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EDITORIAL

Automated Perimetry-Past, Present and Future

Mahmood Ali

The initiation of therapy and switching between treatment options of glaucoma often depends on the monitoring of disease progression with optical coherence tomography or visual fields analysis. Despite of introduction of various new investigations evaluating the glaucomatous damage, visual field testing remains a crucial part of the clinical management of glaucoma. Published glaucoma guidelines have suggested that many glaucoma patients may benefit from more frequent visual field testing in order to facilitate earlier detection and monitoring of progression. [1,2]

Static automated perimetry (SAP), is considered as gold standard to identify any scotomas by typically presenting a small white target, superimposed on a uniform white background and determining the threshold at fixed locations by varying the intensity of light stimulus. On the other hand, setting of Short-Wavelength Automated Perimetry (SWAP) consists of a yellow background upon which a size V narrowband short wavelength (440 nm) stimulus is superimposed. Recent investigations, have reported that SWAP and SAP demonstrate similar properties in the ability to detect glaucomatous visual field progression. The frequency doubling technology (FDT) which targets the magnocellular pathway was developed as a function-specific test for early detection of glaucomatous visual field loss. Prediction of conversion to glaucoma is better achieved by FDT at the expense of slightly lower specificity.[3]

The Swedish Interactive Thresholding Algorithm (SITA) strategy aimed at considerably shorter test time without decreasing the quality of test results as compared to the full threshold strategy. SITA Faster is the newest addition to the SITA family which takes about two-thirds of the time required by SITA Fast and about half the time required by SITA Standard. The three SITA testing strategies – SITA Faster, Fast and Standard – may now be freely intermixed in a new version of HFA3s Guided Progression Analysis allowing clinics to switch over to SITA Faster without having to re-baseline patients. [4]

Recent developments in a technique described as fundus-tracked perimetry allows the retina to be continuously visualized using a fundus imaging system, so that test stimuli can be accurately presented at specific retinal locations throughout a test, and for those same locations to be evaluated at a subsequent test.

Challenges associated with these sophisticated and novel investigations include the ability to provide accurate assessments based on computationally intensive evaluations, presentation of findings that can be quickly determined in a busy clinical setting, and developing methods that can directly relate to how patients experience the glaucomatous disease process. Moreover, conditions like cognitive decline, anxiety and ocular surface disease increase tracking errors and deviations may result in poorer visual field repeatability. Since perimetry is a psychophysical test that relies on precise subjective responses for determining sensitivity threshold, assessment of patient preferences with respect to testing method, target characteristics, and various factors

affecting the test performance can help investigators to develop future prototypes of perimeters.

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ORIGINAL ARTICLE

Agreement of Axial Length Measurements by Optic Biometer OA-2000 and Ultrasound

Sabeen Chaudhry[1], Mustafa Abdul Hameed Ismail[2], Afia Matloob Rana[2]

Objective: To investigate the agreement and correlation between the optical (OA-2000) and applanation ultrasound axial length measurements.
Study Design: Analytical observational study
Patients and Methods: Patients scheduled for cataract surgery at Eye Care Hospital were enrolled for the study. Axial length measurements were performed with the OA- 2000 optical biometer and contact A-scan (Micro Medical Devices, USA) ultrasound unit. Comparison and correlation of axial length of the eye with optical biometer and applanation ultrasound were analyzed. Statistical analysis was performed with SPSS version 16.
Results: 53 eyes of 53 patients were examined. 30 patients were male (56%) and 23 female (44%). Mean axial length of eyes measured by ultrasound method was 23.377 ± 1.108mm (range, 20.82-26.22). Mean axial length of eyes by optic biometry was 23.457 ± 1.120mm (range, 20.98-26.55). There was a strong correlation between devices that was statistically significant (r = 0.992, p = 0.01).
Conclusion: The contact ultrasound and optical biometer OA-2000 are in complete agreement with each other but a conversion equation has to be used when there is need to use the values interchangeably. *Al-Shifa Journal of Ophthalmology 2020; 16(3): 104-109. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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Introduction:

Axial length of an eye (AL) is the sum of anterior chamber depth, lens thickness and vitreous chamber depth. This measurement is essential in calculating the power of intra-ocular lens for cataract surgery and in differentiation of a refractive error as axial myopia/ hypermetropia. Axial length measuring devices utilize the principle of signal reflection, to measure the distance between various ocular structures and calculate the overall length of the eye. The simplest explanation is that the time a signal is reflected back from an interface is measured and divided by two and multiplied by speed of signal in the corresponding medium. [1]

Conventionally, the transmitted signal was ultrasonic. Ultrasound measurements can be performed by applanation of an ultrasound probe to the cornea or by immersion of the probe in a saline filled

shell. Recently, optical biometer has been introduced into clinical practice. These devices utilize a laser for the signal transmission. To determine distances between interfaces, interference phenomenon between the reflected signal and reference signal is utilized in these devices. [2,3]

The two devices measure the ocular parameters by different measurement start and end points. Ultrasound measures AL from the anterior surface of the corneal apex to the internal limiting membrane (ILM) of the fovea, whereas optical biometry measures AL from the second principal plane of the cornea (0.05 mm deeper than the corneal apex) to photoreceptor layer (0.25 mm deeper than ILM) of the fovea. [4]

The OA-2000 (Tomey, Japan) is a new instrument used for optical biometry. It measures ocular biometry by using the principle of low coherence reflectometry (OLCR). This instrument measures the K value, AL, anterior chamber depth (ACD), white to white (WTW) diameter, lens thickness, pupil size, and central corneal thickness (CCT). The OA-2000 optical biometer measures corneal curvature using a placido disc-based topography technique. The CCT, ACD, lens thickness (LT), pupil diameter, WTW diameter, and AL measurements are performed using Fourier domain method, with high-speed tissue penetration and it's also equipped with an automatic search function to perform realignments. The instrument is fast and easy-to-use.

Ultrasound devices are still a common method of measuring axial length, especially in developing countries, due to familiarity with the technique and cost effectiveness of the instrument. Recent studies have suggested that ultrasound and optical biometry can be used interchangeably for axial length measurement and intraocular lens (IOL) implant calculations. However, a conversion factor may be required for measurement from optical biometry and applanation ultrasound biometry.[5]

This study investigates the agreement and correlation between the optical (OA-2000) and applanation ultrasound axial length measurements and looks for a conversion factor between the two modalities to be used interchangeably in our population.

Patients and Methods:

Patients scheduled for cataract surgery at Eye Care Hospital were enrolled for the study. Patients with a history of trauma, previous ocular surgery, or an ophthalmic condition (other than cataract) that could affect vision or axial length measurements such as, retinal detachment, glaucoma or posterior staphyloma were excluded from the study.

Axial length measurements were performed with the OA- 2000 optical biometer and contact A-scan (Micro Medical Devices, USA) ultrasound unit. All measurements were performed by the primary author familiar with both devices. Optical biometry was always performed first followed by ultrasound measurements to avoid the confounding effect of a potential corneal abrasion or ocular compression resulting from corneal touch. Optical biometry was performed with the patient seated at the OA-2000 and asked to fixate on the fixation target. Applanation ultrasound was performed after instillation of one drop of topical anesthetic (Alcaine 0.5%) on the lower conjunctiva of a patient seated upright with head support.

Comparison and correlation of axial length of the eye with optical biometer and applanation ultrasound were analyzed. Mean ± standard deviation are reported here. Pearson correlation coefficient was calculated to determine the axial length measurements between devices. Regression analysis was performed to find the

mathematical relationship (conversion factor) for axial length between optical biometry and applanation ultrasound. Bland–Altman plots were used to evaluate the agreement in axial length between devices with 95% confidence intervals. A p value of less than 0.05 was taken as statistically significant. Statistical analysis was performed with SPSS v. 16.

Results:

The study sample compromised of 53 eyes of 53 patents. All the patients were of age-related cataract reporting for surgery. Among them 30 patients were male (56%) and rest were female (44%). Regarding laterality, 28 right eyes (53%) and 25 left eyes (47%) were included. Mean axial length of eyes measured by ultrasound method was 23.377 ± 1.108mm (range, 20.82-26.22). Mean axial length of eyes by optic biometry was 23.457 ± 1.120mm (range, 20.98-26.55) (Table 1). There was a strong correlation between devices that was statistically significant (r = 0.992, p = 0.01) (Figure 1). Regression analysis provided the following equation for the AL in this study:

$$UAL=0.364 + 0.981 \times OAL$$

where OAL represents axial length from optical biometry and UAL represents axial length from applanation ultrasound (F(1-51)=3.151, p=0.001). Bland–Altman plot was constructed to show the agreement in axial length measurements (AL) with applanation ultrasound versus optical biometry (Figure 2).

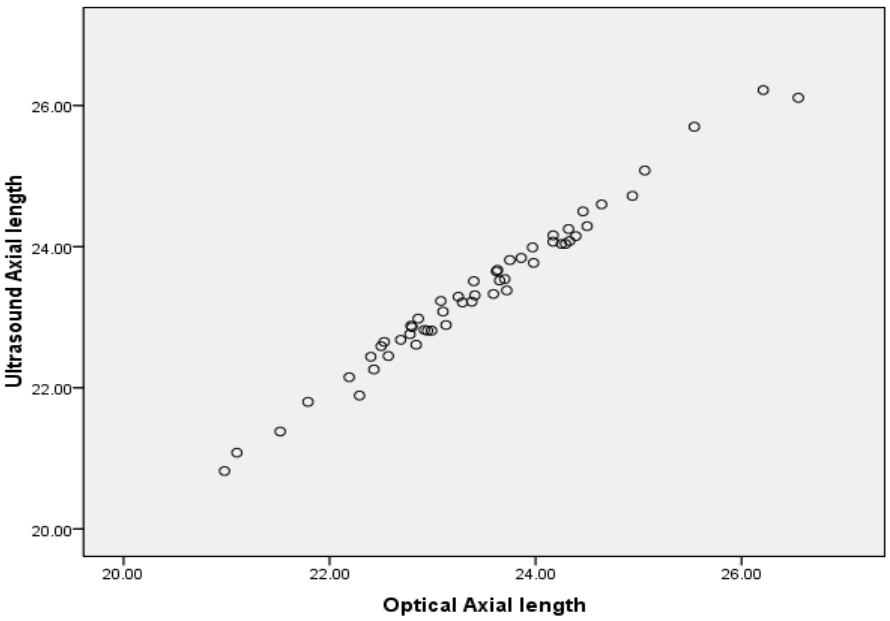

Figure 1: Positive Correlation of axial length measurements with applanation ultrasound versus optical biometry.

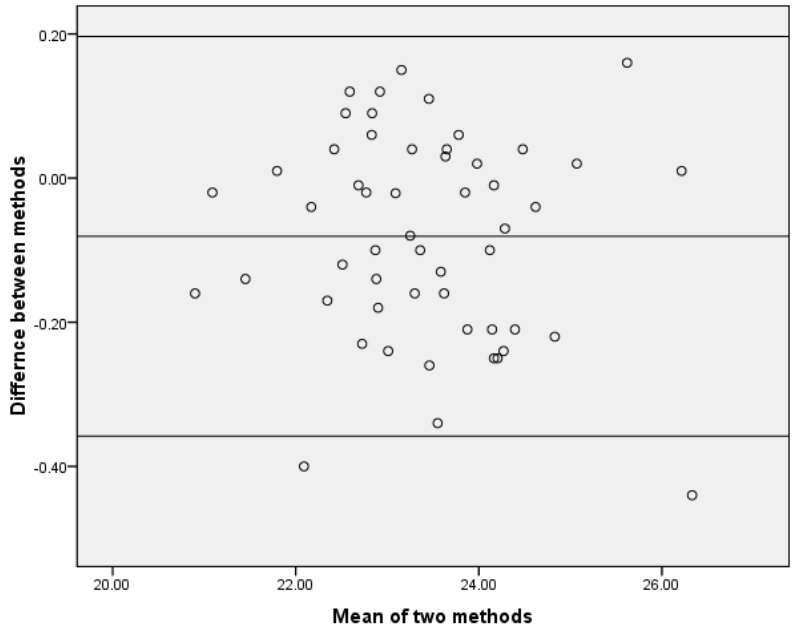

Figure 2: Bland–Altman plot of the agreement in axial length measurements (AL) with applanation ultrasound versus optical biometry.

Table I. Axial length measurements with Optical biometry and Applanation ultrasound.

	Mean	Standard deviation	P value	95% confidence interval	
				Lower limit	Upper limit
Ultrasound axial length (in mm)	23.3768	1.10818			
Optical axial length (in mm)	23.4576	1.12055			
Difference between means	-0.0808	0.14145	0.001	-0.1198	-0.0418

Discussion:

Cataract surgery is the most common surgical procedure done in Ophthalmology. With ever-advancing surgical techniques, accurate intraocular lens (IOL) calculations are important in achieving the desired refractive outcomes. Biometry data, including the axial length (AL), keratometry (K), and in some cases, anterior chamber depth, are necessary for an accurate estimation of lens power. Conventionally, the AL is measured using A-scan ultrasound biometry. A study using ultrasound biometry reported that 54 % of errors in the predicted refraction can be attributed to errors in AL measurements.[6] The optical biometres have been reported to have good repeatability and accuracy for AL measurements, and many studies have reported the accuracy of optical biometry when compared with traditional ultrasound biometry. [7,8] It may be because resolution improves as wavelength decreases. Hence, as light has a very short wavelength compared to sound, the laser light has better resolution. Therefore, the accuracy of AL with ultrasound AL can be less than that for optical AL.[9]

Most of these studies have made this comparison using an optical biometer by another manufacturer (IOL Master 500). But previous studies have proved that the OLCR biometer (OA-2000) shows very strong agreement with the standard optical biometer (IOL Master) for almost all ocular biometry measurements, except for the WTW diameter. [10,11]

Our study was to compare the ultra-sound method and OA-2000 optical biometer measurements of axial length. We found that there is excellent repeatability of measurement with both methods. The statistically significant Pearson's correlation coefficient of 0.992 and Fig. 1 indicates excellent correlation of axial length measurements between methods (p =0.01). Although, the correlation proved that this pair of measurements increased or decreased together but did not indicate that this pair of measurements was identical. Hence, basing on the results, the regression Eq. (1) can predict axial length with optical biometry in 98.4% (adjusted R^2) of future cases.

The mean difference of 0.0808 mm in AL measurements by the two methods can be attributed to the difference in the measurement principal of both devices. The first major difference is the starting and end points of measurement between the two methods. Ultrasound devices measures AL from the anterior surface of the corneal apex to the internal limiting membrane (ILM) of the fovea, whereas optical biometry measures AL from the second principal plane of the cornea (0.05 mm deeper than the corneal apex) to photoreceptor layer (0.25 mm deeper than ILM) of the fovea. Secondly, in ultrasound technique the probe has to make contact with the eye, thus inadvertent indentation of the cornea may occur.[12] Theoretically, optical biometry reads longer than ultrasonic axial length.[1] Our study showed the AL calculated by optical method to be more than by ultrasound method for probably the same reasons. This is in agreement to the observation by other authors comparing the two methods.[13,14]
It has been argued by some that ultrasound measurements are performed on the anatomic axis i.e. through the center of the cornea measuring anatomic axis as axial length whereas optical biometry measurements are performed on the visual axis measuring visual axis as axial length. As visual axis is shorter than anatomic axis; hence, optical measurements may read shorter axial length compared to ultrasound measurements. Our study results, however, was in disagreement of this hypothesis as our axial length measurements were more with optical method.

The study did not include eyes with very large or very short axial lengths and we were unable to predict the positive correlation of the two methods in such eyes.

Conclusion:

For eyes with axial lengths between 20-26mm the contact ultrasound and optical biometer OA-2000 are in complete agreement with each other but a conversion equation has to be used when there is need to use the values interchangeably.

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ORIGINAL ARTICLE

Visual Outcome of Corneal Collagen Cross Linking in Early Keratoconus

Maria Saleem[1], Muhammad Irfan Sadiq[2], Muhammad Usman Sadiq[3], Aziz Jan Bashir[4], Amna Manzoor[4], Yasir Ahmed[4]

Abstract:

Objectives: To determine the mean keratometry in apical meridian (kmax), uncorrected visual acuity (UCVA) and best-corrected visual acuity (BCVA) in early keratoconic eyes after 6 months of corneal collagen cross linking (CXL).

Study Design: Quasi Experimental Study

Methodology: Study was conducted in Cornea department, Al-Shifa Trust Eye Hospital Rawalpindi from 27th May 2015 to 20th August 2015 and then from 20th Sept 2015 to 27th Dec 2015. A total of 164 keratoconic eyes fulfilling inclusion criteria were included in the study. Uncorrected Visual Acuity (UCVA) and Best Corrected Visual Acuity (BCVA) were recorded at baseline and at six months post CXL using LOGMAR charts. Keratometry readings were obtained with the help of corneal topography using Haag-Streit (Galilei) topographer at baseline and 6 months after CXL.

Results: The mean age was 23.27± 5.379 years. Male patients were 93(57.32 %) and female were71(42.68%) with early keratoconus. Our study showed that mean baseline logarithm of minimum angle of resolution for uncorrected visual acuity and best corrected visual acuity were 0.349± 0.1126 and 0.202± 0.0803 respectively. Six months after corneal cross linkage the values improved to 0.268 ± 0.1126 and 0.134± 0.0881. The mean apical keratometry reading was 51.56± 1.19 that changed to 50.60± 1.31 after six months of CXL. All results were found to be statistically significant with p value <.001.

Conclusion: The study showed significant halting and even improvement in uncorrected Visual Acuity, Best Corrected Visual Acuity and Mean Apical Keratometry Readings when corneal cross linking was carried out in eyes with early keratoconus. *Al-Shifa Journal of Ophthalmology 2020; 16(3): 110-118.*

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Introduction:

Keratoconus is a degenerative non-inflammatory disease of the cornea, resulting in distortion, apical thinning and central scarring. These corneal changes lead to decreased vision due to high irregular astigmatism and less frequently, central corneal scarring. The condition usually begins at puberty and tends to progress during adolescence.[1]

Treatment consists of glasses, rigid contact lenses and intra-corneal rings early in the disease, however none of these modalities affect progression of the condition. Eventually, penetrating keratoplasty may

be required in advanced cases to restore vision.[2]

Collagen cross linking has been studied during recent years by Wollensak and colleagues.[3] Collagen cross linking, using riboflavin and ultraviolet A (UVA) light, has been shown to alter the biomechanical, thermo-mechanical, and morphological properties of the cornea. It increases corneal rigidity by almost 300% and enhances its resistance to proteolytic enzymes.[4-6] Numerous clinical studies on collagen cross linking in progressive keratoconus have shown an arrest in progression and even regression in the majority of patients.[7-9] Longitudinal studies have demonstrated visual improvement and long-term stable outcomes after collagen crosslinking.[10] The principal goals of such therapy are to increase corneal rigidity, stabilize its refractive and biomechanical properties and thus improve vision.

The current study was designed to evaluate the effectiveness of this procedure as primary treatment for eyes with early keratoconus. The rationale of this study is to determine and compare the mean apical keratometry value (kmax), mean uncorrected visual acuity and mean best corrected visual acuity before and after six months of corneal collagen crosslinking among patient with early (less or equal to 53D) keratoconus. Although literature is there showing efficacy of CXL and its applicability in cases of advanced Keratoconus, but a limited literature exists on the efficacy of CXL for early keratoconus with only a single study available without detailed information regarding the short term 6-month effect of CXL. Thus this study will help determine the outcome of this procedure in treating patients with early keratoconus in terms of keratometry and visual acuity changes and providing further information to the ophthalmologist regarding early effect of CXL and better management of keratoconus.

Materials and Methods:

This study was conducted in Cornea Clinic, Al-Shifa Trust Eye Hospital, Rawalpindi, from 27th May 2015 to 20th August 2015 and then from 20th Sept 2015 to 27th Dec 2015 i.e. for a period of 6 months (IERB Approval Certificate # ERC-56/AST-20 attached).

The sample size was calculated by using WHO sample size calculator on the basis of recent study.[11] About 164 patients presenting to the Cornea department of Al-Shifa Trust Eye Hospital and fulfilling the inclusion criteria i.e. Age 15 to 35 years, both genders and patients with early and advanced keratoconic eyes undergoing corneal collagen cross linking, were included and an informed consent was taken from before enrolling in the study. Information regarding their demographic data and study variable was be obtained and noted in the proforma.

Slit lamp examination and Uncorrected visual acuity, best corrected visual acuity with Logmar chart and corneal topography was done for mean apical keratometry(kmax) before and after six months of corneal collagen cross linking. CXL was done by epithelium removal and using riboflavin drops every 3minutes for half an hour and then every 5 minutes post UVA exposure. Patients enrolled in the study were given follow-up cards and appointments. These results were noted in the Performa and Confidentiality of the data was ensured.

As per exclusion criteria, patients having hydrops, corneal opacities, corneal scars, severe atopy, herpetic keratitis, corneal dystrophies, recurrent corneal erosion syndrome, collagen vascular, autoimmune diseases, or other systemic diseases determined by history, examination and medical records, pregnant and breast-feeding females and diabetic patients were excluded from the study. Data was entered and analyzed using SPSS software version

17.0. Numerical variable i.e. age, keratometry value, uncorrected visual acuity and best corrected visual acuity summarized as mean and standard deviation. Qualitative variables like sex were presented in the form of frequency and percentages.

Preoperative or baseline and post-operative comparison of Mean Apical Keratometry value (Kmax), Uncorrected Visual Acuity and Best Corrected Visual Acuity was done by paired sample t-test to check statistical significance. The p-value of ≤0.05 was considered significant.

Results:

The study included 164 eyes of 164 patients. The eyes selected were diagnosed with early keratoconus having mean apical keratometry (Kmax) readings < 53D. The age of the patients ranged from 15 to 35 years with a mean age of 23.27±5.379 years.

Of the total 164 patients selected, 93 were male and 71 were female. The percentage of males included in the study came out to be 57.32% while that of females was 42.68%. 53 eyes studied were right and 47 were left; right eyes studied were 53.05% and left were 46.95%.

Visual acuity is often measured according to the size of letters viewed on a Snellen chart and was expressed on a LogMAR scale. The baseline or preoperative uncorrected VA ranged from 0.2 to 0.7 with a mean of 0.349±0.1126. The values at six months after CXL changed to range of 0.6 to 0.1 with a mean of 0.268±0.1033. This difference was statistically significant; $p < 0.001$.

Maximum refractive error correction to achieve best tolerated visual acuity and refractive status is termed as BCVA. The baseline or preoperative BCVA ranged from 0 to 0.6 with a mean of 0.202 ±0.0803. These values changed to a range of 0 to 0.5 with a mean of 0.134 ± 0.0881 at six months post CXL. The difference was statistically significant $p < 0.001$.

Corneal topography was done to get maximum apical corneal power K-max at baseline and compared with readings six months post CXL. Baseline K-max was in a range of 49.12 to 53 with a mean value of 51.56±1.19. Postop K-max was in a range of 47.13 to 52.95 with a mean value of 50.60 ±1.31.The difference was statistically significant with a p value < 0 .001.

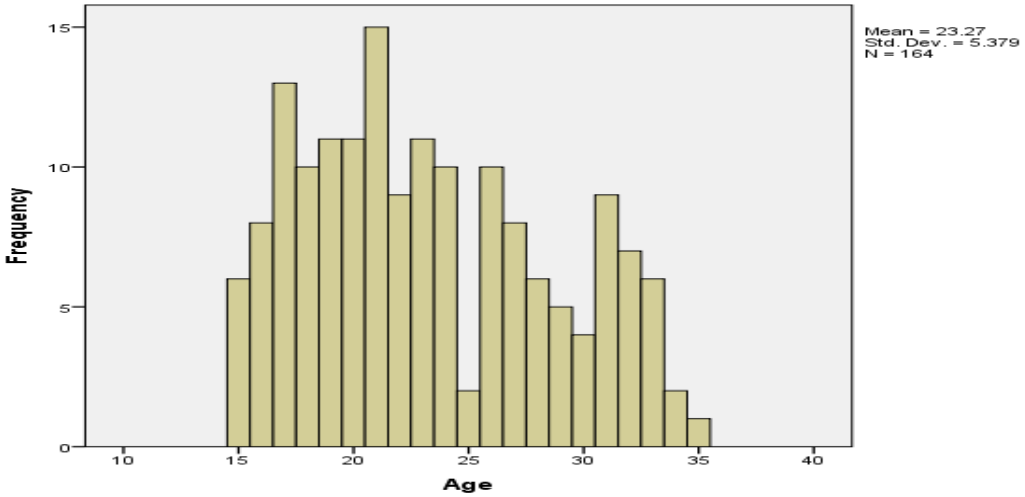

Figure 1: Age Distribution in the Study

Table I: Mean Age in Study

Age (Years)			
Mean	**Std. Deviation**	**Maximum**	**Minimum**
23.27	5.379	35	15

Table II: Comparison of Visual Acuity using Paired Sample T-Test

#	Visual Acuity (LogMar)				
	Mean	**Std. Deviation**	**Maximum**	**Minimum**	**p Value**
Pre-op	0.349	0.1126	0.7	0.2	**<.001**
Post-op	0.268	0.1033	0.6	0.1	

Table III: Comparison of Best Corrected Visual Acuity using Paired Sample T-Test

#	Best Corrected Visual Acuity (LogMar)				
	Mean	**Std. Deviation**	**Maximum**	**Minimum**	**p Value**
Pre-op	0.202	0.0803	0.6	0	**<.001**
Post-op	0.134	0.0881	0.5	0	

Table IV: Comparison of K-max using Paired Sample T-Test

#	K-max (Diopter)				
	Mean	**Std. Deviation**	**Maximum**	**Minimum**	**p Value**
Pre-op	51.56	1.19	53.08	49.12	**<.001**
Post-op	50.60	1.31	52.95	47.13	

Discussion:

Keratoconus usually starts during adolescence and progresses until the third or fourth decade of life. The CLEK (Collaborative Longitudinal Evaluation of Keratoconus) Study[12] showed a mean change in flatter keratometry readings of 1.6 diopters in the natural course of keratoconus progression over an eight year period, where higher rates of progression occurred in younger than in older patients. Furthermore, an increase of more than 3 diopters in spherical equivalent was observed in 24.1 % of patients with risk factors for high progression, such as young age and poor high-contrast visual acuity.[12] Treatment consists of glasses, rigid contact lenses and intra-corneal rings early in the disease, however none of these modalities affect progression of the condition. Eventually, penetrating keratoplasty may be required in advanced cases to restore vision.

The intention of the corneal cross-linking (CXL) procedure using riboflavin is to halt the progression of keratoconus. The induction of covalent molecular cross-links in corneal tissue using riboflavin and UVA-Radiation was first described by Spoerl et al. in porcine corneas in 1998.[13] In vitro experiments have since shown that CXL leads to changes in the thermo-mechanical behavior of the cornea[14], the collagen fiber diameter, the resistance to enzymatic digestion[15] and the corneal thickness[16]. In addition, apoptosis and loss of keratocytes have been observed.[17]

The method was clinically introduced in 2003 with a non-randomized pilot study in 22 patients[3]. In this prospective pilot study, Wollensak et al. reported a halt in the progression in all treated eyes. Since then, many more non-randomized studies, case series or cohort studies[18] have demonstrated similar results, with the largest trial being that of Raiskup-Wolf et al., which included 241 eyes.[10] However only a single comparative study is available on which the topographic and refractive effect of corneal collagen cross linking between early and advanced keratoconic eyes have been compared.[19]

The study showed that the mean baseline logarithm of the minimum angle of resolution (logMAR) for uncorrected visual acuity and best corrected visual acuity in patients with early keratoconic eyes was 1.007 ± 0.30 and 0.566 ± 0.21, respectively. The values improved to 0.727 ± 0.29 (P = 0.001) and 0.306 ± 0.15 (P = 0.001) at 1-year post CXL. The mean baseline logMAR UCVA and logMAR BCVA in advanced keratoconic eyes were 1.040 ± 0.24 and 0.641 ± 0.25, respectively. It changed to 0.953 ± 0.26 (P = 0.054) and 0.633 ± 0.27 (P = 0.891) at 1 year. The mean baseline apical keratometry was57.3 ± 2.3 D which changed to 56.2 ± 2.7 D at the end of 1 year. But the study lacks detailed information regarding the short-term effect on keratometry after 6 months of CXL.

The rationale of this study was to determine and compare the mean apical keratometry value (kmax), mean uncorrected visual acuity and mean best corrected visual acuity before and after six months of corneal collagen cross linking among patient with early (less or equal to 53D) keratoconus.

Although literature is present on efficacy of CXL and its applicability in cases of advanced keratoconus. But a dearth of literature exists on the efficacy of CXL for early keratoconus with only a single study available which does not give detailed information regarding the short term 6 month effect of CXL.[20]

Thirty-one eyes of 22 patients with early keratoconus were included in this study. Collagen cross linking was performed without epithelial removal. Patients were

re-assessed 1, 3, and 6 months after treatment.

Postoperatively, UCVA increased by 2 Snellen lines and BSCVA was improved by 1.7 Snellen lines (P < 0.001). Spherical equivalent refractive error was reduced by 0.55 D, and maximum and mean K values were decreased by 0.65 D and 0.51 D respectively (P < 0.05 for all comparisons). Evidence of regression was present in 71% of treated eyes.

This study included 164 eyes of 164 patients. All patients underwent slit lamp examination and assessment of uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), intraocular pressure, corneal topography and pachymetry. Collagen crosslinking was performed with epithelial removal. Patients were re-assessed 1, 3, and 6 months after treatment. The eyes selected were diagnosed with early keratoconus having mean apical keratometry(kmax) readings < 53D.The age of the patients ranged from 15 to 35 years with a mean age of 23.27±5.379 years.

Of the total 164 patients selected, 93 were male and 71 were female. The percentage of males included in the study came out to be 57.32% while that of females was 42.68%. 53 eyes studied were right and 47 were left; right eye studied were 53.05% and left were 46.95%.

The baseline or preoperative uncorrected VA ranged from 0.2 to 0.7 with a mean of 0.349±0.1126. The values at six months after CXL changed to range of 0.6 to 0.1 with a mean of 0.268±0.1033. This difference was statistically significant; p< 0.001.

The baseline or preoperative BCVA ranged from 0 to 0.6 with a mean of 0.202 ± 0.0803. These values changed to a range of 0 to 0.5 with a mean of 0.134 ± 0.0881 at 6 months post CXL. The difference was statistically significant p<0.001. Baseline kmax was in a range of 49.12 to 53 with a mean value of 51.56±1.19. Postop kmax was in a range of 47.13 to 52.95 with a mean value of 50.60 ±1.31. The difference was statistically significant with a p value< 0.001. Collagen crosslinking demonstrated significant improvement in vision with reduction in corneal power and spherical equivalent refractive error in eyes with early keratoconus. In study cases there was visually insignificant mild anterior stromal haze that resolved in first 3 months. In two of our cases there was increase in K-max value related to constant rubbing and noncompliance.

Thus, the study helped determine the short-term outcome of CXL in treating patients with early keratoconus in terms of keratometry and visual acuity changes. The results supported that CXL stabilized cornea and improved uncorrected and best corrected visual acuity in early keratoconus.

various promising randomized trials of corneal cross-linking have performed in the past. Wittig-Silva et al. first published interim results of an Australian trial in 2008 which showed a stabilization of all treated eyes.[21] The final results with 46 patients in the treatment group and 48 patients in the control group demonstrated an improvement in maximal keratometric power (K-max) and visual acuity in the treated patients, while the untreated patients showed further keratoconus progression.[22]
A second randomized controlled trial performed by Hersh et al. included eyes with keratoconus and post-Lasik ectasia[23], as well as a sham treatment group that received corneal cross-linking after three months. All patients were aware of their randomly assigned groups. An improvement in uncorrected and corrected visual acuity, as well as the topographic measurements was reported in the treatment group. After one-year follow-up, an overall

improvement in corneal shape was observed.[24]

A third randomized controlled study, conducted by O'Brart in 24 patients, demonstrated an improvement in in corrected visual acuity, Orbscan simulated and keratometry simulated astigmatism. The control group consisted of the fellow eyes.[11] Sharma et al. performed the fourth study—a prospective randomized controlled trial in an Asian population with a total of 43 patients. A decrease was observed in the maximum and minimum keratometry in the cross-linking group in this study.[25]

The safety of cross-linking has also been assessed in various trials. The removal of the epithelium can lead to the occurrence of bacterial keratitis , corneal melting, haze, corneal endothelial loss and even calcific band keratopathy.[26] A study by Greenstein et al. described an increase in haze up to three months after treatment, followed by a decrease up to month 12.[27] Koller et al. described an overall complication rate of 2.9 % in a prospective trial and identified risk factors such as patient age of more than 35 years and a visual acuity better than 20/25.[28]

The efficacy and safety of corneal cross-linking has been suggested by different authors, but clear proof of a therapeutic effect is not available through a placebo-controlled study with an independent control group.[29] Another study was carried out in our setting to assess the effectiveness of CXL in arresting progression of keratoconus.[30] Results showed improvement in uncorrected visual acuity and halting of progression over 3 years follow-up. Therefore, we investigated the efficacy of corneal cross-linking with riboflavin in halting the progression of keratoconus by conducting a placebo-controlled, randomized, blinded, multi-centric clinical trial that included an independent control group.

Clinical studies of CXL have shown great promise in stabilizing keratoconus and post-refractive surgery ectasia. While further randomized, prospective and long-term follow-up studies are necessary, it is very likely that in the future corneal ectasia can be halted at an early stage and the need for rigid contact lenses and keratoplasty avoided. Future refinement in techniques will allow for safer and more rapid procedure with less patient discomfort.

Conclusion:

Corneal CXL is more effective in improving the refractive and topographical parameters at six months, when it is performed early in the course of the disease. CXL procedure was effective to stabilize progression of keratoconus with significant reduction in topographic keratometric values and significant increase in UCVA and BCVA in 6 months

In conclusion, we recommend collagen cross linking for patients with early keratoconus who can be optically corrected and those who demonstrate recent progression. It may be preferable to delay such treatment for patients that are adequately corrected and show non-progressive disease. Further studies with larger sample size and longer follow-up are required to determine the optimal time for intervention and the long-term effects of cross linking for early keratoconus.

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Prevalence of Uncorrected Refractive Errors in School Going Pediatric Population in Four Districts of Azad Jammu and Kashmir

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Abstract.

Objective: To calculate the prevalence, types, age and gender-based distribution of different refractive errors in school going pediatric population in the age group of 05-16 years in District Mirpur, Pallandri, Bhimber and Kotli, AJK.

Place and Duration of Study: This descriptive cross-sectional study was carried out in both public as well as private school going pediatric population in district Mirpur, Kotli, Bhimber and Pallandri, AJK, Pakistan from 1st March, 2016 to 30th June, 2020.

Materials and Methods: After taking consent, data was collected through a self-designed proforma from both public sector and private schools of District Mirpur, District Kotli, District Bhimber and District Pallandri. A team of teachers from each school was trained by conducting workshops to detect visual deficit. After training workshops, the teachers were provided with an eye examination kit consisting of vision chart, a rope of three-meter length and first aid eye material. The screening was carried out at the community level initially and the affected children were referred for further examination to district hospitals of AJK and Pakistan.

Results: In our study total 155,776 children, 66523(42.70%) were male and 89253(57.30%) were of female gender. The prevalence of refractive errors was found to be 3.87%. Myopia was found in 3259(53.93%), Hypermetropia in 1342(22.20%), Astigmatism in 1324 (21.90%), Amblyopia was seen in 118 (01.95%) cases. Refractive errors were more commonly recorded in females.

Conclusion: Basic Ocular screening based upon school screening programs can play a pivotal role in early detection, timely treatment and improvement of eye health care. *Al-Shifa Journal of Ophthalmology 2020; 16(3): 119-124. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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Introduction:

Refractive errors are abnormal conditions in which the human eye fails to focus light rays upon retina. Subsequently, a blurred image is formed on retina due to these refractive errors. A normal cornea with a proper shape and curvature bends the light accurately and focuses light rays on retina precisely. On the other hand, a cornea with an abnormal shape or curvature is unable to focus light precisely, the light rays cannot properly focus on retina. In this case the image is not clear and leads to blurring of vision [1]. Three refractive errors that are commonly encountered in Ophthalmology clinics include, Myopia, Hypermetropia and Astigmatism. Myopia is a condition, in which the light rays focus in front of retina. In Hypermetropia, the rays of light focus

behind the retina. In Astigmatism, the light rays are unable to focus on a single point leading to blurred vision [2].

It is a well-known fact that refractive errors and visual defects due to them are most commonly encountered pediatric problems. They are one of the leading causes of avoidable blindness. Worldwide, around 153 million children above 5 years of age are reported to be visually handicapped due to undiagnosed refractive errors. Out of these, around 08 million have lost their vision [3]. On the other hand, pediatric population of 12.8 million in the age group 5–15 years are also reported to be visually handicapped due to undiagnosed or inadequately treated refractive errors. The global prevalence of refractive errors is around 0.96% and maximum prevalence is found in highly developed urban areas in south-east Asia[4].

It is therefore obvious that undiagnosed uncorrected refractive errors are a serious public health eye health problem. Much of the Pediatric population with undiagnosed refractive errors do not report with symptoms other than occasional headaches and unable to read the written content on classroom board. These undiagnosed refractive errors can have a serious impact on a child's learning capacity, performance scores, academic achievement as well as general personality [5].

Factors influencing development and delayed correction of refractive errors include, unawareness of the pediatric population, teachers, parents, community as well as the public health authority, costly refraction, inadequacy of affordable glasses by local health authorities and non-compliance of children to wearing glasses. If we diagnose these refractive errors after 10 years of age in a child, it might not be effective in terms of treatment as the child would have developed incurable amblyopia that may lead to blindness [6].

Significant research has been done to identify possible etiological factors responsible for refractive errors in children. There is evidence that both environmental as well as genetic factors are responsible. Studies have proposed that if an increased time is spent in playing outdoors by pediatric population, it can lead to prevention of Myopia. There are other studies, which show that adequate daylight exposure to children holds a positive dose response relationship with ocular axial elongation, which plays a pivotal role in Myopia reduction[7].

The protocol of the Refractive Error Study in Children (RESC) was introduced in 2020. This protocol was specially formulated to standardize the methodology in an order to obtain data on childhood refractive error prevalence. RESC elaborated the significance of screening refractive errors in children by using cycloplegic refraction. Many studies have used RESC protocol smoothly to screen refractive errors in Pediatric population[8].

Materials and Methods:

This was a quantitative, descriptive, cross-sectional study. The study was conducted over a time span of 04 years and 03 months in both public as well as private school going Pediatric population in District Mirpur, Kotli, Bhimber and Pallandri, AJK, Pakistan from 1st March 2016 to 30th June, 2020. After taking permission from hospital ethics committee, an informed consent was taken from parents and data was collected through a self-designed proforma from both public sector and private schools of District Mirpur, District Kotli, District Bhimber and District Pallandri. Teachers training workshop were conducted in each district to train teachers about how to screen pediatric population for refractive errors. The screening was carried out at the community level initially and the affected children were referred for further examination to Districts and Divisional Headquarters Teaching Hospital Mirpur AJK, Pakistan.

Results:

In our study total 155,776 children, 66523(42.70%) were male and 89253(57.30%) were female. Refractive error was detected in 6043(03.87%) children. Age distribution revealed that maximum affected children were aged 13-16 years, followed by 9-12 years of age. Age and district wise distribution of refractive errors is shown in table I and II while frequency of various types of refractive errors is shown in table III.

Table I: Age distribution of Refractive Errors

Age in Years	**Frequency**	**Percent**	**Valid Percent**
5-8 Years	622	10.3	10.3
9-12 Years	2066	34.2	34.2
13-16 Years	3355	55.5	55.5
Total	6043	100.0	100.0

Table No. II: District wise distribution of Refractive Errors

District	Frequency	Percent
Mirpur	2235	36.98
Kotli	1650	27.30
Bhimber	1426	23.60
Pallandri	732	12.12
Total	6043	100.0

Table No. III: Types of Refractive Errors

Sr. No	Type of Refractive Errors	Frequency	Percentage
1	Myopia	3259	53.9 %
2	Hypermetropia	1342	22.2 %
3	Astigmatism	1324	21.9 %
4	Amblyopia	118	2.0 %
T	Total	6043	100.0 %

Discussion:

Undiagnosed and subsequently uncorrected refractive errors lead to multiple immediate as well as long-term consequences in pediatric as well as adolescent population. These include low performance scores, less educational competency, decreased employment opportunities, low socio-economic status and finally poor daily life quality[5]. Visual impairment due to undiagnosed refractive errors is a major public eye health problem and their correction with corrective glasses remains a very cost-effective intervention in eye healthcare [4].

In our study total 155,776 children, 42.70% were male and 57.30% were female. Refractive error was detected in 03.87% pediatric population. This prevalence is comparable to another study done in KPK, Pakistan where the prevalence of uncorrected refractive errors was observed to be 3,99%[9] and 8.9% in Karachi [10].
A higher prevalence of 19.8% is reported from another study done in Lahore[11]. Myopia was found to be the most commonly reported refractive error being 43%. The reported prevalence of Astigmatism was also high 35.5%, however, hypermetropia was only 21.5%. They have demonstrated a significant association of refractive errors with a positive family history of glasses at earlier age, T.V watching from a very close distance, study indoors, reading in low or dim light as well as excessive use of computer and video games[11].
Another significantly higher prevalence of refractive errors was reported from 02 studies done in Lahore where, refractive errors were present in 20.07%[11] and 24.4% children respectively[2]. Myopia 52% was the major type of refractive errors, followed by astigmatism 38.1% and hypermetropia 9.8% [2].

A lower Prevalence of refractive errors 3.3% is reported from Rawalpindi[12], 5.4% in Lakki Marwat[13]and 9.4% prevalence was reported from neighboring town Mangla[14]. The Prevalence rate of Refractive errors reported in international studies is 2.2% in Iran[8],9.8% in India[15], 13.1% in Philadelphia[16], 13.7% in Al-Hassa[4], Saudi-Arabia, 18.6% in Qassim[5], 23% in China[7] and 34% in Western Saudi-Arabia[6].
In our study, Age distribution revealed that maximum affected children were aged 13-16 years, followed by 9-12 years of age. Ali et al and Latif et al [2] demonstrated refractive error most commonly from 12 to 14 years[11]. Female children (56.26%) were affected more as compared to male children (43.73%). Malik et al also demonstrated female predominance in refractive errors [9]. Gull et al showed that Myopia was associated with older age and female gender [12].

Affected number of children per district showed that in District Mirpur, 2235 children, in District Kotli, 1650 children, in District Bhimber, 1426 children and in district Pallandri, 732 children were having undiagnosed refractive errors. Higher prevalence in Mirpur district can be attributed to larger urban population, more schools and more access to electronic gadgets owing to online classes in COVID pandemic. Uzma et al also showed that a greater prevalence of refractive errors 25% was seen in urban areas as compared to 8% in the rural areas (8%) [15].

In our study, Maximum Pediatric population was observed with Myopia 53.93%, then hypermetropia in 22.20%, followed by astigmatism in 21.90% and Amblyopia in 01.95%) cases only. Similar results are reported by Malik et al [9] who showed myopia as leading cause, followed by hypermetropia and astigmatism. However, no Amblyopia is reported in that study [9]. Latif et al showed comparable results where myopia accounted for 61.70%, hypermetropia 14% and astigmatism 24.30% of the total refractive errors [17]. In contrast, a study done in Saudi Arabia, the prevalence of astigmatism (25.3%) was higher compared to that of hypermetropia (1.5%), and myopia (0.7%)[6].

Refractive errors were more commonly recorded in females. The prevalence of myopia in female students was 2.21% and in male it was 1.94%. Hypermetropia in girls was 0.98% and in boys, it was found to be 0.84%. Similarly, Astigmatism in male was lower 0.76% and in female it was higher 0.92%. Aldebasi et al [6], Al Wadaani et al [4], (Odds ratio, OR=1.39, P=0.012) and Faheemullah et al [13] also showed female predominance in their study.

Upon cross tabulation of the frequency of refractive error against gender of Pediatric population, a statistically significant correlation was observed with female gender ($p < 0.001$) as well as age ($p < 0.001$). Similarly, a positive association of refractive errors with age was reported by Alrahili et al [6] and Aldebasi et al [5].

These results portray an immediate requirement of making and implementing basic public health policies regarding screening of school-children for undiagnosed refractive errors. These screening programs should be strengthened by public awareness programs and campaigns to ensure public participation leading to improved compliance. The screening programs should also have a pre-planned comprehensive plan for the provision of spectacles. The school teachers should participate, trained well and be provided with the screening kits, Relevant Government agencies, NGOs, social society, Ophthalmologists and other stakeholders should come forward and work for the improvement of eye healthcare of Pediatric population.

Conclusion:

The commonly encountered refractive errors have an effective treatment by simple and inexpensive simple visual aids. Therefore, it is mandatory to periodically screen the prevalence and types of these refractive errors, so that they should be timely diagnosed and treated. Only in this way, we will be able to prevent avoidable blindness and lead to improved quality of eye healthcare in Pediatric population

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ORIGINAL ARTICLE

Effect of Indoor and Outdoor Activities on Myopia in School Going Children

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ABSTRACT

Objective: To report the effect of indoor and outdoor activities on myopia in children with ages between 8 to 15 years.

Study Design: Descriptive cross-sectional study was performed from November2019 to January 2020.

Methodology: The study population included all children with ages from 8 to 15 years with myopic refractive error of up to -6.00D. The sample size was 354 and it was adjusted to 360 calculated by the formula Z^2Pq/e^2. Children during screening camps were included in this study, held at different private and public sectors of age having myopia of -0.50DS to -6.00DS. Amblyopic patients, astigmatic patients, patients having any ocular allergy and congenital anomalies, patients with myopia greater than -6.00 DS and Non-volunteers were excluded in the study. The research question was proforma based and included three sections. Data was analyzed by using SPSS version 20. The confidence level set 95% (a=0.05). The p-value <0.05 was considered statistically significant.

Results: Total 360 participants were included in the study with age group of 8-15 years with their mean age of 12.56±1.91 years. According to chi-square test of association myopia was not significantly associated with indoor activities like reading books, study duration, video games and mobile phone but there was a significant($p<0.021$) correlation of using computer with myopia. Chi square test showed no significant correlation of myopia with outdoor activities.

Conclusion: Indoor activities like reading books, study hours, playing video games and use of mobile phone have no significant effect on myopia but there is a significant correlation of myopia and computer usage. Outdoor activities were not associated with myopia. *Al-Shifa Journal of Ophthalmology 2020; 16(3): 125-131. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

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Introduction:

As per the World health organization (WHO) International Classification of Disease (ICD-10) definition of myopia is, "a refractive error in which rays of light entering the eye parallel to the optical axis are brought to focus in front of the retina when accommodation is relaxed". It is also called near sightedness. Nearsightedness is brought about by broad close to work, for example, perusing, composing and dealing with PC. It is additionally realized that open air exercises diminishes the predominance of nearsightedness [(1)]

Nearsightedness is by and large separated into two groups: physiological and non-physiological nearsightedness. The two groups have separate disease strategy, clinical highlights, and diagnosis. (2)

Kids with physiological nearsightedness normally present with grumblings of obscured distance vision. Guardians may likewise see their kid squint their eyes while seeing distance objects. On the off chance that the level of nearsightedness is moderate or high, at that point children might be noticed sitting nearer to the TV and PC or holding perusing material nearer. Diminished distance vision is the fundamental side effect of nearsightedness. Patients with pathological nearsightedness may likewise report visual mutilation auxiliary to retinal pathology. Treatment choices include spectacles, contact lens, orthokeratology and other refractive surgery procedures. (2)

Different component influences the predominance of nearsightedness including age, nationality, the standards for characterizing nearsightedness and hereditary and environmental factors. The fundamental natural variables analyzed thus far include close to work, outdoor activities and population type. More advanced education is repeatedly associated with greater myopia prevalence. (3)

Nearsightedness is the most widely recognized reason for visual hindrance around the world. In spite of the fact that nearsightedness is uncommon in the youth, its commonness rises slowly to 25-80% in young adults. It was said that constantly 2050 almost 50% of the total population will have nearsightedness and almost one-tenth of population will have high myopia.[3]

Myopia is as of now a significant public health concern in many countries in East and South East Asia where the prevalence of myopia has rapidly increased over the past few decades with nearly 80-90% of high school graduates having myopia and 10-20% having sight threatening high myopia. As per the public visual impairment and visual disability study rough prevalence of nearsightedness in grown-up Pakistani population was 36.5%. Increase in nearsightedness recurrence represents a danger to the health and is an avoidable burden on the economy of developing countries. (3)

There is adequate proof in the ophthalmic literature to help the basic perspective on relationship of nearsightedness with the scholarly individuals or having higher level of education. In any case, there is likewise a recommendation to the part of climate, nutritional, innate and work relationship for this dramatic expansion in nearsightedness. (2)

Materials and Methods:

Descriptive cross-sectional study was performed from November 2019 to January 2020. Before the start of the data collection, ethical clearance was secured from Institutional Review Board of Pakistan Institute of Ophthalmology. Participation in the study was voluntary and based on the ability of each person to give verbal informed consent. Participants were guaranteed confidentiality of the information and had the right to quit participation at any time during data collection of study.

The study population included all children with ages from 8 to 15 years with myopic refractive error of up to -6.00D. The sample size was 354 and it was adjusted to 360 calculated by the formula Z^2Pq/e^2
Where **Z** = is standard normal variant (at 5% type 1 error $p < 0.05$). It is 1.96**P** = Expected proportion in population based on previous studies (Myopes =36.5%)[12]**E** = Absolute error or precision which is 0.05%. Children during screening camps were included in this study, held at different private and public sectors of age between 8-15 years having myopia of -0.50DS to -6.00DS.

Amblyopic patients, astigmatic patients, patients having any ocular allergy and congenital anomalies, patients with myopia greater than -6.00 DS and Non-volunteers were excluded in the study. The research question was proforma based and included three sections. First section was demographic profile and other two were indoor activities and outdoor activities and qualitative variable was used. Data was collected by adapted questionnaire which included demographic profile, history of patients, average time spent on indoor and outdoor activities and concerns of patients about near work that can induce myopia. Chi-square was used to test the association of myopia with indoor activities and outdoor activities. Data was analyzed by using SPSS version 20. The confidence level set 95% (a=0.05). The p-value <0.05 was considered statistically significant.

Results:

Total 360 participants were included in the study with age group of 8-15 years with their mean age of 12.56±1.91 years. Among all the 360 participants duration of onset of myopia in months was 18.09±16.85 SD. Out of total 360 respondents 48.6% (N=175) studied for 2-4 hours, 48.1% (N=173) respondents watched TV for less than 2 hours, 67.5% (N=243) were not using computer and laptop, 25.6% (N=92) played video games for 2 hours or less than 2 hours. Out of total respondents 47.5% (N=171) played sports like football, cricket etc. 86.7% (N=312) respondents were not having any outdoor activity. According to chi-square test of association myopia was not significantly associated with indoor activities like reading books, study duration, video games and mobile phone but there was a significant($p<0.021$) correlation of using computer with myopia. Moreover, 228 (99.6%) participants study <6 hours had low grade myopia and 130 (99.2%) participants studied <6 hours had moderate myopia (Table 1). Chi square test showed no significant correlation of myopia with outdoor activities (Table II).

Maximum respondents belong to urban area 75% (N=270). (Fig 1). According to their education level maximum respondents were in class 7 and class 9. (Fig 2)**.** Myopia was classified as mild and moderate myopia. 229 (63.6%) participants have low myopia and 131 (36.4%) have moderate myopia. (Fig 3).

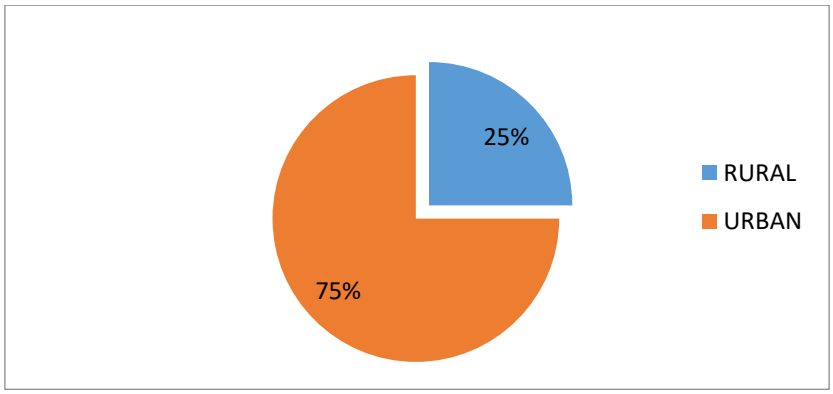

Figure1: Bar charts showing Residence of respondents

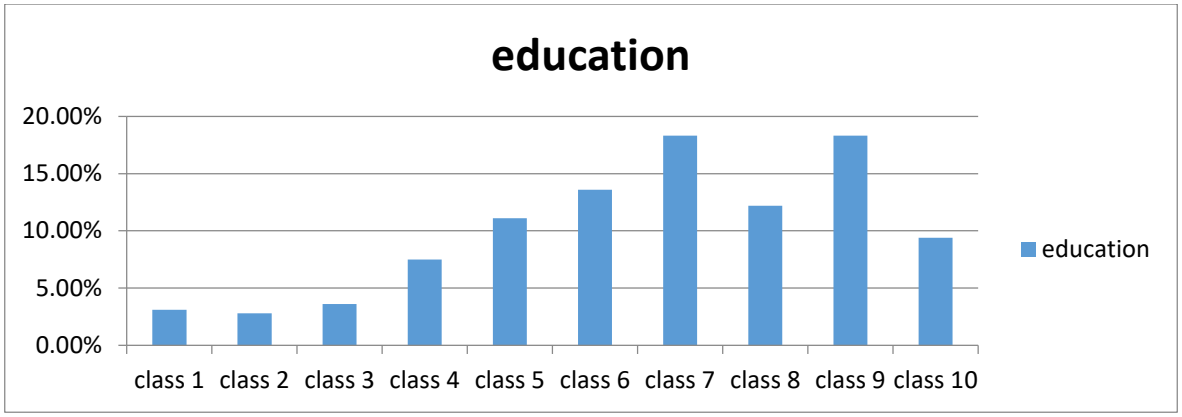

Figure 2: Bar chart showing education of respondents

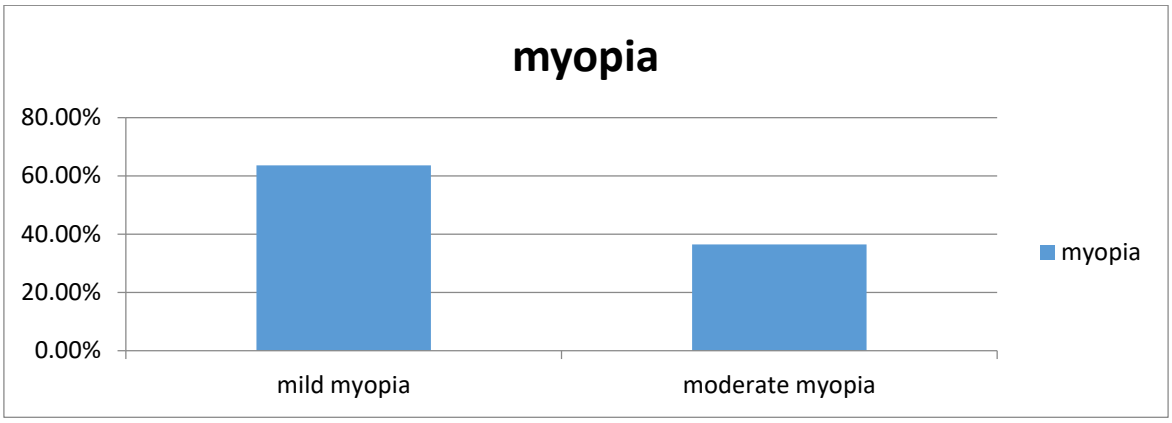

Figure 3: Grades of myopia

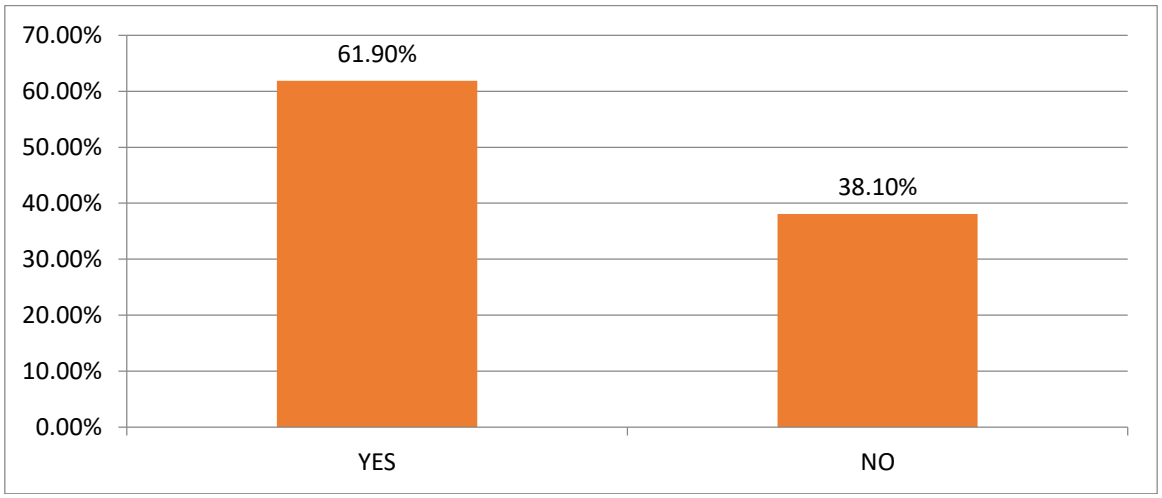

Figure 4: Near work induce myopia

Table I: chi square test of association with indoor activities

Variable	Option	Prescription		Df	P value
		Low myopia	Moderate myopia		
Hours of reading books per day	Less than 6 hours	228(99.6%)	130(99.2%)	1	0.688
	More than 6 hours	1(0.4%)	1(0.8%)		
Hours of studying per day	Less than 6 hours	203(88.6%)	121(92.4%)	1	0.258
	More than 6 hours	26(11.4%)	10(7.6%)		
Hours of watching television per day	Less than 6 hours	227(99.1%)	129(98.5%)	1	0.569
	More than 6 hours	2(0.9%)	2(1.5%)		
Hours of using computer per day	Less than 6 hours	229(100%)	128(97.7%)	1	**0.021**
	More than 6 hours	0(0%)	3(2.3%)		
Hours of playing video games	Less than 6 hours	228(99.6%)	131(100.0%)	1	0.449
	More than 6 hours	1(0.4%)	0(0.0%)		
Hours of using mobile phones	Less than 6 hours	228(99.6%)	130(99.2%)	1	0.688
	More than 6 hours	1(0.4%)	1(0.8%)		

Table II: chi square test of association with outdoor activities

Variable	Options	Prescription		df	P value
		Low myopia	Moderate myopia		
Hours of sports	Less than 6 hours	228(99.6%)	1(0.4%)	1	0.449
	More than 6 hours	131(100%)	0(0.0%)		
Hours of playing	Less than 6 hours	228(99.6%)	1(0.4%)	1	0.449
	More than 6 hours	131(100%)	0(0.0%)		
Other outdoor activity	Less than 6 hours	228(99.6%)	1(0.4%)	1	0.688
	More than 6 hours	130(99.2%)	1(0.8%)		
Time spent outside	Less than 6 hours	229(100.0%)	130(99.2%)	1	0.186
	More than 6 hours	0(0.0%)	1(0.8%)		

Discussions:

In this examination, 4 fundamental areas of risk factor for nearsightedness were explored which include financial status, family history, close to work and open-air activity. A sum of 360 participants included in the study. In this study, it was discovered that out of 360 members the occurrence of nearsightedness in male was 117 (32.5%) and in female it was 243 (67.5%) which associates with the past studies. [4] Magnitude of myopia was more in urban areas 75% than rural areas 25% which is

parallel with the investigation of foster et al. [5]

An investigation of Australian younger students likewise noticed that nearsighted commonness is least in external rural areas and most noteworthy in the inner city, with mean refraction inclining toward more prominent myopia as per region. [7] This what we also achieved in the current investigation, that myopia was more in urban school children than rural school children. There are potential explanations behind this metropolitan country contrast. Children of urban areas are more exposed to indoor activities than outdoor activities. Additionally, the best, scholastic star schools are situated in urban areas.

In the present study, we explored the impacts of every day time spent on perusing and writing, using computer, and sitting in front of TV, playing video games and using mobile phone independently, on myopia. Our outcomes demonstrated that everyday reading and writing time was connected with myopia progression, time spent on using cell phone, playing video games and sitting in front of TV had no relationship with myopia. But our outcome shows the relationship of daily using computer with myopia.

The consequences of past examination exploring the relationship between myopia progression and near work are conflicting. Saw et al[7]have found no connection between near work and myopia progression in children aged 6–12 years. Tan et al[8] reported that there were no measurable significant relationships between myopia progression and near work in children aged 7, 9, and 12 years, after a follow-up period of one year. In another study, Saw et al. showed that there was no relationship between axial elongation and reading in myopic children aged 7–9 years. [7] On the other hand, Parssinen et al found that myopic progression was associated with time spent on reading and close work in schoolchildren with a mean age of 10.9 years. It can be speculated that the different age groups might cause the contradictory results.[9] Our results were in accordance with the study by Tan et al.[8] We believe that it might be because of the similar age ranges of study populations and less time.
In our study there is no association between outdoor activities and myopia. The results of previous studies investigating association between outdoor activities and myopia are also conflicting. Although several previous studies have found an association between outdoor activities and the onset of myopia. [9]

Jones-Jordan et al have reported no significant correlation between outdoor activities and the rate of myopia progression, in accordance with our results. [10] It was found that among the 360 myopes 147(40.8%) were irregular users and 161(44.7%) remove their spectacles during study. 61.90% participants have their concern that near work can induce myopia.
Our study concluded that myopic progression was faster in urban than in rural school children, especially in junior high school children. These data might be explained by the influence of the students' environment, or by the early onset of myopia and fast myopic progression. However, this study did not demonstrate a direct effect of indoor and outdoor activities on myopia. Previous epidemiologic studies have suggested that near work activity, such as reading, writing, and computer use, may be related to the development of myopia. [11] However, some studies have shown that near work may not be the main factor contributing to myopic progression. [16]
In this study there is no clear causal relationship between myopia and a student's academic environment. It is clear that myopia typically develops in young children and exhibits a gradual increase in prevalence and severity from grade school through senior high school.

Conclusion:

Indoor activities like reading books, study hours, playing video games and use of mobile phone have no significant effect on myopia but there is a significant correlation of myopia and computer usage. Outdoor activities were not associated with myopia. Myopia and its related visual impairment may affect the productivity, mobility, and quality of life when these children become tomorrow's citizens. Hence, not only early recognition of myopia is important but also the awareness regarding its progression and the influence of environmental factors should be emphasized

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ORIGINAL ARTICLE

Awareness and Attitude of Spectacle Wearers Towards Refractive Surgery as An Alternative Vision Correction Method

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ABSTRACT

Objectives: To determine the awareness and attitude of spectacle wearers towards refractive surgery as an alternative vision correction method and to analyze the preferences of subjects regarding vision correction tools among the methods known to them.

Study Design: Cross-sectional study

Study Setting and Duration of Study: The study was carried out at two universities of Rawalpindi i.e. Arid Agriculture University and Fatima Jinnah Women University from October to December 2019.

Methodology: The study population included 100 students using spectacles as a vision correction tool and age ranging from 18-25 years. Data was collected with the help of a self-administered questionnaire after taking verbal informed consent from the participants.

Results: The study included 100 spectacle wearers with a mean age of 21.4 years (SD±1.699); out of which 52% were females. Overall, 41% of the participants had a clear perception of 'ophthalmologist' and 'optometrist' term. Only 28% preferred contact lenses as a vision correction tool while spectacles were the most preferred choice followed by refractive surgery (36%). The major barrier found towards refractive surgery was fear of complication (22%), financial constraints (17%) and lack of information about (13%), while lack of reliable centers was found as weakest barrier.

Conclusion: Awareness and attitude towards refractive correction methods was low among participants. These findings emphasize the necessity for proper public education on available services and especially about newer correction methods for improvement of quality of vision.
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Introduction:

Normally, the light rays focus on the retina, a clear and sharp image is formed known as Emmetropia. The Refractive error whereby the light rays does not focus on the retina known as Ametropia. Due to some environmental and genetic factors, the incidence of refractive errors has been increasing day by day. Spectacles are the easiest and cheap method for correcting refractive errors. However, the most popular method used nowadays is refractive surgery to correct refractive errors. It should be done when a refractive error is stabilized, preferably at the age of 20 years.

Uncorrected refractive errors are the leading cause of visual impairment and blindness in the world. In Pakistan, Refractive errors are the third most common cause of blindness (11.4%) after cataract (66%) and corneal opacity (12.6%)[1].Globally, around 8.2 million people are blind and approximately 145 million people have low vision due to uncorrected refractive errors.

The figure of visual impairment is dramatically increasing day by day. To reduce this figure WHO initiated the program Vision 2020 (The Right to Sight). It was launched on 18th February 1999. The main objective of this program was to reduce or either eliminate all the causes of Avoidable Blindness by the year 2020. Refractive error was considered as the main factor of avoidable blindness[2].

By addressing this issue, we can improve patient's quality of life[3]. Many people were aware of spectacle use and they feel safe and comfortable. However, some people took spectacle as a stigma to their cosmetic appearance. Later on, a contact lens was introduced[4].

Despite all medical advances, the use of contact lens has also introduced the complications such as infections and corneal ulcer[5]. Continuous use of contact lens for 24 hours is also not possible. To tackle this problem a new technology of "Refractive surgery" was launched to improve the quality of life[6,7].

Refractive eye surgery is used to improve the refractive state of the eye and to eliminate the dependency on the glasses and contact lens. It can cure myopia, hypermetropia, astigmatism and presbyopia[8].

A study shows that in Asia, among the spectacle users, 23.56% wanted to switch over to contact lenses and the main reason was cosmetic. 92.51% were aware of refractive surgery, out of which 36.66% were willing to undergo refractive surgery and 65.92% were not willing to undergo refractive surgery due to fear of complication. "Freedom from glasses" and "Cosmetic blemish" are making refractive surgeries attractive for the young population[9].

Unlike glasses or contacts, Laser Eye Surgery is not a temporary fix but permanently adjusts the vision. About approximately 35 million people had performed surgery and considered it as the most safest and effective procedure in the world[10].

The purpose of this study was to evaluate the reasons why ammetropes using spectacles do not opt for refractive surgery and on the other hand to ascertain the cause of their motivation toward refractive surgery. The investigated population included all the university students who had refractive errors and were using spectacles. This population of educated individuals was chosen as they were mature enough to make their decisions independently to undergo refractive procedures in future.

Material and Methods:

This cross-sectional study was conducted at the two universities i.e. Arid Agriculture University and Fatima Jinnah Women University. The sample size was calculated using online software OpenEpi, with confidence level of 95%, and frequency of outcome factor in the population from previous study was 6.2%±5. A sample size of 100 was obtained.

The individuals were selected by convenient sampling. All students who had refractive error and were using glasses, aged between 18 to 25years irrespective of gender were included in the study. All students with any ocular pathology or having squint and showing un-willing behavior towards sharing their opinion regarding the topic were excluded. The study was conducted after the approval by

the head of university. Verbal informed consent was taken from every participant of the study.

Data was collected with the help of self-administered questionnaire, which was typed in English. Questionnaire contained three basic parts. First part consisted of questions regarding demographic profile (5 items) e.g. age, gender, educational status, residence and monthly income Second part included questions regarding individual's spectacles related attitude (12 items). Third part was composed of questions regarding awareness about refractive surgery (8 items).

Data analysis was done using Statistical Package for Social Sciences (SPSS) version 20. Analysis was done in two phases, descriptive analysis followed by inferential analysis. For inferential analysis, Chi square test for independence was used for finding associations between outcome variables and independent variables. P value <0.05 was considered significant.

Results:

A total of 100 subjects were enrolled in this study. The mean age of participants was 21.4 years (SD±1.699), ranging from 18 to 25 years. Majority of studied individuals were females (N=52, 52.0%). More than half of subjects (59.0%) did not know the difference between ophthalmologist and optometrist.

All the participants were spectacle users, but they had different beliefs towards spectacle wearing[11,12]. This section included 5 questions, just to assess their perception and knowledge about glasses see Figure 1. About 20% of students were reported to be not interested in using contact lens. Fear of complications was observed as a major hindrance i.e. 25%. While cost of contact lenses was the least encountered barrier towards its use[7].

It was observed that most of the females wanted to undergo refractive surgery (36.5%) and the main reason was cosmetic appearance (69.2%). On the other hand, males were more confident with the use of glasses i.e. 36.5%. More than half of population i.e. 71% knew about the refractive surgery. On investigating the preference of individuals regarding vision correction tools, contact lenses were found to be the least preferred choice (28%) as compared to glasses and refractive surgery i.e. 36%[13] (Figure 2).

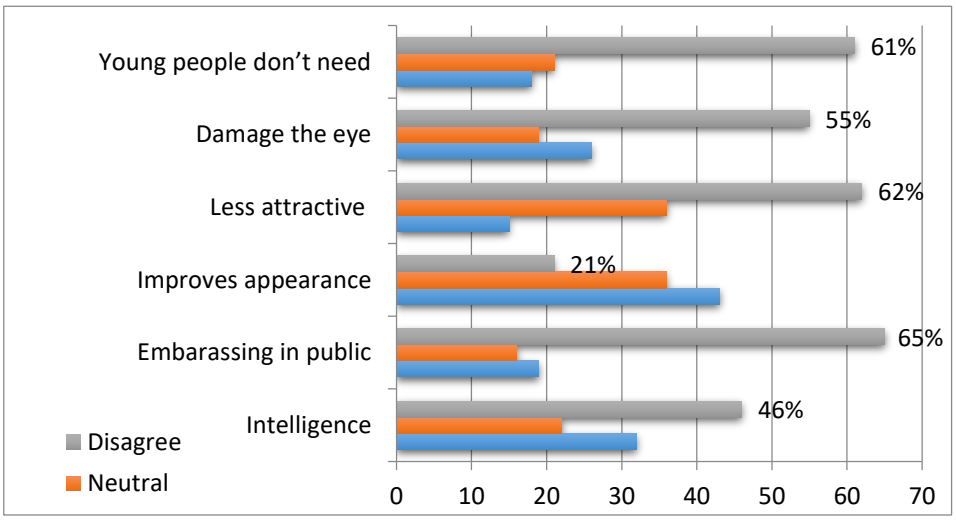

Figure 1: Perception of participants about glasses

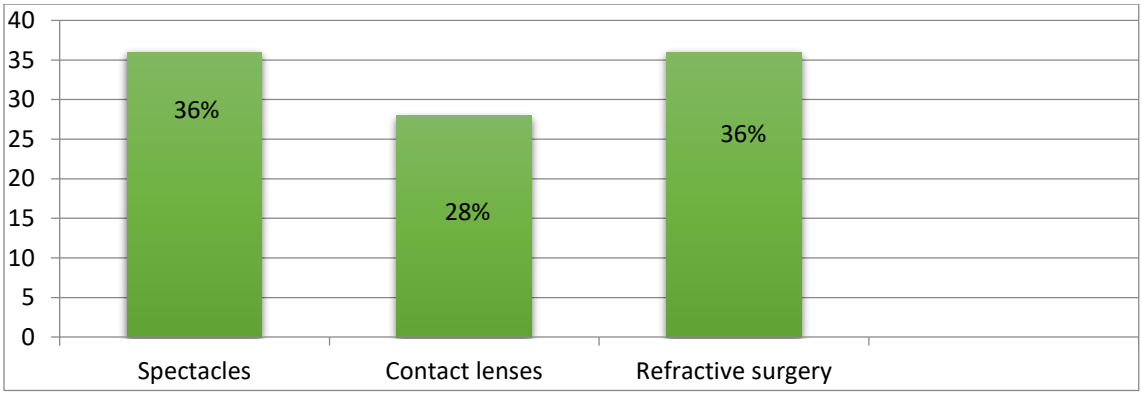

Figure 2: Preference of participants regarding vision correction tools

On the other hand, fear of complications of refractive surgery was observed as the major barrier toward refractive surgery (22%) and financial constraints (17%) being the other leading barrier.

It was noticed that 35% of students were highly motivated for refractive surgery but only 29% had enough knowledge about it. On the same aspect, 100% of population showed their interest to know more about it.

For inferential analysis; after computing, 12 median was taken out as cut off and it was transformed to binary i.e. low and high awareness. Overall the students had low awareness about refractive surgery such as males 64.6% (n=31) and females 53.8% (n=28).
After computing, 42 median was taken out as cut off and it was transformed to binary i.e. good and poor attitude. Overall, the respondents showed poor attitude such as males 75.0% (n=36) and females 40.4% (n=21) towards other correction methods. A chi-square test for independence indicated significant association between gender, (Df=1, n=100, p=0.00), residence (Df=1, n=100, p=0.03) and monthly income (Df=3, n=100, p=0.03) in relation to their attitude towards refractive surgery.

Discussion:

This study determined the awareness, attitude and reasons for the poor interest among spectacle wearers to contact lens and refractive eye surgery as alternatives. This study was conducted to elicit the hurdles in the way of spectacle users because of which they don't find refractive surgery as an alternative vision correction tool. The preference of investigated participants towards refractive correction methods was also evaluated.

On investigating about the possible barriers for the spectacle users towards refractive surgery, fear of complications (eye infections) and financial constraints came out to be the major barriers towards their choice of refractive surgery. On investigating the preference of individuals regarding vision correction tools, contact lenses were found to be the least preferred choice (28%) as compared to glasses and refractive surgery i.e. 36% each. On the same side, lack of information about correction methods and perceived expenses of these alternatives affected their interest in uptake of eye services. These issues should be addressed to increase uptake of vision correction methods and prevent avoidable blindness.
Overall, awareness and attitude towards correction methods was moderately low among the participants of this study.

Abdulmalik H. et al in 2019; conducted a study on the awareness of refractive surgery among general population in Saudi Arabia. The study concluded that there was a moderate knowledge about refractive surgery among participants. However, the primary source of information was friends and family, so physicians should provide

proper information to patients about refractive surgery and increase their awareness[14,15].

Another study was made by Ragni Kumari et al in 2019; on awareness and attitude toward refractive error correction modalities among paramedical students. They concluded that awareness and attitude towards refractive correction methods was moderately low among the participants. The percentage of those aware of refractive surgery was only 14.2%[16,17].
On comparison with other studies it is clearly illustrated that our community had little awareness about refractive surgery. Due to lack of information, their level of motivation was also low i.e. 35%. On the same side, negative attitude (57%) towards refractive surgery was found[18–20].

Conclusion:

Overall, awareness and attitude towards correction methods was moderately low among the participants. Myths about correction methods were also found to be one of the barriers towards treatment. Counseling among educated population would help in dispelling the myths and misconceptions about vision correction methods. Provision of reliable centers and making them more affordable could enhance awareness and create positive attitudinal change among them.

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ORIGINAL ARTICLE

Assessment of Dry Eye Disease among Patients with Keratoconus at Ophthalmology Department, Hayatabad Medical Complex, Peshawar

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Abstract

Purpose: The aim of the study was to determine the frequency of Dry Eye Diseases among keratoconus and control groups among subjects visiting Ophthalmology department Hayatabad Medical Complex.

Material and Methods: It was a comparative cross-sectional study conducted between June 2019 to Dec 2019 in which Dry Eyes Diseases were assessed among the Keratoconus and control groups using Mcmonnies Questionnaire.

Results: A total of 24 subjects were recruited for this comparative cross-sectional study, which includes 12(50%) cases and 12(50%) controls. Mean age of the subjects was 22.34±4.5; among these subjects 10(41.7%) were male with mean age of 20.25±3.5 years and while the mean age of 14(58.3%) females was 24.53±4.9 years. Mean Mcmonnies scores and standard deviation for cases and control were 17.50±1.8 and 12.30±1.2 respectively. Gender wise distribution of Mcmonnies score for cases among males and females were 18.50±1.9 and 16.50±1.7 respectively, while among controls the mean score for males and females were 11.30±1 and 13.40±1.4 respectively.

Conclusion: The conclusion of study was that Dry Eye Diseases is strongly associated with Keratoconus as compared to control groups. *Al-Shifa Journal of Ophthalmology 2020; 16(3): 138-143.*

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Introduction:

Keratoconus is (KC) is a progressive, usually bilateral and of asymmetric nature disease of the cornea manifested as steepening, distortion and apical thinning and ectasia. The etiology of KC is not known but genetic predisposition is strongly considered.[1]

Keratoconus (KC) is almost bilateral in about 96% of cases but due to asymmetric nature often one eye is diagnosed earlier than fellow eye among teenagers and second decade of life. It typically stops progressing by the fourth decade, possibly secondary to age-related cross-linking resulting in great rigidity and less likelihood for the ectasia to result. For the same reason, keratoconus is unlikely to result after age 40. Also evidence from

literature shows that incidence is common on eyes and gender.[2,3]

Prevalence of KC is approximately 1/2000 persons. It is estimated that among 270 million Americans, 135000 have KC, however this estimate of incidence and prevalence was concluded from Olmsted country Minnesota, which identify 64 cases of KC Between 1935 and 1982 at Mayo clinic. In this study KC cases were labeled based upon Irregular reflexes of Ophthalmoscopy and Retinoscopy and irregular mires at Keratometry. Kennedy *et al* findings revealed the incidence rate 2/100,000 and prevalence of 55/100,000. These estimations were low and the diagnosis was based upon corneal topography. Other ethnicity reported 86/100,000 in Denmark with incidence of 25/100000 population with consensual marriages. This high incidence indicated the genetic factor as an etiology of KC.[4]

Dry Eye disease (DED) is well recognized as a global public health problem affecting millions of people because of its high prevalence and morbidity. The prevalence of Dry Eye disease as documented in large epidemiological studies ranging from five to over 30 per cent. Dry Eye disease has significant socio-economic implications, such as increased health-care costs and a negative impact on vision-related quality-of-life issues, such as driving, television watching, reading, computer work and emotional wellbeing. Evaluating the cost of treatment for Dry Eye disease is problematic in view of the multi-factorial nature of the condition. The cost of managing Dry Eye disease in health-care organizations in the United States has been estimated at US$700,000 per million Patients. Furthermore, the total annual health-care cost has been reported to range from US$270,000 in France to US$1.10 million in the United Kingdom for every 1,000 Dry Eye disease Patients managed by Ophthalmologists. A two-year retrospective study at the Singapore National Eye Centre (SNEC) on 54,052 Patients reported a total annualized cost of Dry Eye treatment of about US$1.5 million for 2008 and 2009.There is a lack of published data on Dry Eye prevalence in Singapore. Tong and colleagues reported a prevalence of 6.5 per cent and associations with cigarette smoking, presence of thyroid disease and higher income; however, this work investigated only Patients of Malay ethnicity aged 40 to 80 years selected from south-western Singapore.[5]

This study was trying to clarify this contradiction and to fulfill any existing gapes. Mcmonnies questionnaire was used for diagnosing Dry Eyes which has a sensitivity of 98% and specificity of 97%.[6] the purpose of the study was to find the frequency of Dry Eyes among Keratoconus cases, which will be used for the better management of Patients with Keratoconus associated Dry Eyes as rubbing of eyes, is an aggravated factor.

Dry Eye Diseases are the most commonly presented cases and account for the 25% of cases presenting in ophthalmic clinic, making Dry Eyes as a public health problem.[7] According to various Epidemiological studies the prevalence of Dry Eye Diseases (DED) varies ranging from 5% to 30%.[8,9]The Dry Eye Diseases is presented in 81.5% of keratoconus patients and among them 70% have higher tear film instability.[10] It has been evident from Literature that some corneal topographical parameter like Surface regularity index (SRI) and Surface asymmetry index (SAI), which are used for diagnosis of KC are also sensitive to Dry Eye Diseases (DED).

Participants and Methods:

This comparative cross-sectional study was carried out among keratoconus patients with dry eye disease at Ophthalmology department, Hayatabad Medical Complex Peshawar between June 2019 to Dec 2019. All subjects' fulfilling modified Rabinowitz–McDonnell criteria were

included as cases and subjects with no Keratoconus taken as controls. Keratoconus was diagnosed using modified Rabinowitz–McDonnell method, with the central corneal power of >48.7 diopter or the Inferior and superior (I–S) value of >1.4 D.[11] Likewise, subjects with age and gender matching with case and having total spherical error of less than -5D and astigmatism of less than -3DC were taken as controls.[12] Dry Eyes Diseases were define as subjects with Mcmonnies score greater than 14.5 on Mcmonnies Questionnaire. [13,14] Subjects in both cases and controls containing local and systemic preexisting conditions that may have dry eyes association were excluded. Patients with compliance of diabetes, using antihypertensive drugs, ocular surface disorders, allergic conjunctivitis and disorder of eye lid and previous history of any ocular surgery were excluded from the study. Non-probability purposive sampling techniques were used by considering Keratoconus cases and same age match control were taken.

After getting the ethical approval form ethical and research review boards of PICO. A structured and self-design questionnaire was used for the collection of data from research subjects after getting fully informed verbal consent. All the ophthalmic examinations were taken which is visual acuity measurement and related test were performed. Dry Eyes screening were done among cases and controls using Mcmonnies questionnaire as it is the most effective test and subjects with more the 14.5 Mcmonnies scores were taken as Dry Eyes.

Statistical analysis was performed using SPSS software (version 20.0, IBM), Descriptive statistics mean and standard deviation were used for quantitative variables i.e. Age, Mcmonnies scores likewise mode and frequency were used for qualitative variables. McNemar's test was used to compare the frequency of Dry Eye symptoms between KC Patients and control subjects.

Results:

A total of 24 subjects were recruited for this comparative cross-sectional study, which included 12(50%) cases and 12(50%) controls. Mean age and standard deviation of these subjects were 22.34±4.5; among these subjects 10(41.7%) were male with the mean age of 20.25±3.5 and while mean age for females 14(58.3%) was 24.53±4.9 (Table I). Mean Mcmonnies scores and standard deviation for cases 12(50%) and control 12(50%) were 17.50±1.8 and 12.30±1.2 respectively (Table II).

Gender wise distribution of Mcmonnies scores for cases among male and females were 18.50±1.9 and 16.50±1.7 respectively, while among controls for males and females were 11.30±1 and 13.40±1.4 respectively.

Table I: Distribution for age among males and females

	Frequency	Percentages	Mean and SD
Males	**10**	**41.7**	**20.25±3.5**
Females	**14**	**58.30**	**24.53±4.9**
Total	**24**	**100**	**22.34±4.5**

Table II: Comparison of Mcmonnies score among cases and controls

	Frequency	Percentages	Mean and SD
Cases	**12**	**50**	**17.5±1.8**
Controls	**12**	**50**	**12.30±1.2**

Table III: Gender wise comparison of Mcmonnies score among cases and controls

	Gender	Frequency	Mcmonnies scores Mean and SD
Cases	**Male**	**6**	**18.50±1.9**
	Females	**6**	**16.50±1.7**
Control	**Male**	**4**	**11.30±1**
	Females	**8**	**13.40±14**

Discussion:

Keratoconus (KC) was first described in detail in 1854, despite the intensity of research activities over the last few decades into its etiology and pathogenesis, the cause(s) and possible patho-mechanisms for development of KC remain poorly understood. Several hypotheses propose genetic, environmental, biomechanical causes and mechanisms. In present study we focused on the relationship of corneal topography/tomography to tear film properties in Keratoconus Patients.[15]Clinical experience shows, that the majority of Patients with Keratoconus develop symptoms, which are typical for Dry Eye Disease (DED).[16] Together with the fact that some of the Keratoconus screening indices are also sensitive to DED interaction between topographic or tomographic indices and parameters indicating dry eyes have to be studied. This means, that neither anterior corneal properties which in part are influenced by the tear film behavior nor posterior corneal properties which are not affected by the tear film behavior are correlated with DED.[17] Nevertheless, Scheimpflug systems such as Pentacam are inappropriate to analyze tear film properties due to limited resolution in axial direction.

In this study, KC Patients had a significantly higher frequency of Dry Eye Diseases than control subjects. This conforms to a study by Gonzalo *et al*. (2015) who found a significant correlation between Dry Eye symptoms and KC. According to Dogru *et al*. (2003), 81.5% of Patients with either KC had self-reported clinically relevant Dry Eye. Acera*et al.* (2011) stated that there is a correlation between KC and Dry Eye Disease. The present findings are comparable to Ali *et al*. (2011) who evaluated tear functions in KC Patients in Malaysia. Their results showed an average value of 3.99 (1.69) seconds in Patients with KC versus 7.03 (3.48) seconds in control subjects with a significant difference of Tear-break-up-time (TBUT) between them. The authors also reported no significant difference was noted between the Schirmer test values of both groups. On the other hand, Gonzalo *et al.* (2015) found neither a significant decrease of aqueous tear flow nor an impaired Tear-break-up-time test among KC Patients. It can be concluded that the present study findings support the suggestion that KC Patients have an elevated frequency of Dry Eye Disease. In addition, TBUT was significantly less in

KC Patients with Dry Eye disease at the Eye Hospital in Gaza. We suggest a further prospective investigation to identify the relationship between KC and Dry Eye. Amazingly according to the finding of the present study not a single subject was identified with Dry Eyes among controls which indicate the strong association between Dry Eyes and Keratoconus.

Likewise as far as the gender wise distribution was concerned dry eye diseases were significantly higher among females as compared to males according to the findings of the present study which is similar to the results of the study conducted at tertiary eye hospital at Karachi, however the main contradiction to the present study findings revealed that among all cases of keratoconus dry eye disease were associated while among controls not a single case of Dry Eye were reported. The possible reason for this could be selection criteria for control groups in which even Keratoconus suspected cases were excluded.

Conclusion:

Dry Eye Diseases is strongly associated with Keratoconus as compared to control groups. Such associations must be considered while evaluating the cases of keratoconus to advise appropriate treatment.

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