pre- vs. post-dilation measurements differ, inconsistent dilation status at the time of biometry could introduce systematic error in IOL selection and surgical planning. Establishing whether dilation meaningfully changes AL-Scan outputs (and whether any change is clinically relevant for IOL power) will guide protocols (measure undilated vs. dilated or require consistent state) and improve refractive predictability.

Methodology:

A cross-sectional study was carried out in the Department of Ophthalmology, Unit-I of Dow Medical College. This project was conducted in coordination with Dr. Ruth K.M. Pfau Civil Hospital and the Shaheed Mohtarma Benazir Bhutto Trauma Centre, both located in Karachi. Study was conducted from November 2025 till January 2026. Approval to begin the research was granted by the Institutional Review Board (IRB) of Dow University of Health Sciences (DUHS), with ethical clearance officially documented in an approval letter dated IRB-4141/DUHS/Approval/2025/440.

Participants meeting the study inclusion criteria were asked to join the research. Before enrollment, the study procedures were explained to each individual. Written informed consent was obtained to ensure voluntary participation and compliance with ethical standards. The inclusion criteria were carefully defined to maintain consistency and reliability in the data. Both men and women aged 40 to 80 years with a confirmed diagnosis of cataracts were enrolled in the study. Only those with normal intraocular pressure and a healthy posterior segment on examination were considered suitable. This helped to prevent interference from unrelated ocular issues.

Patients were not included if they had experienced eye trauma in past or had undergone any ophthalmic surgery, or had inflammatory eye conditions such as uveitis. Likewise, anyone diagnosed with retinal pathology or glaucoma was excluded. Since all these findings could distort the results. Systemic illnesses known to affect ocular measurements specifically hypertension and diabetes were also added exclusion factors. Individuals who struggled to maintain steady fixation on a target, refused participation, or showed corneal surface abnormalities during examination were excluded. These problems can compromise the accuracy of biometric readings hence were eliminated.

Non probability consecutive sampling technique was used. Altogether, 100 individuals fulfilled the criteria and were enrolled. The required sample size had been determined beforehand using Open Epi software. Earlier studies reporting a cataract prevalence of more than 90% in Asian populations were used for reference¹³. At a 95% confidence level, the study's sample size was estimated to be 101, and the final number of participants closely aligned with this estimate.

Biometric assessments were performed twice before and after pharmacologic dilation. Baseline readings were collected under natural pupillary conditions. Mydriasis was produced with three drops of 1% tropicamide administered five minutes apart. Roughly 45 minutes from the first instillation were allowed to achieve full dilation prior to repeating the measurements.

To prevent corneal factors from affecting the measurements, intraocular pressure was assessed using a non-contact tonometer. Participants were asked to blink normally prior to each reading to ensure a smooth tear film as irregularities on the corneal surface can influence optical scans. All measurements were taken under dim lighting to avoid pupil constriction caused by bright light.

Biometric data were collected using the AL-Scan optical biometer. This device measured anterior chamber depth, axial length, and corneal curvature (K1, K2, and mean keratometry). Each measurement was taken in both un dilated and dilated states. Intraocular lens (IOL) power was calculated using the SRK/T formula, which is suitable for eyes with standard axial lengths and is commonly used in clinical practice.

To ensure consistency, a single consultant ophthalmologist at Civil Hospital Karachi performed all measurements and IOL calculations. Data for each participant were recorded on a structured data form. Participants were recruited using a

consecutive, non-probability sampling method.

Data were analyzed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Pre- and post-dilation biometric measurements were compared using paired t-tests. A p-value of ≤0.05 was considered statistically significant. Tables and charts were created to illustrate changes in biometric and kerato-metric parameters before and after pupil dilation.

Results:

The study included a total of 100 participants. The average age of participants was 66.1 ± 6.46 years. The age range was from 56 to 75 years, indicating a relatively uniform distribution. Two-thirds of the participants were male 67 (67%) and one-third were female 33 (33%), yielding an approximate male-to-female ratio of 2:1. Both eyes were equally represented in the study as right and left eyes accounted for 50 (50%) of the cases. Table 1 summarizes Demographic details of the participants.

Table 1: Demographics of Participants (n=100)

Variables	Mean ± SD
Age (years)	66±6.46
Variables	N(%age)
Gender	
Male	67(67%)
Female	33(33%)
Laterality	
Right eye	50(50%)
Left Eye	50(50%)

Comparisons of biometric measurements before and after pharmacologic dilation showed that most parameters remained largely unchanged. Axial length had a mean value of 23.7 ± 1.16 mm and did not vary after dilation. Mean keratometry values were similarly stable at 44.4 ± 2.25 D. Calculated intraocular lens (IOL) power remained consistent, averaging 19.9 ± 2.7 D. Slight changes were observed in central corneal thickness (CCT) and anterior chamber depth (ACD). Following dilation, CCT decreased marginally, with

an average reduction of 0.87 µm compared to pre-dilation measurements. Conversely, ACD showed a slight increase of +0.09 mm following dilation. Statistical analysis using paired t-test showed that the changes in AL, CCT, K mean, and IOL power between pre- and post-dilation were not significant (p > 0.05). In contrast, the increase in ACD was statistically significant, with a p-value of less than 0.01, suggesting a measurable clinical difference in anterior chamber depth after dilation. These observations are further detailed in Table 2

Table 2: Clinical correlation in parameters between pre and post dilation phase

Variables	Pre-Dilation (Mean ± SD)	Post Dilution (Mean ± SD)	Mean difference between pre and post dilation	P value
Axial Length (mm)	23.728±1.16	23.730±1.17	0.02	0.24
Keratometry (D)	44.374±2.25	44.377±2.26	0.003	0.23
Central Corneal thickness (µm)	524.56±38.29	523.69±37.53	-0.870	0.25
Anterior Chamber Depth (mm)	3.12±0.34	3.21±0.37	0.09	0.0001
IOL Power (D)	19.89±2.78	19.86±2.74	-0.03	0.007

Only a few isolated readings differed from this overall pattern. Two participants showed a slight decrease of 0.5 D in IOL power after dilation, while one participant exhibited a 1.0 D increase. These outliers were rare and did not affect the overall statistical results. Overall, the findings

indicate that pharmacologic dilation does not have a significant impact on axial length, keratometry, or IOL power. The isolated outlier changes in IOL power are illustrated in Figure 1.

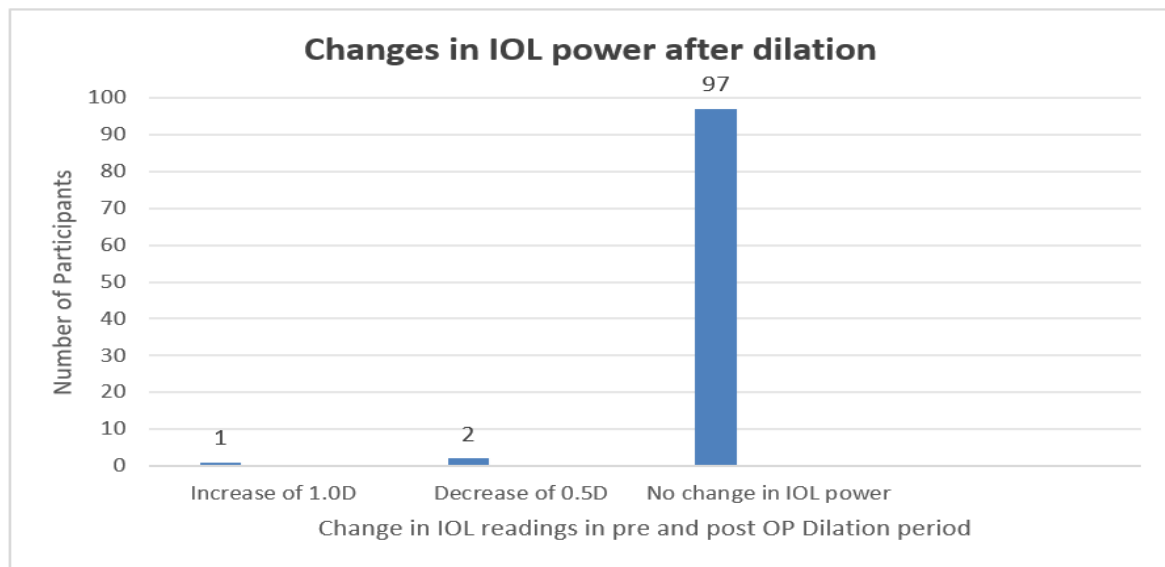


Figure 1: Distribution of isolated changes in intraocular lens (IOL) power following pharmacologic pupil dilation among study participants.

Discussion:

With the advancement in technology there is a drift towards the use of multivariant formulae for calculating IOL power. Changes in different parameters of SRK-T formula was compared in the pre and post pupil dilation phase in our study. A cross sectional study by Momeni-Moghaddam H et al., 2019 in Masha University of Medical Sciences showed a mean age of 35.2 ± 9.4 years with a female predominance. Participants in our study had a mean age was 66.1 ± 6.46 years with a male predominance of twice compared to females¹⁴. From our study results no change in axial length was recorded in the two periods; before and after dilation (p-value=0.23). Study by Huang J et al., 2012 revealed that axial length measured with both Lenstar AL and IOL Master showed

that while statistically significant ($p < 0.001$), the variation between pre- and post-cycloplegic measurements (0.03 ± 0.03 mm compared to 0.02 ± 0.03 mm) was too small to be clinically important¹⁵. A study on 64 patients by Sadiq SA et al., 1996 published in European Journal of ophthalmology measured axial length before and after dilation of pupil, concluding a minimum difference of $< \pm 0.3$ mm with a p value of 0.1¹⁶.

Ozcaliskan S et al., 2019 investigated the impact of pupil dilation on IOL calculation parameters and found a statistically significant increase in central corneal thickness, which was also considered clinically relevant ($p < 0.05$)¹⁷. Similarly, a study comparing parameters among different age groups showed central corneal

thickness was significantly different in pre and post dilation phase for age range 50-60 years and 10-20 years¹⁸. Our study results were not in this favor, since, no clinical or statistical difference in central corneal thickness was noted.

Like our study reported no change in kerato-metric readings after pupil dilation, similarly study measuring biometry parameters using IOL Master concluded no significant change in the keratometry values ($p > 0.5$)¹⁹. In contrast a prospective study in 2014 analyzed 114 patients and derived the conclusion that there is short term change in the mean, maximum and minimum values of keratometry after dilation²⁰.

The two parameters that came out to be clinically and statistically significant in our study were Anterior Chamber Depth and IOL readings. ACD increased by 0.09mm in our study after dilation. These results are supported by other study like by Arriola-Villalobos P et al., 2021 that reported deepening of ACD after pupil dilation²¹. Another study from Turkey found that anterior chamber depth (ACD) increased significantly following pupil dilation, with a mean change of -0.0821 ± 0.0489 mm ($p < 0.001$)²². This occurs because cycloplegia relaxes the ciliary muscles, eliminating accommodation. As a result, the lens is pulled radially, becoming flatter and shifting slightly toward the back of the eye. This change reduces lens thickness and leads to an increase in anterior chamber depth.

When calculating IOL power in using SRKT formula, our results showed that despite having statistical significance ($p < 0.05$) difference after dilation, clinically only a difference of 0.03D was noted. Can et al., 2016 reported that cycloplegia had no significant effect on intraocular lens (IOL) power calculations using the SRK/T formula with the AL-Scan in healthy participants, who had a mean age of 33.12 years. The only exceptions were two cases in which IOL power increased by more than 0.50 D²³. An observational study by

Rodriguez-Raton A et al., 2015 used SRK/T and Haigis formula for IOL calculation. The results revealed that pupil dilation did not have a significant effect on IOL power calculations using the SRK/T formula, whether the target was emmetropia or residual myopic refraction. In contrast, calculations based on the Haigis formula showed significant changes for both emmetropia and the lowest myopic refraction ($p = 0.01$)²⁴. A study conducted at Rohilkhand Hospital in India in 2018 found that changes in intraocular lens (IOL) power after pupil dilation, calculated using the SRK/T formula, were neither statistically nor clinically significant ($p = 0.5$)²⁵.

There were several limitations of the study, we measured IOL power using only SRK/T formula. Comparison with other formula was not made like Haigis and Holladay. Likewise, all types of cataracts were taken under one roof and no classification system for different cataracts was taken into account. Our study data had elder patients only hence effect of different age groups on IOL calculation was eliminated unintentionally. Our post op target refraction of emmetropia was in focus, minor difference of refraction error in post op period was not validated in the study. So further multi centered study on a larger sample size incorporating the variables addressed in limitations is needed for better understanding of their effect on IOL power calculation.

Conclusion:

Pupil dilation by tropicamide 1% has no effect on the IOL calculation obtained by Nidek AL-Scan using SRK/T formula. The findings of this study assisted us to decide that none of the techniques with or without dilation is superior. Therefore, IOL calculation can be performed on the same day of OPD either before or after dilation immediately after examination to save time, money and effort for follow up just for biometry.

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Contrast Sensitivity in Patients with β -Thalassemia Major: A Cross-Sectional Study

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Abstract:

Objective: To assess the contrast sensitivity in patients with β -Thalassemia major using reliable testing methods.

Methods: This observational cross-sectional study was conducted at Fatimid Foundation Hospital, Hayatabad, from Sep 1, 2019, to Mar 1, 2020. The sample size of 44 patients was selected from those aged 15–40 years with β -thalassemia major, a transfusion history of 360–600 units, and visual acuity of $\geq 6/9$. Visual acuity was measured using the Snellen chart, while contrast sensitivity was measured using the Pelli-Robson chart at a 3-metre distance. Frequencies and percentages were calculated; ANOVA and chi-square tests were used to analyze data in SPSS V27.

Results: Out of 44 patients, females comprised a high percentage (59.1%), while rural residents were more common (63.6%). Most of the patients were aged between 15–20 years (59%). Contrast thresholds showed 4.5% with <2.5 , 31.8% with 2.5, and 63.6% with >2.5 , with a significant difference between groups (ANOVA: $F=25.6$, $p<0.001$). In word recognition, most patients in both age groups recognized 11–20 words. Blood transfusion volume was significantly associated with word recognition, with those receiving 360–480 ml showing higher odds of better performance (OR=6, $p=0.0044$).

Conclusion: The contrast sensitivity was reduced in β -thalassemia major patients, suggesting that ocular examination, like contrast sensitivity and visual acuity, should be tested on a routine basis to detect early ocular involvement. *Al-Shifa Journal of Ophthalmology 2026; 22(1): 17-22.*

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Introduction:

Thalassemia is considered to be the most common inherited blood disorder, often leading to various eye problems. These issues may stem from the disease itself, iron buildup caused by frequent blood transfusions, or side effects of medications used to remove excess iron¹⁻³. Regular blood transfusions are often the main treatment for several severe or refractory anemias, especially beta-thalassemia major (BTM) and sickle cell disease (SCD)⁴. Although regular transfusions help prevent death from severe anemia in infancy and allow normal growth and development in childhood, they also cause iron to build up in the body. Over time, this excess iron can become toxic and lead to organ damage or failure⁵. Contrast sensitivity was lower in beta-thalassemia major patients and sickle cell patients at all spatial frequencies; it was reduced mainly at low and medium frequencies. A likely reason for these

changes is the toxic effect of deferoxamine. This drug can cause toxic retinopathy, which may appear as pigment changes in the retina, bull's-eye maculopathy, or vitelliform-type maculopathy⁶. In 2000, Gartaganis et al., 2000⁷ studied contrast sensitivity in patients with β -thalassemia major who were receiving regular blood transfusions and subcutaneous DFO treatment. They used the Vector Vision CSV-1000 contrast sensitivity test and found that contrast sensitivity was significantly lower in all thalassemia patients compared to healthy individuals. They also found a significant difference, especially at spatial frequencies of 2, 3, and 6 cycles per degree (cpd), showing reduced contrast sensitivity in thalassemia patients^{8,9}. Later, in 2010, Spyridon et al., 2010¹⁰ used the B-VAT II SG Mentor Visual Acuity Tester to measure contrast sensitivity in similar patients. Due to the high number of β -thalassemia cases in the Iranian population, especially in the northern regions, and the eye problems that can affect their quality of life, it is important to check their contrast sensitivity. A very simple and cost-free, reliable test can be used for the detection of any ocular complications for the prevention of complications¹¹. This study aims to address this important gap in patients' quality of life, while assessing contrast sensitivity using a simple method is essential.

Methodology:

A cross-sectional observational study conducted at the Fatimid Foundation Hospital, Hayatabad Phase 1. A convenience sampling technique was used for sampling. Using the formula $n = Z^2 * p(1-p) / e^2$, and 95% confidence level ($Z=1.96$), $p=0.5$, and a margin of error around $\pm 5\%$ our sample size was 44. The duration for this study was 6 months, i.e., from September 1, 2019, to March 1, 2020. After obtaining official permission from the

hospital authority, informed consent was obtained from the patients. Medical histories were taken from all patients, and an eye examination was conducted. Patients were included who had a history of blood transfusion of blood of 360-480 and 504-600 units, β -Thalassemia Major, and other systemic illnesses. In this study, we excluded participants with pathological eye conditions or other systemic diseases like diabetes, which can negatively impact the ocular system. Additionally, the thalassemia patients who have refractive errors were excluded, especially in high myopia. Initially, the visual acuity of the patients was recorded by the Snellen visual acuity chart, followed by contrast sensitivity measurements at a distance of 3 meters using the Pelli-Robson Chart. The age of the patients ranged from 15-40 years, with visual acuity of 6/9 or better in both eyes documented in the record form. Frequencies and percentages were calculated for qualitative data, and ANOVA and chi-square tests were applied to check the association within and between the groups using SPSS version 27.

Results:

Out of total 44 patients, most of the patients were female, from rural areas, and belonged to the age group 15–20 years and majority had contrast sensitivity above 2.5 log units. The inferential statistics ANOVA results showed a significant difference in contrast sensitivity across the three groups. At 3 meters, Word-recognition scores were generally higher in both age groups, with many patients recognizing 11–20 words. Most patients had received 360–480 units of blood transfusion. The association analysis further showed that patients with moderate transfusion levels reported a significantly better visual performance, while those with higher transfusion volumes did not show a statistically significant association.

Table 1: Demographics of the Patients

Variables	N(%)
Gender	
Male	18 (40.9%)
Female	26 (59.1%)
Area	
Urban	16 (36.4%)
Rural	28 (63.6%)
Age	
15-20 years	26 (59%)
21-25 years	18 (40.9%)
Log Unit of Contrast	
< 2.5	2 (4.50%)
2.5	14 (31.8%)
> 2.5	28 (63.6%)

Table 2: One-Way ANOVA – Comparison of Log Unit of Contrast Across Three Groups.

Log Unit of Contrast Group	N	Mean + SD Log Unit of Contrast	Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value
< 2.5	2	2.3±0.1					
2.5	14	2.5±0.0					
> 2.5	28	2.7±0.1					
Between Groups			0.32	2	0.16	25.6	<0.001
Within Groups			0.256	41	0.00624		

Table 3: Words recognized by the Patients at 3 Meters and the Total number of Blood transfusions.

Variables	Word Count	N(%)
Age (15-20 years)	5–10-word count	6 (13.60)
	11-15 words count	10 (22.70)
	16-20 words count	10 (22.70)
Age (21-25 years)	5–10-word count	2 (4.50)
	11-15 words count	10 (22.70)
	16-20 words count	6 (13.60)

Table 4 shows the Total number of Blood transfusions, frequency, and percentage.

Number of blood transfusions	N(%)
360-480 blood volume units	26 (59.00)
504-600 blood volume units	18(40.90)

Table 5: Contrast sensitivity association with the Total number of Blood transfusions.

Total Number of Blood Transfusions	Words Recognized	(OR)	CI 95%	Chi-square	p-value
360-480	30	8.33	(3.36, 20.49)	8.109	0.0044
504-600	18	2.41		8.33	0.144

Discussion:

In the present study, 44 patients with β -thalassemia major were evaluated to determine contrast sensitivity using the Pelli-Robson chart. More than half of the participants were female (59.1%), and were from the rural areas (63.6%). The most of the age group patients were from 15–20 years (59%). Our findings reported that there is a significant reduction in contrast sensitivity among patients with β -thalassemia major, despite of having relatively normal visual acuity (VA).

Contrast sensitivity is a crucial visual function that may help to detect subtle visual impairment even when visual acuity measured by the Snellen chart remains normal. Mitchell et al., 1987 reported that the contrast sensitivity testing helps us to identify the early visual dysfunction earlier than conventional visual acuity measurements in the certain ocular and systemic eye conditions¹¹. Similarly, Woods et al., 2009 also demonstrated that the contrast sensitivity testing is much more sensitive than the Snellen chart to detect the early visual abnormalities¹².

Previous studies have also showed that ocular complications in patients with β -thalassemia major may be related to increasing age, iron overload due to repeated transfusions, and the use of iron chelation therapy such as deferoxamine. Gelmi et al., 1993 and Rinaldi et al., 1988 reported that patients with thalassemia major may develop visual function abnormalities even in the absence of obvious structural eye changes.^{7,8} In the present study, we focused on the contrast sensitivity as an indicator of early visual dysfunction that may help clinically visible ocular abnormalities.

Our findings are consistent with the observations of Gartaganis et al., 2000 who reported that patients with β -thalassemia major had significantly lower contrast sensitivity compared with healthy individuals despite having normal visual acuity on the Snellen chart⁷. This reduction in contrast sensitivity was observed across

different spatial frequencies, suggesting early functional impairment of the visual pathway.

In our study, patients receiving lower volumes of blood transfusions (360–480 units) reported better word recognition performance compared with those receiving higher transfusion volumes (504–600 units). This finding suggests that repeated transfusions and the resulting iron overload may lead to subtle retinal dysfunction. Spyridon et al., 2010 similarly reported decreased contrast sensitivity in patients with β -thalassemia major and sickle cell disease receiving regular transfusion therapy¹⁰. The reduction in contrast sensitivity observed in thalassemia patients may be linked with several ocular complications associated with the disease. These includes; lens opacities, macular degeneration, retinal vascular abnormalities, and degeneration of the retinal pigment epithelium. Such pathological changes may occur due to chronic anemia, hypoxia, iron deposition in ocular tissues, or toxicity related to chelation therapy.

Gartaganis et al., 2000 also showed that although slit-lamp examinations were normal in many patients, FFA revealed that the retinal pigment epithelium degeneration and angioid streaks are in approximately 13% of cases⁷. Furthermore, the decrease in the contrast sensitivity was more noted in the patients with detectable retinal pathology.

Several studies have reported that the relationship between ocular complications and factors such as serum ferritin levels, duration of transfusion therapy, and chelation treatment. However, in our study, no significant association was found between contrast sensitivity and the duration of transfusions, chelator dose, or ferritin levels. These findings are similar to the results as reported by Gartaganis et al., 2000⁷, who suggested that chronic retinal hypoxia may play a more significant role in visual dysfunction than transfusion duration or ferritin levels alone.

A few studies provide complementary, but different, views of eye findings in beta-thalassemia in a nutshell. A high prevalence of diverse structural and functional abnormalities such as lens opacities, dry eye, visual field defects, and retinal degeneration (RPE) in asymptomatic patients in comparison to 19.4% of controls (68.5% vs. controls, $p=0.005$) and a specific, reversible retinal toxicity from desferrioxamine. Our study provides the functional vision measures (contrast sensitivity and word recognition) in a comparable young population (primarily 15-20 years) and shows that most patients have good functional vision, with moderate transfusion volumes (360-480 units) correlating with improved functional vision performance.¹³⁻¹⁶ It is noteworthy that none of the patients in the present study demonstrated obvious structural ocular abnormalities during routine clinical examination. However, previous studies have reported that subtle retinal changes can be detected using advanced diagnostic techniques such as electro diagnostic testing, fluorescein angiography (FFA), and visual field (VF) analysis¹⁷.

Despite providing useful insights to this, the present study has several limitations. The sample size was relatively very small, which may limit the generalizability of the findings. Additionally, advanced diagnostic investigations such as electro diagnostic testing or fluorescein angiography (FFA) were not performed, which could have detected subtle retinal abnormalities. Moreover, the cross-sectional design of the study prevents the development of the causal relationships between transfusion therapy, chelation treatment, and contrast sensitivity changes.

Another limitation of this study is that differences in the administration routes and patient compliance associated with various iron chelators were not considered. Deferoxamine requires prolonged subcutaneous infusion, whereas newer oral chelators such as deferiprone and deferasirox provide easier administration

and may influence treatment adherence and clinical outcomes.

Conclusion:

This study concluded that the contrast sensitivity is significantly reduced in patients with β -thalassemia major despite having normal visual acuity. These findings suggest that contrast sensitivity testing may help to detect early visual dysfunction before the appearance of clinically evident ocular abnormalities. Routine ophthalmic screening, including contrast sensitivity assessment, may therefore be beneficial for early identification and management of ocular complications in patients with β -thalassemia major.

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Progression of Myopia Among Age Groups: A Retrospective Study

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Abstract:

Objective: To scrutinize the annual progression of myopia among individuals from an urban setting of Pakistan across age demographics and ascertain its correlation with the myopia severity.

Methods: The study design of this report is retrospective, and the patients were recruited from Sindh Government Qatar Hospital, Karachi, from 2016 to 2022. Data was collected through a consecutive sampling technique; subjects were stratified into two age groups: <15 years and ≥15 years. The spherical equivalent (SE) was calculated at baseline and at follow-up after 300–415 days (approximately one year). The univariate Mann–Whitney U test, chi-square test, and multivariate logistic regression analyses were used for statistical analysis in SPSS 26.

Results: The participants' median age was 16 years (IQR: 12–20 years). The median spherical equivalent for the right eye was –3.5 diopters (D) (IQR: –5.4 to –2.0), and for the left eye was –3.6 D (IQR: –5.5 to –1.9). Most participants had mild myopia (41%), followed by moderate myopia (32%), while 27% had high or severe myopia. Baseline and one-year SE values were significantly higher in patients aged <15 years (–4.0 [–5.5 to –2.8] D and –4.5 [–6.25 to –3.2] D, respectively; $p < 0.001$). Younger patients showed significantly higher myopia progression contrasted with those aged ≥15 years ($p < 0.001$).

Conclusion: The progression of myopia among pediatric and teenage individuals in Karachi is substantial, particularly among individuals younger than 15 years. The findings of this study highlight the requirement for early identification and strategies for prevention and mitigation of the increasing incidence of myopia in Pakistan. *Al-Shifa Journal of Ophthalmology* 2026; 22(1): 23-32.

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Introduction:

Myopia is among the prevalent refractive errors affecting children. Several reports have projected that by the middle of this century, nearly one billion individuals globally may be at risk of developing complications related to myopia¹⁻³. The development and myopia progression are impacted by multiple characteristics, for instance, age, age at diagnosis, severity of myopia (mild, moderate, high, or severe), ethnicity, and geographic location^{4, 5}. Myopia has transform more prevalent in the United States, from approximately 25% to 42% among young adults and older individuals over the past thirty years, while in Australia, it is around 31% among adolescents^{6, 7}. The populations from East Asian countries are demonstrated to be approximately two-fold as susceptible to

myopia compared with European, American, and Australian populations⁸. Notably, myopia prevalence rates are as high as 97% in South Korea⁹, and rates of 70–80% have been observed among young adults in East Asia¹⁰.

Over the past years, myopia has been identified as a public health concern^{8, 11-13}, particularly in Asian populations. The estimated myopia prevalence in individuals age less than 20 years in Asia is approximately 24%, rising to 30% among adults older than 40 years⁸. Vision loss resulting from pathological myopia is irreversible and contributes significantly to visual impairment worldwide¹⁴. Visual impairment caused by pathologic myopia is approximately 5.8-7.8% in Europeans, 4.5% in South Americans, and 12.2-32.7% in East Asian¹⁵. In Pakistan, a study at an institute in Lahore reported 83.6% of myopia prevalence among 118 medical students. Out of these, 56.4% exhibited a refractive error of less than -3.00 D, while 22.7% had a refractive error characterized as moderate myopia (-3.00 D and -6.00 D), and only 1.8% had a refractive error exceeding -6.00 D¹⁶. In the Islamabad Institute, a cross-sectional study reported myopia prevalence of 23.4%, ranking second-highest among 2,138 patients¹⁷. A study reported the strong association of glaucoma and Myopia in older age. In this multi-center cross-sectional study, two hundred fifty individuals aged between 40 and 65 were recruited¹⁸.

There is a literature gap regarding the myopia progression in Pakistan, specifically the association of myopia severity with different age groups. The studies on the myopia progression and its relationship with various risk factors like age, ethnicity, heredity, etc., can help clinicians provide suitable treatment to patients. In this study, our objective is to scrutinize the annual progression of myopia among individuals from an urban setting in Pakistan across age demographics and

ascertain its correlation with myopia severity.

Methodology:

The study design of this report is retrospective, and the patients were recruited from Sindh Qatar Hospital, Karachi, Pakistan. Between 2016 and 2022, a total of 13,563 patients diagnosed with myopia attended the hospital. Among them, 3,853 patients returned for follow-up ophthalmic examinations. After applying strict data-quality criteria and excluding records without complete longitudinal follow-up, 3,434 patients were included in the final analysis. Ethical approval was obtained from the hospital's Ethics Review Committee (ERC/15/082023).

Inclusion criteria were patients aged 10–25 years diagnosed with myopia who attended follow-up visits approximately one year after baseline assessment. Any patient with a history of ocular pathology or surgery was not included. In this study, 3434 patients were recruited, while 419 patients with incomplete data were excluded. The patients were stratified according to age; there were 1,572 patients aged under 15 years who were categorized into the "<15 years" age group. The remaining age group comprised 1,862 patients aged over 15 years, categorized into the ">15 years" age group, refer to Figure 1.

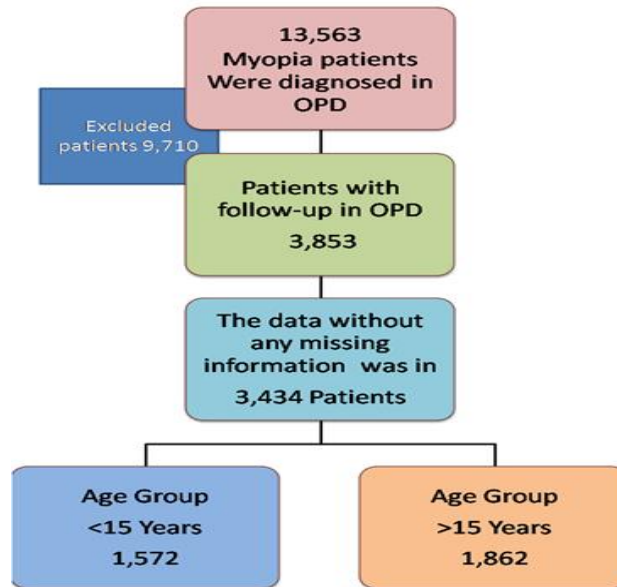


Fig 1: Flow Diagram of Participant Selection and Inclusion in the Study of Myopia Patients Attending the Ophthalmology Outpatient Department (OPD).

At baseline, demographic data (age and gender) and refractive error measurements were recorded. Spherical equivalent values were documented at baseline and during follow-up visits conducted 330–415 days later. The patients have visited the OPD twice, and the refractive examination was cycloplegic for patients younger than 16 years. The age cutoff of 15 years was selected based on evidence indicating stabilization of axial length and slowing of myopia progression toward the end of puberty [1]. Mild myopia was characterized as a spherical equivalent of (−0.5 to −3.0 D), moderate myopia as (>−3.0 to −6.0 D), high myopia as (>−6.0 to −9.0 D), or severe myopia as (<−9.0 D) [1]. The difference between the spherical equivalent at baseline and after one year was defined as Myopia progression.

SPSS version 27 was used for the statistical analysis. Categorical variables were reported as frequencies and percentages, while continuous variables were reported as medians and interquartile ranges. The Shapiro–Wilk test was utilized to assess the normality of quantitative variables. The evaluation of quantitative variables was estimated by the univariate Mann–Whitney

U test, and for categorical variables, the chi-square test was utilized.

Hosmer et al., have described the purposeful selection of covariates. We follow these criteria for the selection of variables for multivariate analysis [19]. This criterion recommends a screening threshold of p-value <0.25 or p-value <0.1 to make sure that the marginal insignificant variables can be significant confounders when compared in multivariate analysis. The statistical significance of a variable was considered if any variable had a p-value <0.05.

Results:

The participants' median age was 16 years (IQR: 12–20 years). No significant differences were observed between right and left eye spherical equivalent values; therefore, the analysis focused on the right eye. Male participants accounted for 53% (n = 1,818) of the sample, while females comprised 47% (n = 1,616). At baseline, 41% of participants were characterized with mild myopia, 32% were characterized with moderate myopia, and 27% were characterized with high or severe myopia (Table 1).

Table 1: Demographic and clinical characteristics at baseline

Variables	Median (IQR)
Baseline SE	
Right Eye	-3.5 (-5.375--2) D
Left Eye	-3.6 (-5.5- -1.9) D
Follow up SE	
Right Eye	-4 (-5.875--2.375) D
Left Eye	-3.8 (-5.875--2.375) D
SE Difference	-0.25 (-0.75-0.125) D
Variables	N (%)
Gender	
Male	1,616 (47)
Female	1,818 (53)
Age	
<15 years	1572(46)
>15 years	1862(54)
Myopia Severity	
Severe	273(8)
High	663(19)
Moderate	1085(32)
Mild	1413(41)
SE: Spherical Equivalent, IQR: Inter-quartile range, D: Diopter	

Females exhibited significantly higher baseline spherical equivalent values than males (median -4.0 D vs. -3.25 D; $p < 0.001$) (Table 2). Both genders

demonstrated significant progression in myopia over one year ($p < 0.001$) (Figure 2).

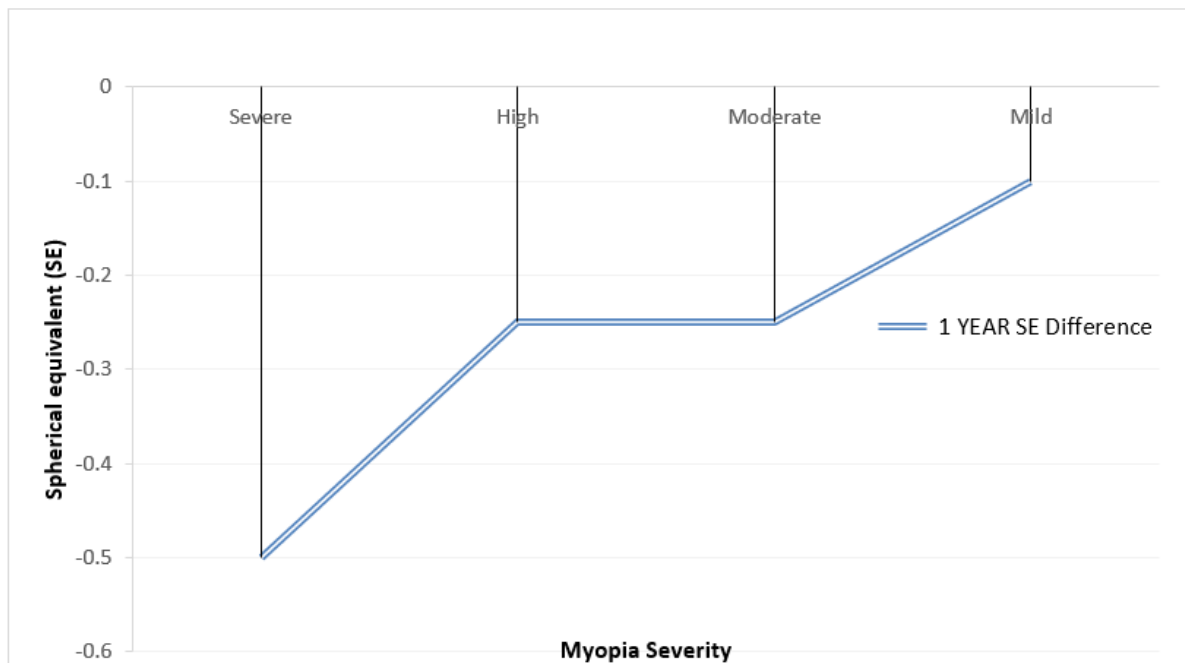


Figure. 2: The Spherical equivalent difference according to the Myopia severity:

Table 2: Univariate analyses of age group with clinical and demographic characteristics

Patient Characteristics:		Age Group		P-value:
		<15 years	>15 years	
Baseline SE (Median (IQR))		-4 (-5.5--2.8)	-3 (-5.25--1.8)	<0.001
Follow up SE (Median (IQR))		-4.5 (-6.25--3.2)	-3.25 (-5.5--1.9)	<0.001
SE Difference (Median (IQR))		-0.5 (-1-0)	0 (-0.5-0.25)	<0.001
Gender (N (%))	Female	737 (46.9)	942 (51)	0.02
	Male	835 (53)	920 (49)	
Severity of Myopia (N (%))	Severe	149 (9.5)	124 (6.7)	<0.001
	High	312 (19.8)	351 (19)	
	Moderate	635 (40)	450 (24)	
	Mild	476 (30)	937 (50)	
SE: Spherical Equivalent; IQR: Inter-quartile range; D: Diopter				

Patients younger than 15 years had significantly higher baseline and follow-up spherical equivalent values compared with those aged 15 years or older ($p < 0.001$). Myopia progression was greater in the younger age group, with a median SE change of -0.5 D compared with 0.0 D in older patients ($p < 0.001$). Multivariate

analysis revealed that age <15 years was independently associated with increased odds of myopia progression (OR: 2.14; 95% CI: 1.91–2.40; $p < 0.001$). Male gender was also associated with higher odds of progression compared with females (OR: 1.41; 95% CI: 1.16–1.71; $p < 0.001$) (Table 3).

Table 3: Multivariate analysis of age association with other factors

	Reference Category (Categorical Data)	Beta coefficient	Standard Error	P-value	Odds Ratio	95% C. I.	
						Lower	Upper
SE Difference		.761	.058	<0.001	2.141	1.912	2.397
Baseline SE		-0.738	0.07	<0.001	0.478	0.4	0.5
Follow up SE		0.766	0.06	<0.001	2.2	1.9	2.4
Severity of Myopia Severe	Mild	-0.650	0.38	0.08	0.5	0.25	1.1
Severity of Myopia High	Mild	-0.663	0.19	0.001	0.5	0.353	0.75
Severity of Myopia Moderate	Mild	-1.085	0.12	<0.001	0.34	0.269	0.424
Gender (Female)	Male	0.342	0.1	<0.001	1.41	1.158	1.713
Constant		0.92	0.08	<0.001	2.51		
Omnibus Tests of Model Coefficients			Step, Model	lock,	Chi-square 378.2	<0.001	
Hosmer and Lemeshow Test					Chi-square 9.3	0.32	
Nagelkerke R Square			0.139				
SE: Spherical Equivalent: IQR: Inter-quartile range D: Diopter.							

Discussion:

This retrospective study evaluated myopia progression among children and young adults in an urban population of Karachi, Pakistan, and identified age, gender, and baseline myopia severity as significant factors associated with refractive progression. These findings provide important longitudinal evidence from a South Asian context, where data on myopia progression remain limited.

A key finding was the significantly greater progression of myopia observed in patients younger than 15 years compared with older individuals. Younger participants demonstrated larger negative shifts in spherical equivalent over the one-year

follow-up period, consistent with Verkicharla et al., 2020, Chen et al., 2018, and Ducloux et al., 2023 showing that myopia progression is most rapid during childhood and early adolescence. This period corresponds to active ocular growth and axial elongation, which typically stabilize in late adolescence, explaining the slower progression observed in older patients 1, 20, 21.

Age is a major characteristic in the evaluation of myopia progression. In this study, results confirmed that progression of myopia is significantly higher among patients with an age less than 15 years of age as compared to older patients. However, the myopia progression is

different among the age groups, as Chua et al., 2016, Jensen 1995, and Saw et al., 2005 report the progression faster in the age group of 7-9 years or 9 to 12 4, 22,23.

Multivariate analysis confirmed younger age as an independent predictor of myopia progression, with patients under 15 years having more than twice the odds of progression compared with those aged 15 years and above. This highlights the importance of early identification and monitoring of myopia, as preventive and control strategies are likely to be most effective when implemented during childhood.

In contrast, a study reported that in children from Australia, the annual progression was reported as -0.31 to -0.4 D. In Europe, the UK, the USA, China, Japan, and Singapore, it ranged from -0.55 D to -0.34 D to -0.5 D and -0.31 to -1.2 D, respectively 5, 24,25. Chua et al., 2016 from India reports a lesser progression of myopia at -0.24 ± 0.42 D (4). The severity of myopia demonstrated a correlation with its progression based on our dataset. This observation is consistent with findings from Saw et al., 2005, and Zhou et al., 2016 conducted in East Asia 23,26. Upon stratification by age, females under 15 years old exhibited a higher inclination for progression of myopia compared to males in the same age group. Furthermore, in a report by Hsu et al., 2017, gender is reported as a risk factor for the progression of Myopia, with females displaying a higher inclination for progression compared to males, at ages of 7 and 12 27. Gender differences were also observed, with female participants demonstrating higher baseline myopia and greater progression than males. Although the mechanisms underlying this difference remain unclear, similar trends have been reported in previous studies and may be influenced by biological or behavioral factors. Baseline myopia severity was significantly associated with progression, with moderate to severe myopia showing greater refractive worsening, emphasizing the need for closer follow-up in these

patients due to the risk of vision-threatening complications, consistent with findings from studies conducted in Europe and Asia Tricard et al., 2022, demonstrates that a small difference of 0.03 D or a difference of 9% was observed between males and females. Several studies have indicated a greater progression of myopia in females compared to males 28. For instance, Hymen et al., 2005 documented a disparity of 0.16 diopters in spherical equivalent over three years 29.

Donovan et al., 2012, in his meta-analysis revealed a statistically significant disparity in the annual progression of myopia between genders. Specifically, females exhibited a mean difference of -0.8 diopters, whereas males showed a mean difference of -0.7 diopters (p-value <0.001) 5. This gender-based discrepancy persisted across prospective studies conducted by Saxena et al., 2017 in the subcontinent 30 and East Asia by Saxena et al., 2022 25 as well as in several other longitudinal investigations from North America reported by COMET group 2013, (31).

Donovan et al., 2012, reported that the progression rate of myopia was found to be higher in Asian patients (-0.82D), while in European patients it was lower (0.5D) 5. Verkicharla et al., 2020, have done a study on 10000 school children aged 5 to 15 years reported an annual progression of -0.27 ± 0.42 D. A hospital-originated study from South Asia was carried out on kids and adolescents; it reported 4.3% participants had myopia associated with pathologies comparable to European and East Asians 1).

A study by Younan et al., 2002, reported the severity of myopia is a risk factor for various conditions that cause the loss of vision, and Myopia equal to or higher than 5.00 D is documented as a vital reason for complete vision loss. Patients with myopia 6.00D or more have 14.4 times greater odds of glaucoma, Cataract is 3.3 times, and retinal detachment is 7.8 times higher in patients having myopia 8.00D or higher 32.

The consistent findings across by Yu et al., 2023 suggest a potential correlation. However, the specific cause remains speculative. One plausible explanation could be the variance in outdoor exposure between genders, potentially contributing to the pronounced myopic progression observed in females 33.

Our study has few limitations worth noting. Firstly, its retrospective nature limits the scope of data collection to a specific timeframe, spanning from 2016 to 2022. Additionally, the study's single-center design may restrict the generalizability of our findings to broader populations. Furthermore, certain significant risk factors potentially linked to myopia, such as outdoor activity or exposure, near work, screen time, and hereditary predispositions, were not incorporated into our analysis. Moreover, data regarding the onset of myopia and the age at which individuals first received corrective glasses were unavailable, further constraining our comprehensive understanding of the condition.

This investigation adopted a Cohort study design, incorporating longitudinal follow-up assessments, which facilitated a more comprehensive understanding of the observed progressions. To the best of current knowledge, this represents the inaugural examination into the progression dynamics of Myopia. The sample size has been deemed adequate to undertake a rigorous analysis of the progression patterns.

Conclusion:

Myopia progression among children and young adults in Karachi is substantial and comparable to rates reported in East Asian and European populations. Younger age and greater baseline severity are key predictors of progression. Early diagnosis and timely preventive interventions may help slow progression and reduce the long-term burden of myopia-related visual impairment. Further prospective and interventional studies are needed to

establish causal relationships and evaluate preventive strategies.

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Comparison of Changes in High Order Ocular Aberrations after Near Work in Myopic and Myopic Astigmatic University Students

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Abstract:

Objective: To compare changes in high order ocular aberrations (HOA) in myopic and myopic astigmatic university students after doing near work (reading continuously for 30 minutes).

Method: This Quasi experimental study was conducted after the approval of ethical review board of College of Ophthalmology and Allied Vision Sciences, (KEMU) Lahore. The study took place in COAVS/Mayo Hospital Lahore from March, 2024 to November, 2024. Sample size was 60 in which 22 were male and 38 were female students. Myopic university students ageing between 18 to 30 years were included. Data collection procedure consisted of pre and post reading measurement of HOAs with SIRIUS ORB scan. Data was entered and analysed using SPSS version 26. Paired t test was applied to check for statistical significance. P value ≤ 0.05 was considered significant.

Results: After near work for 30 minutes, myopes showed mean increase in spherical Abs i.e. 0.10 ± 0.03 to 0.12 ± 0.05 (P 0.001), Coma i.e. 0.14 ± 0.06 to 0.16 ± 0.07 (p 0.021), astigmatic i.e. 0.45 ± 0.36 to 0.50 ± 0.38 (P 0.014). However, Compound myopic astigmatic patients showed mean decrease in spherical Abs i.e. 0.12 ± 0.05 to 0.09 ± 0.06 (P 0.037) and Coma abs i.e. 0.16 ± 0.14 to 0.15 ± 0.13 (P 0.026).

Conclusion: High order ocular aberrations after doing near work increased in myopes and decreased in those with myopic astigmatism. *Al-Shifa Journal of Ophthalmology 2026; 22(1): 33-41.*

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Introduction:

Ocular aberrations are the retinal image imperfections to unequal refraction and focus of light rays by refractive structure of eye on retina.¹ Ocular aberrations are of two types i.e. lower-order (0, 1, 2 order) and higher-order aberrations. Lower order aberrations include positive defocus, negative defocus, and regular astigmatism. Low order aberrations account for approximately 90% of the overall wave aberration in the eye.² While Higher-order aberrations include Coma, Spherical aberration, Trefoil, and Quadrifoil. Higher-order aberrations (HOAs) cannot be corrected by simple sphere and cylinder corrections. HOAs may be cause of glare, halos and decrease contrast after corneal refractive surgery.³ Common refractive errors in University Students are myopia, hyperopia, and astigmatism which cause blur vision. Investigation of myopia's prevalence and risk factors is essential for

early detection, intervention, and prevention of vision impairment.⁴

The highest prevalence of hyperopia in children and adults was seen in the America.⁵ Refractive errors were significantly associated with positive family history and mobile use per day.⁶ Prolonged near-work activities, such as reading, writing, and using digital devices, have been associated with various visual effects. Understanding effects of extensive near work on vision is necessary to reduce its bad effects on visual performance.⁷ Near work also effects on ocular aberrations of the eye. A previous study enlightens that corneal wavefront aberrations coefficients change significantly after near work like reading.⁸ Because of the lens's shape and position change during accommodation, optical aberrations also change. Since most modern activities necessitate ocular accommodation, which in turn causes changes in eye aberrations.⁹ All near tasks require activation of ocular accommodation to see clearly which effectively leads to variation in eye aberrations.¹⁰ Pupil controls the amount of light entering the eye, thus variation in pupil size influences the amount of light reaching retina ultimately affecting image quality and visual perception. Pupil size variation also effects ocular aberrations which increase in magnitude with increasing pupil size. In a study, Spherical abs were increased more when pupil size change 4 to 5 than 5 to 6mm.¹¹ The purpose of this study was to evaluate the impact of near work and pupil size on ocular high order aberrations in myopic and myopic astigmatic university students.

Methodology:

This Quasi experimental study was conducted after the approval of ethical review board of College of Ophthalmology and Allied Vision Sciences (COAVS), Lahore. The study took place in COAVS/Mayo hospital, Lahore. Students of COAVS and KEMU, Lahore

participated in Research. Sample size was 60 and calculated by formula, $n = \frac{Z^2 P(1-P)}{d^2}$, by taking confidence level 95%, anticipated population proportion 0.04 and absolute precision required as 0.05.¹² Students of both gender and ageing 18-30 years diagnosed with myopia (-0.50D to -6.0D) or myopic astigmatism (-0.50D to -3.0D) were included. Exclusion criteria was age greater than 30 years, high refractive error more than -6.0D, emmetropia, hyperopia, ocular deviation and other any ocular pathology which hinders the measurement of aberrations. After informed consent each participant underwent a preliminary optometric examination including assessment of visual acuity and refractive error. The data collection consisted of two sessions: pre and post reading. For each subject, pre-reading higher order ocular wave front aberrations (Astigmatic, Coma, Trifoil, Spherical, and Quadrifoil) of both eyes were measured with SIRIUS ORB scan. After the measurement the subjects were seated comfortably and instructed to read book in an optimum lighted room for 30 min continuously. All subjects wore spectacle correction during the reading. Immediately after reading HOAs were again measured with same instrument and at the same time pupil size were also measured by orb scan. Data was entered and analysed using Statistical package for social sciences (SPSS version 26). Qualitative variables are presented as frequency and percentage. Quantitative variables are presented as means \pm standard deviation. Paired t test was applied to check the level of significance. P value \leq 0.05 was considered significant.

Results:

Statistically significant changes in high order aberrations after reading occurred in both eye combined myopes shows increase in spherical (p 0.001), Coma (p 0.021), Astigmatic (P 0.014) and Quadrifoil (P 0.021) (Table 2).

Table 1: Demographics

Gender (%)	
Male	Female
22 (18.3%)	38 (63.7%)
Pupil Size in millimeter (Mean±SD)	
Right Eye	Left Eye
3.94 ± 0.64	3.96 ± 0.57
Age in Years (Mean±SD)	
22.0 ± 1.97	

Compound myopic astigmatic students showed mean decrease in spherical (P 0.037) and Coma (P 0.026) (Table 2).

Table 2: Comparison of mean aberrations before and after near work across categories of refractive error

Sr	Parameter	Cylinder (n=)			Sphere (n=)			Sphere + Cylinder (n=)		
		Right Mean±SD	Left Mean±SD	P Value	Right Mean±SD	Left Mean±SD	P Value	Right Mean±SD	Left Mean±SD	P Value
1	Spherical	0.01 ± 0.04	-0.001 ± 0.02	0.253	0.02 ± 0.04	0.01 ± 0.03	0.276	0.02 ± 0.04	0.02 ± 0.05	0.968
2	Coma	0.01 ± 0.02	0.01 ± 0.04	0.772	0.01 ± 0.06	0.02 ± 0.06	0.525	0.03 ± 0.11	0.04 ± 0.11	0.091
3	Astigmatic	0.04 ± 0.15	0.05 ± 0.12	0.846	0.02 ± 0.13	0.06 ± 0.16	0.425	0.16 ± 0.34	0.08 ± 0.24	0.556
4	Trifoil	0.009 ± 0.03	-0.004 ± 0.08	0.641	0.31 ± 1.79	0.02 ± 0.14	0.344	0.01 ± 0.11	0.009 ± 0.07	0.806
5	Quadrifoil	0.008 ± 0.03	-0.005 ± 0.03	0.925	0.01 ± 0.06	0.01 ± 0.06	0.770	0.00 ± 0.07	0.03 ± 0.09	0.498

When both eyes were compared separately, right eye showed decrease in spherical (P 0.006) and Quadrifoil (P 0.021). However, left eye showed decrease in spherical (P 0.038) and increase in coma (P 0.048), (Table 3).

Table 3: Comparison of mean change in high-order optical aberrations in right eye versus left eye across different refractive error categories.

Sr No	Parameter	Sphere + Cylinder (n= 25)			Sphere (n= 74)			Cylinder (n= 21)		
		Before Mean \pm SD	After Mean \pm SD	P Value	Before Mean \pm SD	After Mean \pm SD	P Value	Before Mean \pm SD	After Mean \pm SD	P Value
Both Eyes Combined										
1	Spherical	0.12 \pm 0.05	0.09 \pm 0.06	0.037 *	0.10 \pm 0.03	0.12 \pm 0.05	0.001*	0.10 \pm 0.06	0.11 \pm 0.06	0.255
2	Coma	0.15 \pm 0.14	0.16 \pm 0.13	0.746	0.14 \pm 0.06	0.16 \pm 0.07	0.021*	0.15 \pm 0.06	0.17 \pm 0.06	0.120
3	Astigmatic	1.04 \pm 0.62	1.15 \pm 0.54	0.055	0.45 \pm 0.36	0.50 \pm 0.38	0.014*	0.75 \pm 0.63	0.81 \pm 0.62	0.102
4	Trifoil	0.11 \pm 0.06	0.12 \pm 0.06	0.468	0.11 \pm 0.06	0.13 \pm 0.10	0.110	0.13 \pm 0.08	0.13 \pm 0.12	0.904
5	Quadrifoil	0.09 \pm 0.06	0.10 \pm 0.08	0.435	0.06 \pm 0.04	0.08 \pm 0.06	0.021*	0.07 \pm 0.07	0.06 \pm 0.04	0.659
Right Eye										
6	Spherical	0.12 \pm 0.07	0.10 \pm 0.07	0.135	0.10 \pm 0.03	0.12 \pm 0.05	0.006*	0.09 \pm 0.02	0.11 \pm 0.05	0.157
7	Coma	0.20 \pm 0.17	0.18 \pm 0.15	0.425	0.15 \pm 0.07	0.17 \pm 0.07	0.213	0.15 \pm 0.05	0.17 \pm 0.07	0.184
8	Astigmatic	1.06 \pm 0.67	1.19 \pm 0.58	0.131	0.49 \pm 0.42	0.52 \pm 0.43	0.232	0.61 \pm 0.58	0.66 \pm 0.57	0.398
9	Trifoil	0.09 \pm 0.06	0.11 \pm 0.07	0.564	0.11 \pm 0.05	0.13 \pm 0.08	0.282	0.12 \pm 0.07	0.13 \pm 0.06	0.484
10	Quadrifoil	0.10 \pm 0.08	0.10 \pm 0.09	0.901	0.06 \pm 0.04	0.07 \pm 0.05	0.164	0.08 \pm 0.10	0.07 \pm 0.04	0.823
Left Eye										
11	Spherical	0.11 \pm 0.02	0.08 \pm 0.05	0.174	0.11 \pm 0.03	0.12 \pm 0.04	0.038*	0.12 \pm 0.08	0.12 \pm 0.07	0.818
12	Coma	0.10 \pm 0.04	0.15 \pm 0.11	0.202	0.13 \pm 0.05	0.16 \pm 0.07	0.048*	0.16 \pm 0.06	0.17 \pm 0.05	0.354
13	Astigmatic	1.02 \pm 0.57	1.10 \pm 0.52	0.275	0.42 \pm 0.29	0.48 \pm 0.32	0.030*	0.86 \pm 0.67	0.92 \pm 0.66	0.160
14	Trifoil	0.13 \pm 0.06	0.14 \pm 0.06	0.683	0.11 \pm 0.07	0.14 \pm 0.12	0.238	0.13 \pm 0.09	0.13 \pm 0.15	0.875
15	Quadrifoil	0.07 \pm 0.03	0.10 \pm 0.08	0.300	0.06 \pm 0.04	0.08 \pm 0.06	0.065	0.06 \pm 0.03	0.05 \pm 0.04	0.534

Table 4: Comparison of mean change between Sphero-cylinder, sphere and cylinder

Sr No		Sphero Cylinder	Spherical	Cylinder	P value
Both Eyes					
1	Spherical (Mean±SD)	-0.022 ± 0.05	0.016 ± 0.04	0.009 ± 0.03	<0.001*
2	Coma (Mean±SD)	0.007 ± 0.11	0.018 ± 0.06	0.013 ± 0.038	0.815
3	Astigmatic (Mean±SD)	0.11 ± 0.27	0.044 ± 0.152	0.052 ± 0.139	0.284
4	Trifoil (Mean±SD)	0.013 ± 0.08	0.0226 ± 1.26	0.001 ± 0.071	0.695
5	Quadrifoil (Mean±SD)	0.012 ± 0.078	0.016 ± 0.06	-0.006 ± 0.068	0.359
Right Eye					
6	Spherical (Mean±SD)	-0.02 ± 0.04	0.02 ± 0.04	0.02 ± 0.04	0.014*
7	Coma (Mean±SD)	-0.02 ± 0.10	0.01 ± 0.06	0.01 ± 0.03	0.261
8	Astigmatic (Mean±SD)	0.13 ± 0.31	0.02 ± 0.13	0.04 ± 0.16	0.229
9	Trifoil (Mean±SD)	0.01 ± 0.10	0.01 ± 0.09	0.01 ± 0.04	0.978
10	Quadrifoil (Mean±SD)	-0.002 ± 0.06	0.01 ± 0.06	-0.007 ± 0.10	0.581
Left Eye					
11	Spherical (Mean±SD)	-0.02 ± 0.05	0.01 ± 0.03	-0.001 ± 0.02	0.020*
12	Coma (Mean±SD)	0.04 ± 0.11	0.02 ± 0.06	0.01 ± 0.04	0.537
13	Astigmatic (Mean±SD)	0.08 ± 0.24	0.06 ± 0.16	0.05 ± 0.12	0.911
14	Trifoil (Mean±SD)	0.009 ± 0.07	0.02 ± 0.14	-0.004 ± 0.08	0.710
15	Quadrifoil (Mean±SD)	0.03 ± 0.09	0.01 ± 0.06	-0.005 ± 0.03	0.360

Table 5: Association of pupil size with mean change in Aberrations

Eye	Parameter	Pupil Size (Mean±SD)	Aberration mean change (Mean±SD)	Correlation Coefficient (r)	P value
Right	Spherical	3.94 ± 0.64	0.01 ± 0.048	-0.009	0.944
	Coma	3.94 ± 0.64	0.005 ± 0.073	0.046	0.729
	Astigmatic	3.94 ± 0.64	0.055 ± 0.196	0.125	0.342
	Trifoil	3.94 ± 0.64	0.160 ± 0.090	-0.022	0.867
	Quadrifoil	3.94 ± 0.64	0.007 ± 0.068	0.035	0.791
Left	Spherical	3.96 ± 0.57	0.002 ± 0.039	-0.057	0.666
	Coma	3.96 ± 0.57	0.024 ± 0.072	-0.032	0.808
	Astigmatic	3.96 ± 0.57	0.064 ± 0.173	0.081	0.538
	Trifoil	3.96 ± 0.57	0.018 ± 0.121	-0.159	0.225
	Quadrifoil	3.96 ± 0.57	0.016 ± 0.064	0.001	0.993

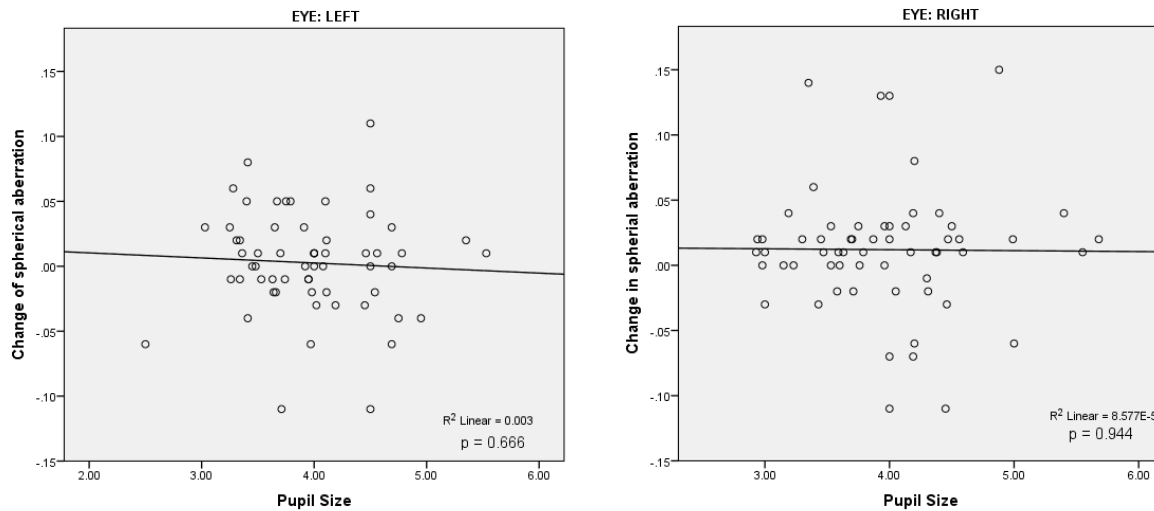


Figure 1. Graphical representation of Association of pupil size with mean change in spherical Aberration in both eyes (using Pearson correlation analysis)

Discussion:

This study compares the changes in HOAs after doing 30 minutes reading in myopes and myopic astigmatism. Myopes showed significant increase in HOAs such as in mean spherical 0.10 ± 0.03 to 0.12 ± 0.05 ($P < 0.001$), coma 0.14 ± 0.06 to 0.16 ± 0.07 ($p < 0.021$), astigmatic 0.45 ± 0.36 to 0.50 ± 0.38 ($P < 0.014$) and Quadrifoil 0.06 ± 0.04 to 0.08 ± 0.06 ($p < 0.021$) while trefoil shows insignificant increase 0.11 ± 0.06 to 0.13 ± 0.10 ($p < 0.468$). These changes were supported by Buehren T et al, 2024 in which the myopes have showed increased HOAs spherical 0.001 to 0.002 , coma -0.018 to -0.016 , astigmatic from 0.067 to 0.073 , trefoil from 0.003 to 0.004 after reading of one and two hours and these changes nearly associated with smaller palpebral aperture during reading in the myopic persons.¹³ Oberholzer M et al, 2019 agreed that myopes have increased negative spherical aberration changes $\pm 0.007 \mu\text{m}$ per dioptre myopia during near tasks, causing a central hyperopic blur and a peripheral hyperopic defocus resulting in myopia progression.¹⁴ Likewise, Ayyub F et al, 2022 showed myopes have more corneal RMS fourth 0.2803 ± 0.16 ($p < 0.009$), coma 0.279 ± 0.17 ($p < 0.03$) and spherical 0.230 ± 0.12 ($p < 0.008$) and with increase of myopia also increase.¹⁵ Gomes JRM et al, 2021 agreed that more changes in spherical -0.014 ($p < 0.030$), coma -0.010 ($p < 0.039$), Quadrifoil -0.006 ($p < 0.029$) and

Trifoil -0.010 ($p < 0.039$) HOAs when reading on printed paper compare to computer screen.¹⁰ Atchison DA et al, 2023 disagreed that with increase in accommodation changes mean decreased in spherical abs were -0.34 D ($P < 0.001$) and third and other abs also changes with accommodation ($p < 0.04$).¹⁶ Ghosh A et al, 2018 showed that near work have major role in myopia and HOAs changes from primary to down gaze as spherical -0.001 ± 0.002 and 0.007 ± 0.004 with $p < 0.001$, Quadrifoil 0.000 ± 0.005 and 0.016 ± 0.005 with $p < 0.009$, astigmatic 0.001 ± 0.005 and -0.016 ± 0.006 with $p < 0.012$ and coma 0.006 ± 0.00 and 0.022 ± 0.006 $p < 0.031$.¹⁷ Karimian F et al, 2020 showed Compound Myopic Astigmatism have significant changes as mean decrease in spherical HOA 0.12 ± 0.05 to 0.09 ± 0.06 with $p < 0.037^*$ and coma abs 0.16 ± 0.14 to 0.15 ± 0.13 ($P < 0.026^*$) while other HOAs and Simple Myopic Astigmatism have insignificant changes with p values of $0.055, 0.468, 0.435$ and Changes between right and left when compared separately were varied such as right eye showed mean decreased in spherical 0.12 ± 0.05 to 0.09 ± 0.02 ($p < 0.006$) and Quadrifoil 0.11 ± 0.05 to 0.07 ± 0.07 ($P < 0.021$) while left eye decreased in spherical 0.11 ± 0.02 to 0.08 ± 0.05 ($p < 0.038$) and increased in coma 0.13 ± 0.05 to 0.16 ± 0.11 ($p < 0.048$). A study agree our results that myopic astigmatic eyes have HOAs mostly with mean Primary horizontal trefoil

0.069±0.152µm, spherical-0.064±0.130µm primary vertical coma-0.038±0.148µm.¹⁸ de Gracia P et al, 2022 nearly disagreed this study that astigmatism and HOAs have effects on visual performance. When coma 0.11 to 0.41µm and astigmatism range of 0.75 D was combined, a significant correlation was noticed and VA improved (p 0.027).¹⁹ Leung T-w et al, 2022 parallels our results such as compared to myopia, myopic astigmatism have more negative trefoil with r=-0.69, p<0.001 and positive coma r=0.48, p=0.001 and these were strongly linked to asymmetry in corneal shape.²⁰ Jiménez R et al, 2018 agreed that near tasks with different difficulty level have significant effects on total RMS 7.45 (p 0.02), internal 4.33, (p 0.049), and astigmatic 4.89, (p 0.045), while Trifoil (p 0.059), spherical (p 0.316) and coma were insignificant effects.²¹ This study showed that changes in HOAs in right vs left eye and different refractive error have insignificant p-values 0.770, 0.344, 0.425 and 0.525 except spherical HOAs with significant p<0.001. Carkeet A et al, 2020 agreed with our results that variations of HOAs in different refractive error groups i.e. myopia and astigmatism have significant changes in spherical HOA (p<0.001), while disagreed in astigmatic HOA (p 0.003) and defocus HOA (p 0.02) and all other types shows insignificant variations with p>0.05.²² This study showed another results that insignificant changes in HOAs with pupil size variation between students right eye p-values range 0.342 to 0.944 and left eye p-value range 0.225 to 0.993. Castejón-Mochón JF et al, 2020 disagreed this study as aberrations rise in magnitude with increase in pupil size as in 3mm pupil have total RMS 0.5255µm, 5mm RMS 1.4901µm and 7mm RMS 2.9240 µm.²³ Another research showed that with increasing pupil size, ocular aberrations also increases specifically spherical HOA at 5 mm size increase in total RMS were 1.54, 1.59, 1.71, and 1.87.¹¹ Zhu X et al, 2020 showed that variation of pupil sizes from 4mm to 6mm have significant changes in aberrations like internal third-order (P0.009), coma (P0.001), total HOA (P 0.007) and ocular coma HOA (P 0.006).²⁴ McKelvie J et al, 2021 showed that high order ocular aberrations were significantly affected in

subjects whose pupil size showed more variability of 54.6% in HOAs than lens tilt.²⁵ A small sample size comprising of certain age group and refractive error constitutes major limitation. Also variation in type of refractive error i.e. spherical, cylinder or combined also leaves the conclusion to have a limited clinical impact. Multicentre research with diverse sample will have to better understand the impact of pupil size with refractive error on ocular high order aberration.

Conclusion:

High order ocular aberrations after doing near work increase in myopes and decrease in myopic astigmatism. However, the change in type of high order ocular aberration may vary according to laterality.

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Correlation of Rubbing of Eyes with Keratoconus

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Abstract:

Objective

To investigate the correlation between eye rubbing and the development of keratoconus and to assess the severity of keratoconus in patients who have a history of habitual eye rubbing.

Methods: A cross-sectional observational study was conducted on 120 patients (222 eyes) who were referred to the outpatient department (OPD) due to astigmatism, ocular pain, frequent prescription changes, suspected keratoconus, or for refractive surgery evaluation. Non-probability sequential sampling was used. Ocular history was recorded, including habitual eye rubbing and comprehensive ocular assessment was performed. The KISA% index, derived from topographic data, was used to confirm keratoconus diagnosis. Data were entered and processed using Microsoft Excel, and R software was utilized for statistical analysis. Statistical significance was set at a p-value of less than 0.05.

Results: A total of 120 individuals with 222 eyes (mean age 19.55±5.79 years) were examined in this study. 55.4% of the patients were men and 44.6% were women. After excluding 18 eyes that had previously undergone ocular surgery, 204 eyes remained in the final analysis. Amsler-Krumeich classification was used to stage keratoconus. 52 eyes had stage-1 keratoconus, 42 had stage-2, 14 had stage-3 and 7 had stage-4 keratoconus. Keratoconus and eye rubbing were found to be statistically significant (p<0.05)

Conclusion: Our study concludes that rubbing of the eyes is a significant risk factor for the onset of keratoconus and may exacerbate disease progression in diagnosed patients. *Al-Shifa Journal of Ophthalmology 2026; 22(1): 42-48.*

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Introduction:

Nottingham used the term "keratoconus" for the first time in 1854. Ectasia, corneal thinning, and increased curvature are characteristics of keratoconus, a bilateral, asymmetrical, progressive, non-inflammatory condition that eventually results in loss of visual acuity, especially in cases of high irregular astigmatism¹.

Studies have found that the prevalence of keratoconus varies greatly, with estimates from 1 in 500 to 1 in 2000 people worldwide². High prevalence rates have been found in recent studies using corneal topography³.

Keratoconus was found in 8.8 to 299 cases per 100,000 people annually in the general population. According to reports, the prevalence is 0.3 per 100,000 in Russia, 1 in 2,000 in US, and 2,300 per 100,000 in central India⁴. Environmental and demographic factors are among the many factors that influence the development of keratoconus. Atopy, eye rubbing, and UV

exposure are examples of environmental factors, whereas genetic and ethnic variations are examples of demographic factors⁵.

Keratoconus is associated with excessive eye rubbing. There are several theories as to how rubbing one's eyes can cause keratoconus. The cornea's elasticity makes it susceptible to shape changes. The frequency and force of rubbing influences the cornea's shape. The keratocyte density in human corneas was found to be significantly reduced after 30 repetitions of a light 10-second eye rub over a 30-minute period. Furthermore, changes in intraocular pressure (IOP) brought on by eye rubbing may indirectly traumatize keratocytes. Keratoconus is the result of keratocytes being traumatized⁶. Numerous studies have shown that increasing the compressive rubbing forces applied to the corneal surface during eye rubbing causes an increase in intraocular pressure (IOP)^{7,8}.

The patient is typically asymptomatic in the early stages of the illness. Significant vision loss and distortion result from a decline in visual acuity as the disease progresses. Although there is no known cure for this degenerative condition, it can be conservatively treated with contact lenses and glasses to enhance vision. Collagen cross-linking (CXL), penetrating keratoplasty, and intact⁹.

Early diagnosis of keratoconus is difficult. The most precise technique for assessing corneal shape and identifying keratoconus is corneal topography, which is based on the ideas of Placido disc and Schimpflug imaging. The gold standard for diagnosing keratoconus is corneal topography. Subclinical keratoconus (KC), also referred to as forme fruste KC, can be diagnosed and its severity graded using a color-coded topographic map of the corneal surface and other parameters. Based on these indices, a number of quantitative techniques have been created. Rabinowitz Rasheed defined the KISA%

index, which is used to diagnose KC and consists of four topography indices.¹⁰. To stage keratoconus, numerous classification schemes have been developed. One of the most widely used methods for diagnosing keratoconus and tracking its development is still the Amsler-Krumeich classification. This grading scheme is based on biomicroscopy, refraction, corneal thickness, and topographic assessment of the anterior corneal surface¹¹.

There is mounting evidence that persistent eye rubbing can lead to keratocyte structural damage and corneal thinning, both of which are factors in the development of keratoconus. Despite this, there is disagreement over how much rubbing the eyes can contribute to the development and progression of keratoconus. The goal of the research is to ascertain whether excessive eye rubbing is linked to keratoconus and whether the condition can be successfully prevented by avoiding eye rubbing. The gold standard for diagnosing keratoconus is the Galeli G4 dual Scheimpflug.

Methodology:

A cross-sectional study was conducted in the tertiary eye care center, in the corneal department of Al-Shifa Trust Eye Hospital (ASTEH), Rawalpindi, from July 2021 to December 2021. The study was carried out after approval from the Institutional Review Board of Alshifa Trust Eye Hospital, Pakistan, according to the Declaration of Helsinki. In this research 120 patients were evaluated. Non-probability sequential sampling was used. A structured questionnaire was used to record the demographic data of the patients, and the patients' ocular history with respect to rubbing of the eyes was taken. All patients underwent a complete ophthalmic examination. We diagnosed the keratoconus using the KISA% index calculated from corneal topography. In this study, patients with suspected keratoconus, frequent changes of glasses,

ocular discomfort, astigmatism, and refractive surgery were included. Patients who had a history of ocular trauma, intraocular disease, current active eye disease, corneal scarring or pterygium, and contact lens wearers (who had worn soft contact lenses in previous 7 days and hard contact lenses previous 14 days) were excluded from the study. Data were analyzed using (R) version 2024.12.1+563. Qualitative data were presented as frequencies and percentages, and the Chi-square test (χ^2) was used to assess the relationship between variables. A P-value of < 0.05 was considered statistically significant.

Results:

Descriptive Analysis

A total of 222 eyes from 120 participants were included in this study. The study

consisted of both genders with a higher representation of men. Specifically, 123 eyes (55.4%) belonged to male participants, while the remaining 99 eyes (44.6%) were from female participants. The mean age of the study participants was 19.55 ± 5.786 years, with participants ranging in age from 10-30 years, indicating a predominance of young individuals affected by or at risk for keratoconus. Systematic history was negative in all cases (N=120,100%). A positive history of spectacle use was reported in 166 eyes (74.8%), suggesting a high prevalence of refractive error in the study population. Additionally, ocular allergy, a known contributor to frequent eye rubbing, was present in 40 subjects (33.3%), highlighting a potential behavioral and environmental link to corneal pathology.

Table 1: Descriptive Statistics of Variables

Variable	Level	N (%)
Gender	Male	123 (55.4)
	Female	99 (44.6)
Eye Rubbing	Positive	154 (69.4)
	Negative	68 (30.6)
Spectacle History	Positive	166 (74.8)
	Negative	56 (25.2)
Ocular Allergy	Positive	40 (18.0)
	Negative	182 (82.0)
Systematic History	Positive	0 (0.0)
	Negative	222(100)
KC Diagnosis (KISA%)	Yes	115 (51.8)
	No	107 (48.2)

The severity of keratoconus was classified using the Amsler-Krumeich classification system, which categorizes the disease into four progressive stages based on keratometric readings, astigmatism, corneal transparency, and corneal thickness. Out of a total of 222

eyes examined, 52 eyes were diagnosed with stage 1, 42 eyes with stage 2, 14 eyes with stage 3, and 7 eyes with stage 4 keratoconus based on the Amsler-Krumeich classification system shown in Figure 1.

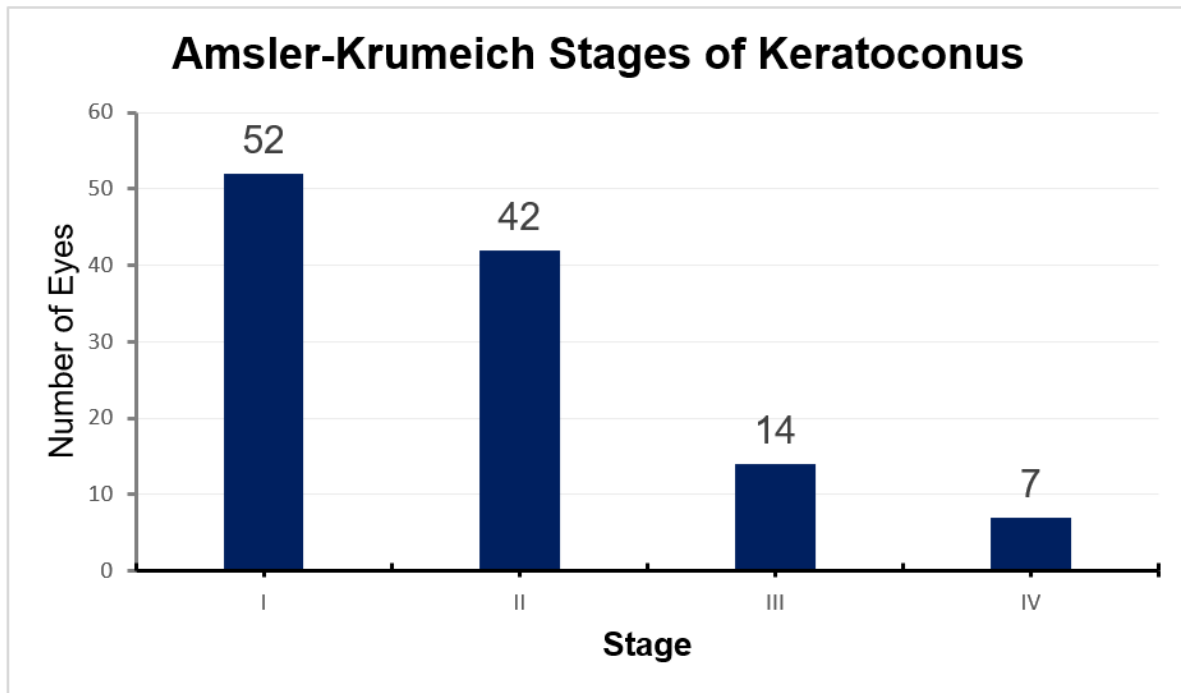


Figure 1: Bar Plot of Eyes by Amsler-Krumeich Stage

Inferential Analysis

Chi-square was used to find the association between rubbing of the eyes with keratoconus. A statistically significant

association was found between rubbing of eyes and keratoconus ($p < 0.05$). The following table gives the value of chi-square and p-value of each variable:

Table 2: Chi-Square for Association between Rubbing of Eyes with Keratoconus

Rubbing of eyes	KC positive(N=115)	KC negative(N=107)	Total (N=222)
Yes	107(69.5%)	47(30.5%)	154(100%)
No	8(11.8%)	60(88.2%)	68(100%)
Chi-square χ^2 (df)	33.315(1)	P=0.000	

Discussion:

This study investigated the correlation of rubbing of the eyes with the development of keratoconus. Table 2 shows a substantial correlation between eye rubbing and Keratoconus ($X^2(1) = 33.315, p < 0.000$). A much larger proportion (69.5%) of respondents who

reported rubbing their eyes were found to have Keratoconus, compared to only 11.8% of those who did not rub their eyes. In contrast, the majority of those who did not rub their eyes 88.2% did not have Keratoconus. These findings support the previously held belief that frequent eye rubbing may add to or worsen the likelihood of developing

Keratoconus. The highly substantial p-values suggested that public health efforts to discourage regular eye rubbing could prevent or reduce the incidence of Keratoconus. The findings of this study are consistent with previous research demonstrating that a complex interaction between genetic vulnerability and behavioral or environmental factors causes keratoconus. Numerous epidemiological and clinical investigations have shown that eye rubbing is the most important modifiable factor linked to KC. According to Gordon-Shaag et al, 2013, persistent rubbing is a major external trigger that interacts with genetic propensity to cause corneal ectasia⁵. In a similar vein, Debourdeau et al, 2022 discovered that eye rubbing increased the risk of KC with an odds ratio of 10.9, whilst family history revealed an OR of 22.2¹². Additionally, Moran et al, 2020 noted that rubbing with knuckles increases mechanical stress, indicating that the kind and degree of rubbing affect corneal injury¹³.

Large-scale prevalence studies provide additional evidence of the substantial correlation between rubbing and KC. While rubbing itself did not achieve statistical significance in that sample, Millodot M et al, 2011, reported a KC prevalence of 2.34% in Jerusalem, which was considerably greater among males. They also found that atopy and familial history were important predictors¹⁵, while a study conducted on a Lebanese medical student screening trial showed no significant correlation of atopy and rubbing of eyes with keratoconus¹⁴.

Yang K et al, 2022, on the other hand, showed incredibly strong correlations, with eye rubbing showing an OR of 15.11 and atopy an OR of 5.30 particular, the cohabitation of rubbing and atopy raised risk by more than 50-fold. All of these results point to rubbing as a key mechanism, and allergy symptoms probably work indirectly by making people more eager to rub¹⁷.

These correlations are supported by meta-analytic data. The hypothesis that rubbing is the predominant behavioural mechanism is supported by Seth et al, 2023, who reported pooled odds ratios of 5.22 for eye rubbing and 6.67 for family history, although atopy showed a smaller connection¹⁶. Rubbing raises the incidence of KC by more than six times, according to a second comprehensive review, in which casual interpretation is limited by the variation in study methods¹⁸. However, these analyses highlight the consistency and biological plausibility of the connection.

Evidence at the molecular level provides important mechanistic insights. The concept that mechanical trauma, rather than immune-mediated inflammation, promotes KC phenotypic expression is highly supported by Jaskiewicz K et al, 2023, who demonstrated that rubbing initiates pathways including apoptosis (TP53, BCL2L1), stress response, and altered cell adhesion within the corneal epithelium¹⁹. This settles the contentious link between allergies and keratoconus; itching-induced rubbing becomes the harmful agent, but allergic illnesses by themselves are insufficient to cause keratoconus¹⁶.

Environmental factors seem to be important as well. It is found that dust exposure had a significant effect¹⁹. Increased screen time is associated with the beginning of KC, causes dryness and irritation, and encourages rubbing behaviour¹³. When taken as a whole, these variables represent cumulative epithelial stress that speeds up stromal thinning.

The necessity of public education is shown by awareness studies. Only 26% of participants in a Saudi Arabian poll have a strong understanding of keratoconus, despite the fact that 81.4% of them massaged their eyes²⁰. This discrepancy implies that teaching populations about the dangers of rubbing, particularly in areas with high KC prevalence, may lessen the clinical burden.

Conclusion:

This study demonstrates a significant positive correlation between eye rubbing and the presence of keratoconus, supporting the hypothesis that mechanical trauma may play a contributory role in the development and progression of keratoconus. These findings highlight the importance of patient education regarding the harmful effects of habitual eye rubbing and behavioral intervention in reducing the modifiable risk factors. By addressing behavioral contributors early, there is potential not only to delay the onset of keratoconus but also to reduce its severity and the need for invasive interventions in the long term.

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Complications of Manual Small Incision Cataract Extraction Surgery

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Abstract:

Objective: To determine the frequency and types of early complications following Manual small-incision cataract surgery (MSICS) among local population.

Methods: The study design was cross-sectional, conducted at Ophthalmology Department of Hayatabad Medical Complex, Peshawar, from September 2020 to 2021, including 135 patients undergoing cataract surgery, recruited using consecutive sampling technique. MSICS was performed under peribulbar anaesthesia. Demographic and clinical data were collected using a structured proforma. Post-operative complications, including increased intraocular pressure (IOP), hypotony, hyphema, and corneal decompensation, were assessed on the first post-op day. Data were analyzed using IBM SPSS version 27. Associations were evaluated using the Fisher Exact test, with $p \leq 0.05$ considered statistically significant.

Results: The mean age of participants was 56.5 ± 5.3 years, with 53.3% males and 46.7% females. Most surgeries were performed on the left eye (71.1%). Post-operative complications included IOP (8.1%), hypotony (3%), hyphema (3%), and corneal decompensation (3.7%). IOP was more frequent in patients aged 51-70 years (8.5%) and procedures lasting >20 minutes (11.8%). Hypotony and corneal decompensation were observed only in patients aged 51-70 years (3.4% and 4.3%, respectively) and procedures lasting >20 minutes (4.3% and 5.4%, respectively). Hyphema was more common in patients aged 35-50 years (5.6%) and procedures lasting >20 minutes (3.8%).

Conclusion: Manual small incision cataract surgery is a safe procedure with a low frequency of early postoperative complications. Surgeons should exercise care during surgery, especially in longer procedures, to minimize early complications. *Al-Shifa Journal of Ophthalmology* 2026; 22(1): 49-55.

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Introduction:

A cataract is a cloudiness or opacity of the normally clear lens or its capsule (the transparent membrane around the lens) which makes it impossible for light to pass through the lens to the retina [1]. This completely sighted state may be experienced by a newborn, a grown-up or the elderly but is very common among the elderly. May be bilateral and may vary in intensity [2]. The condition is a gradual process, and at first it doesn't even cause any problems in everyday activities, but as the cataract grows, around the fourth or fifth decade, it will be completely cloudy, and interfere with normal activities [3]. Cataracts are leading cause of blindness in the world. The treatment options involve refractive glasses correction only in early

stage and surgery can be recommended in case of cataract development to a stage where it interferes with life, which is very beneficial [4].

In most countries, cataract surgery is the most common surgical procedure. With the advancement of the procedure and instruments, surgery is now much less risky than in the past, and has become the option of choice. However, the same benefits, such as more applications, less time consuming, shorter learning curve, and lower cost are equally available with MSICS. The high speed technique allows for MSICS to be done at high volume. Here we will examine various methodologies, safety and efficacy of MSICS, its development and use in the developing and poor countries [6]. There are extra anterior chamber manoeuvres to perform in MSICS such as capsulorrhexis, pushing the nucleus from the posterior chamber to the anterior, and removal of the nucleus from the scleral tunnel. The surgeon has to re-enter the eye for the aspiration of the cortex and for the insertion of intraocular lenses. The removal of the lens nucleus and the cortical material should be done by hand, rather than by phacoemulsification, which is a procedure carried out by a machine that has ultrasonic power and suction. MSICS has been linked to excessive handling and damage to the iris, posterior capsular rent and zonulodialysis [7].

The study in the United States reported that the prevalence of IAP was 9.1%, hypotony 4.5%, hyphema 4.5%, and compaction of the cornea was 4.5% after manual small incision cataract surgery [8].

Other authors have assessed the safety of MSICS however few studies have been done outside Pakistan [8,9] and none so far has been done to assess the early post-operative problems in Pakistan. Cost-effectiveness and high volume practice makes MSICS a widely used approach in Pakistan, and it is the leading cause of preventable blindness. Although there is a strong argument for its use, MSICS has been linked with early post-operative

complications which could impact surgical outcomes, but most of the available evidence is from overseas studies with limited local data available. The overall objective of this study is to find the incidence and nature of early complications after MSICS in our population, so as to provide evidence for optimizing surgical outcomes, patient counseling and healthcare planning.

Methodology:

This cross-sectional study was design to determine the occurrence of post-operative complications after MSICS and was carried out in the Department of Ophthalmology at Hayatabad Medical Complex, Peshawar from September 2020 to 2021. The sample size was determined to be 135 patients, based on the WHO sample size calculator, at 95% confidence interval, 3.5% margin of error, and an expected prevalence of 4.5% for corneal decompensation after MSICS [8]. Consecutive sampling technique was used to include the patients in the study. The inclusion criteria was patients of either gender, age 35 to 70 years, undergoing cataract surgery, and cataract duration > 6 months. Excluded patients were those with any zonular weakness, posterior polar cataract, corneal dystrophy/pathology, status, post-uveitis cataract, pseudo exfoliation, and traumatic cataract.

Cataract diagnosis was made when there was clinically significant lens opacity detected by slit-lamp biomicroscopy that resulted in visual impairment and warranted surgical intervention. The severity of cataract was determined preoperatively using the Lens Opacities Classification System III (LOCS III).

Post-operative complications included: IOP (>21 mm Hg on tonometry), hypotony (<12 mm Hg on tonometry), hyphema (pooling or collection of blood in the anterior chamber), corneal decompensation (cornea guttata, stromal density, or Descemet's membrane folds by slit lamp).

Study obtained approval from IRB with Ref No. 224/HEC/B&PSC/19 on 18th

December, 2019. After giving informed consent, demographic data and clinical details (age, sex, duration of complaint) were gathered. Peribulbar anesthesia was used for the MSICS. A fornix-based conjunctival flap was created and hemostasis was achieved by bipolar diathermy cautery. A partial thickness curvilinear scleral incision was performed with a 6-8 mm slit, 3 mm posterior to the limbus with the creation of a side port at 9 o'clock. Viscoelastic material was used to deepen the anterior chamber and continuous curvilinear capsulorhexis was performed. Several hydro-dissections were carried out to facilitate the passage of the nucleus into the anterior chamber, and this was then removed from the chamber by hydrostatic pressure. A posterior chamber intraocular lens (IOL) was inserted in the bag and the residual cortex was evacuated using a Simcoe cannula. Viscoelastic was aspirated and side port closed with moistening of the stroma.

All surgery was carried out by a consultant ophthalmologist who has three years of post fellowship training in MSICS. Consistency in evaluation by same consultant on the first day after surgery to assess postoperative complications. A structured proforma was used to record any complications and IBM-SPSS version 27 was used to assess the complications. Age, duration of complaint, duration of procedure were recorded as mean \pm SD, gender, side of eye, post-operative problems were recorded as

frequencies and percentages. The problems after the surgery were categorised according to age, gender, eye side, duration of complaint and procedure duration. Associations were evaluated with the Fisher Exact test, and the p-value of ≤ 0.05 was used as the criterion for significance.

Results:

This study consists of 135 patients with a mean age of 56.5 ± 5.3 years, mean duration of complaints of 15.5 ± 4.4 months, and mean procedure duration of 23.1 ± 4.1 minutes. Among participants, 72 (53.3%) were male, and 63 (46.7%) were female, with most surgeries performed on the left eye 96 (71.1%) compared to the right eye 39 (28.9%).

Based on preoperative grading using LOCS III, nuclear sclerosis grade III–IV was observed in 74 (54.8%) patients, followed by grade I–II in 27 (20%) patients, and grade V–VI in 20 (14.8%) patients. Cortical opacities were present in 27 (20%) patients, while posterior subcapsular opacities were noted in 14 (10.4%) patients, either in isolation or in combination with nuclear changes. Some patients demonstrated mixed morphological patterns.

The total post-operative complications was 24 (17.78%), included IOP 11 (8.1%), hypotony 4/24 (3%), hyphema 4 (3%), and corneal decompensation 5 (3.7) (Figure 1).

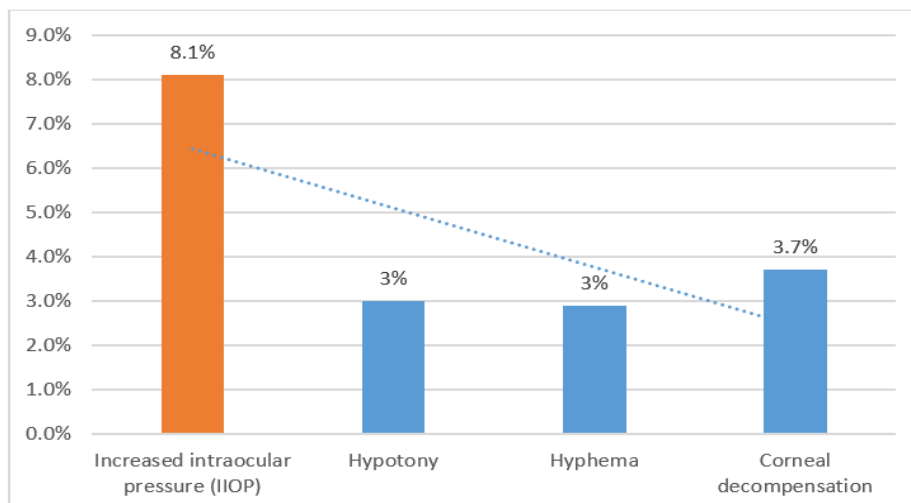


Figure 1: Frequency of Post-Operative Complications

In this study, postoperative complications were analyzed across baseline and procedural variables. No significant association was found between age, gender, side of eye, or duration of complaints and the occurrence of IOP, hypotony, hyphema, or corneal decompensation (all $p > 0.05$). However, longer procedure duration (>20 minutes) showed a

statistically significant association with increased IOP ($p = 0.020$), while its relation to other complications was not significant. Patients with a complaint duration of more than 12 months tended to have a higher frequency of complications, but these associations did not reach statistical significance.

Table 1: Stratification of Postoperative Complications

Variable		Increased IOP n (%)	p-value	Hypotony n (%)	p-value	Hyphema n (%)	p-value	Corneal Decompensation n (%)	p-value
Age (years)	35–50	1(5.6%)	0.666	0(0%)	0.426	1(5.6%)	0.486	0(0%)	0.371
	51–70	10(8.5%)		4(3.4%)		3(2.6%)		5(4.3%)	
Gender	Male	6(8.3%)	0.933	1(1.4%)	0.249	2(2.8%)	0.892	2(2.8%)	0.543
	Female	5(7.9%)		3(4.8%)		2(3.2%)		3(4.8%)	
Side of Eye	Left	7 (7.3%)	0.568	4(4.2%)	0.196	3(3.1%)	0.862	5(5.2%)	0.146
	Right	4(10.3%)		0(0%)		1(2.6%)		0(0%)	
Complaints Duration (months)	6–12	0(0%)	0.064	0(0%)	0.278	0(0%)	0.278	0(0%)	0.223
	>12	11(10.5%)		4(3.8%)		4(3.8%)		5(4.8%)	
Procedure Duration (min)	≤ 20	0(0%)	0.02	0(0%)	0.172	0(0%)	0.172	0(0%)	0.126
	>20	11(11.8%)		4(4.3%)		4(3.8%)		5(5.4%)	

Discussion:

In our study first day post-operative complications were IOP 8.1%, hypotony 3%, hyphema 3% and corneal decompensation was 3.7%. Results of this study are comparable to a study conducted in United states which has shown that frequency of IOP was 9.1%, hypotony 4.5%, hyphema 4.5% and corneal decompensation was 4.5% after manual small incision cataract surgery [8]. MSICS is a safe and effective method for cataract removal, especially in developing countries, and has similar or better early results compared to Extra-capsular cataract extraction (ECCE) and

phacoemulsification[10-13,15]. Phacomorphic glaucoma may be difficult to perform as there is a higher chance of endothelial cell loss because the nucleus emulsifier is close to the endothelial cells during nucleus emulsification and patients have lower endothelial reserve¹⁶, and have a higher chance of shallow chamber, Iris prolapse, and peripheral capsulorrhexis tears. In such circumstances, a pars plana vitreous tap is recommended to extend the anterior segment, which helps to deepen the anterior chamber and allows for effective capsulectomy and cataract extraction [17]. A small-gauge, sutureless pars plana partial-core vitrectomy has also been

demonstrated to be an effective surgical technique to overcome these problems. The drawbacks are that the eye can't be directly visualized because of extensive cataract and there is a very small risk for retinal detachment, which was reported following small-gauge vitrectomy for various posterior segment conditions [15]. MSICS, on the other hand, does not require costly equipment such as phacoemulsification, and the anterior chamber is more stable due to the shelving scleral wound, resulting in less surgical problems.

Many things can cause hypotony following cataract surgery. Corneal edema, corneal Descemet's folds, shallow anterior chamber, retinal and optic disc oedema, retinal folds and choroidal detachment are common anatomic changes associated with chronic hypotony after cataract surgery, typically caused by a wound leak, hidden cyclodialysis or chronic inflammation [17]. In 2015, Alexander et al [18] reported hypotony as a possible complication that occurs on the first day of pars plana vitrectomy. Hypotony occurs in about 6% of patients shortly after surgery, indicating that improved wound formation might improve surgical outcomes [19]. Hypotony can be more or less depending upon the size and structure of the wound. Improper incisions were associated with decreased postoperative intraocular pressures [20]. Clear corneal cataract surgery may leave the eyes with low intraocular pressure, and the margins may gap, increasing the risk of introduction of organisms into the aqueous²¹ which may result in endophthalmitis. One of the estimates is 1.6% cases needed suturing because of wound leaking. The leak can also occur in the scleral tunnel and limbal [22]. In 2014, Hayashi et al. [23] reported that scleral tunnel incisions have superior ability to self-seal and water tightness than transparent corneal incisions.

Our study highlights that early post-operative IOP elevation is more likely in procedures lasting longer than 20 minutes. The occurrence of hypotony, hyphema, and

corneal decompensation was low. Although 71.1% of surgeries in our study were performed on the left eye, this was due to consecutive patient enrollment during the study period and was not the result of intentional selection. No systematic preference for operating on the left eye was applied.

The study limitations include, early (first-day) complications assessment, so long-term outcomes such as posterior capsular opacification or final visual acuity were not evaluated. Small sample size and a single-center design may limit generalizability. The sample size for some complications was small, reducing statistical power. Postoperative assessments relied on clinical examination, which may introduce observer variability. Although procedure duration was analyzed as a risk factor for complications, the underlying reasons for longer surgeries, like dense cataract, small pupil, or intraoperative difficulties, were not recorded in this study. Future studies should document these factors to more accurately assess their impact on postoperative outcomes. Also future studies should include larger, multicenter cohorts and follow-up beyond the first postoperative day to assess long-term outcomes objectively.

Conclusion:

Manual small incision cataract surgery is a safe procedure with a low frequency of early post-operative complications. In this study, first-day complications included IOP (8.1%), hypotony (3%), hyphema (3%), and corneal decompensation (3.7%). Surgeons should exercise care during surgery to minimize early complications, particularly in procedures of longer duration.

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Unseen Challenges: Presbyopia in Free Eye Camp

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Abstract:

Objectives: Free eye camps were conducted to find the magnitude, gender distribution and age of onset of presbyopia in the underserved communities.

Methods: Cross sectional study was conducted in 17 free eye camps in Peshawar District during 2016-2020. Those aged ≥ 30 years and with visual acuity (VA) of 6/6 to 6/12 at distance who complained of near vision problems were included. Presbyopia defined as the inability to read at N4 corrected with at least +1.0 D lens. Snellen chart was used to assess visual acuity and retinoscopy was used for the assessment of refraction. Data collected were analyzed descriptively and by using chi-square tests in the Statistical Package for the Social Sciences (SPSS) version 22.

Results: Of 10,983 patients examined, 1,867 (17.0%) were presbyopic. Females accounted for 61.0% and males 39.0% (ratio 1:1.56). The highest prevalence was seen in the age group of 35-40 years, which was prior to the global averages. Patients aged 56-60 were most affected, up to +2.50 required to correct near vision. There was a statistically significant association found between age group and gender ($\chi^2 = 38.09$, $p < 0.001$).

Conclusions: The prevalence of presbyopia is high in the rural communities and onset of presbyopia occurs at an earlier age and is more of a burden for females. Free eye camps successfully meet unmet needs and, especially, the needs of women who are excluded from hospital based care. There is a high need for sustainable outreach and incorporation of presbyopia in national vision care planning. *Al-Shifa Journal of Ophthalmology 2026; 22(1): 56-62.*

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Introduction:

Presbyopia, which is a loss of lens accommodation, usually occurs after the age of 40, and can present as problems with close-up vision like reading or sewing¹⁻³. It is a condition caused by progressive changes of the crystalline lens, zonules and ciliary body that impact the eye's ability to focus on close objects⁴. Hofstetter's formulas illustrate what happens to the amplitude of accommodation as a person ages, from about 20 D at birth to less than 1 D by age 60⁴.

In 2015, 1.8 billion people in the world were afflicted with presbyopia, and by 2030, this number is projected to increase to 2.1 billion⁵. This burden is especially severe in low income countries (LIC) where 94% (26 of 28) people with profound near vision disability are uncorrected⁶. There are geographical variations, ranging from 43.8% in Japan to 88.9% in the USA, and highest prevalence reported was 90% in Nicaragua⁷. The prevalence of hepatitis B

infection has been reported in Pakistan as 57.5%⁸. The challenges to correction are low availability of eye care services, especially in rural areas, where it is more prevalent; low awareness and poor affordability^{9,10}.

The WHO's Vision 2020 aimed at eliminating avoidable blindness, highlighting the fact that 75% of all blindness in the world is in the poorer countries¹¹. Free eye camps have always been an important part of eye care services in Pakistan and South Asia in reaching people with limited access to eye care services^{12,13}. However, with the limited resources of the national health care systems allocated to eye care, these outreach efforts continue to be vital.

This study aimed to determine the prevalence of presbyopia, evaluate its distribution across genders, and identify the age at onset among individuals attending free eye camps in District Peshawar.

Methodology:

This was a cross sectional study carried out in 17 free eye camps, which were organized in District Peshawar, Khyber Pakhtunkhwa from 09/2016 to 01/2020. The Government National Program for the Prevention and Control of Blindness had been put in place by arranging camps with Lions Club International and Pakistan Institute of Community Ophthalmology (PICO).

Enrollment of participants was through consecutive sampling. The following inclusion criteria were used: Distance VA

6/6-6/12 (WHO classification); age ≥ 30 years. Presbyopia is when a person cannot read N4 optotypes at 40 cm corrected +1.0D or higher. The following patients were excluded in this study: diabetes, pseudophakia, patients with diabetes who did not understand the near chart, and patients who have other eye diseases that affect their near vision. Patients with diabetes, pseudophaks, diseases that impaired close-up vision and patients who did not wish to be included were excluded from the study.

Snellen chart was used to assess visual acuity. The refraction was carried out by trained optometrists and the near vision spectacles had to be given immediately following the refraction. The rest of the patients with ophthalmic diseases received treatment on-site or referred to Hayatabad Medical Complex.

Permission for all camps and the study was obtained from the medical director of Hayatabad Medical Complex, provincial health authorities, and local administration. Descriptive statistics summarized demographic and clinical characteristics. Near vision before and after correction was recorded. A chi-square test examined the association between age group and gender. Data were analyzed using SPSS version 22.

Results:

Of 10,983 patients examined, 1,867 (17.0%) met the criteria for presbyopia. Among these, 1,139 (61.0%) were female and 728 (39.0%) were male (ratio 1:1.56).

Table 1. Distribution of patients attending the free eye camps

Categories	Male n (%)	Female n (%)	Total n (%)
Children <18 years	651 (5.92)	994 (9.05)	1655 (15.07)
Adults ≥ 18 years	3743 (34.07)	5595 (50.94)	9338 (84.49)
Total	4394 (40.0)	6589 (60.0)	10,983 (100)

Table 1 shows the total number of patients (adults and children) who attended the eye camps.

Table 2. Age distribution of enrolled presbyopic patients by gender

Age groups (years)	Male (n)	Female (n)	Total (n)
35–40	174	298	472
41–45	108	211	319
46–50	121	186	307
51–55	150	278	428
56–60	175	166	341
Total	728	1,139	1,867

Table 2 shows the age distribution of male and female patients enrolled in the study.

Table 3. Near vision before and after correction among presbyopic patients

Age groups (years)	Male (n)	Female (n)	Total (n)	Near vision before correction (target size)	Lens power (D)	Near vision after correction (target size)
35–40	174	298	472	< 6–8	+1.00	6
41–45	108	211	319	< 10	+1.25	6
46–50	121	186	307	< 12	+1.50	6
51–55	150	278	428	< 14	+2.00	6
56–60	175	166	341	< 18	+2.50	6
Total	728	1,139	1,867	—	—	—

Table 3 shows patients near vision before and after correction, measured with the Snellen chart, for both male and female participants.

Table 4. Chi-square test of association between age group and gender among presbyopic patients

Statistic	Value	df	Sig. (p-value)
Pearson Chi-Square	38.087	4	<0.001
Likelihood Ratio	36.108	4	<0.001
Linear-by-Linear Association	14.328	1	<0.001
N of Valid Cases	1867	—	—

Table 4 shows that the chi-square test demonstrated a statistically significant association between age group and gender among presbyopic patients ($\chi^2 = 38.09$, $df = 4$, $p < 0.001$).

Discussion:

Uncorrected presbyopia can negatively impact quality of life, affecting productivity, mental well-being, and daily activities. Economic burden: The condition, especially when uncorrected, leads to significant productivity losses worldwide. Our study shows (Table 1) that a large number of people in the community are unable to access hospital-based eye care services. Many welfare organizations, such as Layton Rahmatulla Benevolent Trust (LRBT), Al-Shifa Eye Trust Hospital, Al-Mustafa Welfare Trust, and the Prevention of Blindness Trust (POBT), have also reported a high number of patients examined through free eye camps. The LRBT alone reported 2.9 million numbers of patients in their Annual Review/Annual Report 2017¹⁴. The high turnout (presbyopic and eye disease patients) in our eye camps reflects the effective coverage of underprivileged community members who are unable to utilize hospital services, which may be due to poverty and poor accessibility.

The age of participants presenting with symptoms of presbyopia in our study ranged from 35 to 60 years. We observed the development of presbyopia at an earlier age compared to other studies, which generally report onset at 40 years and above. The onset of presbyopia symptoms is typically around 40 years in Western societies, while earlier onset has been observed in countries closer to the equator, such as those in Central and South America¹⁵. The reason for this earlier or before 40 years of onset of presbyopia in central/south American countries was presumed to it may be because of premature degradation of the crystalline lens which may be caused by ultraviolet radiation exposure¹⁶. In our rural communities, outdoor activities and sun exposure are more frequent than in Western societies. Therefore, early onset of presbyopia among both men and women in our population may be linked to UV-induced lens changes. Additionally, Jonathan S. Pointer's study on presbyopia

reported that presbyopia tends to occur earlier in women than in men, possibly due to hormonal differences¹⁷. Individuals in rural areas often spend more time outdoors and have little engagement in near-work activities, such as reading or sewing, which are common among literate populations. Jonathan S. Pointer studied presbyopia and reported that with increasing age, the power of lenses increases, and there are gender differences in optical changes of the onset of presbyopia¹⁷. Another reason may be that these people in their childhood may have spent more time in outdoor activities and have no interest in reading (illiterate) or near work activities like reading, playing games on a computer or mobile, which leads to preventing myopia development in childhood. The Beijing Children Eye Study on myopia development, Wu, P. C., Tsai, C. L., Wu, H. L., et al and Read S.A. reported that children who spent more time in outdoor activities will be having less chance of developing myopia as compared to those who spent more time in indoor activities¹⁸⁻²⁰ and thus these changes in lens, size of eyeball, and outdoor activities may lead to early onset of presbyopia.

Reading glasses were prescribed based on appropriate refraction for near vision. The severity of presbyopia increased with age, and the number of early presbyopic subjects (aged 35–40 years) was higher than those aged 55–60 years. The dioptric power of near-vision correction most commonly prescribed ranged between +1.00 and +2.50 diopters (Table 3). Other studies have similarly reported the distribution of a large number of reading glasses among underprivileged communities. Jerry Vincent et al. reported that among adult refugees on the Thailand–Burma border, 84% of the 7,219 distributed glasses were for presbyopia²¹. As age increased, the required dioptric power for near correction also increased. In our study, individuals requiring +2.50 diopters for near vision were functionally blind for near tasks. Other research also indicates that with increasing age, both the severity and

prevalence of presbyopia increase, affecting up to approximately 85% of individuals aged 40 years and older. Presbyopia prevalence is greater in regions with longer life expectancies. Without optical correction, presbyopia negatively impacts daily life, leading to difficulties such as inability to read fine print, need for increased lighting, diplopia, epiphora, headaches, eye fatigue, and asthenopia, as well as problems performing tasks like threading a needle or viewing fine details²². However, appropriate visual correction can greatly improve productivity and quality of life²³.

Gender differences were also observed in our free eye camps, with a male-to-female ratio of 1:1.4. Female participants (60%) outnumbered males (40%) in both children and adults (Tables 1 and 3). Other free eye camps in Pakistan have similarly reported that about two-thirds of participants were female²⁴. Research conducted in India, Tanzania, southwestern Uganda, Ghana, and Zanzibar reported presbyopia prevalence rates of 55.3%, 61.7%, 48%, 65%, and 89.24%, respectively, with women demonstrating a higher prevalence compared to men²⁵. Furthermore, women aged over 40 years have consistently exhibited greater rates of presbyopia than their male counterparts within the same age category²⁶.

Jayaraman, R., Ray, D. B., & Wang, S.-Y. Studies show that hospital visits among women are fewer than among men²⁷, yet in free eye camps, female participation is higher. We observed that many women were using the glasses of their husbands or other family members to manage daily tasks, while others had stopped sewing often their main source of income due to poor near vision.

Several factors may explain the higher number of female participants in our camps. First, women may not be given importance by male family members to be taken to hospitals for proper refraction and spectacles. Second, domestic responsibilities and mobility restrictions

prevent them from visiting health centers independently. Third, they may tolerate visual problems until they become severe. When eye camps are organized near their homes, women can overcome these barriers and access services easily. Financial constraints may also limit access to hospital-based eye care, as economic status strongly influences frequency of eye care utilization and spectacle use among presbyopes. Another possible factor is the social stigma associated with wearing glasses, leading women to hide symptoms and delay care until free services are available. Women may also seek correction only when visual impairment begins to interfere with tasks requiring near vision, such as sewing or reading. The greater demand for presbyopia correction among women may be associated with variations in daily visual tasks and preferred working distances, rather than inherent physiological differences in accommodative function²⁸. It is evident that women are more neglected in terms of vision care. With presbyopic correction, many were able to resume their income-generating and religious activities such as sewing, tailoring, and Quran recitation, as well as other near-vision tasks necessary for daily life.

Conclusion:

Presbyopia is highly prevalent in underserved communities, with earlier onset and greater burden among females. Free eye camps provide effective correction and highlight the importance of outreach programs in addressing inequities in eye care.

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