FREQUENCY OF REFRACTIVE ERROS IN SCREEN USERS EMPLOYES OF LAHORE

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ABSTRACT

Background:
Among all types of vision impairment, refractive errors remain a common issue around the world. Inappropriately, if an individual continues using laptop for about 7-8 hours daily, this put pressure on the eyes causing refractive errors that include myopia, hyperopia and astigmatism but since it occurs gradually, people seldom know they are suffering from them.

Purpose of the study:
Specifically, this research will seek to establish the frequency and incidence of refractive errors; myopia, hyperopia and astigmatism among the lad emmetropic employees engaged in the abundant screen time.

Materials and methods:
The sample comprised 185 participants aged 18-35 years: 102 of them male (55.1 percent) and 83 females (44.9 percent). The following equipment was used for the assessment of refractive errors among the students: Auto refractometer, retinoscopy, and a distance Log Mar chart, and trial box and pen torch.

Results:
Among the participants, 39.5 percent were myopic, 11.4 percent were emmetropic. More than half of the students had normal vision; 8 percent of the students were hypermetropic, while 38.4 percent had astigmatism.

Conclusion:
Presenting a work-related prevalence rate of 39.5 percent for myopia and 38.4 percent for astigmatism, the study was also able to establish that participants underwent more than 7 hours of cross. Emmetropia and hyperopia were less frequent in the whole sample, 11.4 percent and 10.8 percent, respectively. The only recorded difference was a slightly higher proportion of males in the study, where they considered 55.1 percent. Overall, these findings point to the high prevalence of myopia and astigmatism and stress the importance of prevention strategies and more research regarding screen related visual related damage.

Keywords: Abnormality, Eye disorders, Eye health, Near-sightedness, Presbyopia

INTRODUCTION

The primary underlying reason behind vision impairment in children is errors in reflection. RE is quite a typical eye condition (1). It happens when the retina's ability to clearly focus images from the outside world is compromised. The outcome of the refractive error is hazy vision, which is sometimes so severe that it causes visual impairment. When the eye cannot correctly bend and focus light onto the retina, it results in refractive error. It could get foggy, doubled, or fuzzy, making you squint and strain your eyes. Other typical symptoms include headaches brought on by strained eyes or trouble reading (2). Types of refractive errors include myopia, hyperopia, presbyopia and astigmatism (3).

In people with nearsightedness, also known medically as myopia, objects farther away appear blurry while close objects are clearly visible. If the cornea is incredibly long or too curved, myopia will occur. This disaster arises from the entering of defocus light in to the eye due to the shape of cornea, its condition or by both (4). While it had no cure, you can successfully deal with the conditions of refractive surgery and corrective lens, such as LASIK. Presently, there are two factors known for the cause of myopia which are form deprivation and optical focus.

When the retina's image quality is compromised, it's known as form deprivation; when light is at the front of or behind the retina, it's known as optical defocus. Numerous experiments with humans have shown that myopia can be created by exposing to either of these conditions. Axial myopia has been observed in human models using negative spectacle lenses as a result of the eye's elongation in response to optical misfocus. It is still unclear how this mechanism of image production works. It has been advised that Accommodative lag leads to foggy vision (e.g. optical focus shift) which in turn stimulates axial elongation and myopia (5).

Not only can high myopia impair your vision for some time, but it can also result in blindness over time. Global research has demonstrated that having myopia increases your chance of developing blindness from conditions like cataracts, glaucoma, macular degeneration, and retinal detachment. By compensating for the increased corneal curvature or increased ocular length, nearsightedness is treated with corrective lenses. Types of corrective lenses include eyeglasses. Wearing glasses is the easiest, refined way to sharpen your vision caused by nearsightedness. In the adverse rising threats of the myopia, some steps should be taken properly for the management of myopia and its control (6).

Far sightedness can also be called longsightedness or hyperopia which is a common vision defect. It occurs when the outside light is not focused properly on the retina and also from the size of eye ball being small due to which the refractive power of the eye lies in the plus numbers, which means we be adding some convex numbers to make it equal to the standard or normal power of the eye (7). The structure as well as functioning of the eye can be used to categorize hyperopia. Simple hyperopia happens due to the minimum axial length or limited converging ability of cornea, lens, and/or media (flat cornea/min. curvature, maximum thickness of lens) (8).

Abnormally high vision originates from abnormal growth, eye accident, or eye problems (i.e. Cataract, microphthalmia, Nan ophthalmia, aniridia, etc.). Functional hyperopia is due to paralysis of accommodation. Functional hyperopia, if present, it usually occurs at birth. Moreover, pharmaceuticals like cycloplegic medications can result in a brief hyperopia (9). Hyperopia can also be related to some serious problems such as squint. Specially designed eyeglasses that correct for part or all of the far sightedness may treat the problem. Low quality of life with uncorrected hyperopia , you may not be able to perform your daily life tasks as you wish (9).

Corrective lenses are the most common and secure treatment for symptoms bearing hyperopia. Mild hyperopia does not need correction. Hyperopia can be corrected by glass lenses, contact lenses, or ref surgery. Plus, lenses, which have the ability to converge light and bring the rays of light on the surface of retina. Typically speaking, contact lenses should not be used until adolescence or later; however, this depends on the patient's or caregiver's degree of responsibility. According to a survey of practitioners, children between the ages of 3.00D and 5.00D with asymptomatic hyperopia are typically candidates for treatment intervention (10).

A common, treatable irregularity in the curvature of the eye that results in blurry near- and far-sightedness is called astigmatism. Occurs when one of the front surfaces of the eye or the lens inside the eye has misaligned focal points. If you have astigmatism, light which is entering your eye is bending more than the usual. The light won't focus on your retina. This means only parts of an object you are looking at are in focus. That irregular focus makes object look cloudy or wavy (11). One can have regular or irregular astigmatism. The genesis of astigmatism might be lenticular, retinal, or corneal. Additional classifications for ordinary astigmatism include oblique, bi-oblique, against the rule, and

with the rule astigmatism. Regular astigmatism optics can be defined by the Sturm's conoid principle. It had three variations : common, compound, and mixed (12). Regular signs of astigmatism include asthenopia, pain, distorted or blurry vision, object elongation, and difficulty with accommodation. Partial lid closure, head tilt, vertically oval or tilted optic disc, and varying power in different meridians are some of the symptoms. The investigations needed include retinoscopy, slit lamp, examination, keratometry, Schiempflug imaging, astigmatic fan, and Jackson cross-cylinder evaluation (13).

Astigmatism can be effectively managed through various means, including spectacles, contact lenses, and surgical interventions. Refractive surgery, such as Toric IOL implantation or astigmatic relaxing incisions, offers surgical correction options for astigmatism. These interventions aim to reshape the cornea or lens to improve the focusing ability of the eye, thereby reducing or eliminating the blurriness associated with astigmatism (14).

Digital eye fatigue refers to a appearance marked by visual disturbances or irritation in the eyes associated with using digital devices. It arises from various stressors on the ocular system, such as glare, blurred vision, difficulties with focusing, misalignment of eye movements, dryness, fatigue, and general discomfort (15).

Digital eye strain, also known as computer vision syndrome, encompasses a collection of symptoms experienced by individuals who use visual display units. Among these symptoms, ocular discomfort is more prevalent than non-ocular symptoms (16). While "CVS" has been extensively employed in literature, given the widespread use of various digital devices beyond computers, "DES" appears to be a more fitting term (17). Symptoms of digital eye strain affecting the eyes comprise tearing, tiredness, blurred vision, overall fatigue, burning sensation, redness, and double vision. Non-ocular symptoms encompass a stiff neck, general fatigue, headaches, and backaches (18).

Objectives of the study

• To calculate the frequency and prevalence of refractive errors on screen users among emmetropic personnel in Lahore, including myopia, hyperopia, and astigmatism.

Materials & Methods

STUDY DESIGN

A cross-sectional study design was used.

Place of study

Data was collected from employees in Lahore.

DURATION OF STUDY

Four months following the approval of the synopsis, the study was finished.

SAMPLE SIZE

A sample size of 185 was calculated with the help of Rao soft.

SAMPLING TECHNIQUE

A non-probability convenient sampling strategy was used in the investigation.

TARGET POPULATION

Normal young individuals.

Inclusion criteria

- Both genders (male and female)
- Screen users
- Emmetropic individuals

Exclusion criteria

- Presbyopia
- Ametropic individuals
- Non screen users

Data Collection Tools (Performa/Questionnaire)

- Trial box
- Pin Hole
- Auto refractometer
- Torch light
- Log mar chart
- Retinoscope

4.8 DATA COLLECTION PROCEDURE

The Riphah International University was set to host an eye screening camp. Participants in our study were selected from university personnel who had gone through screening. Following refraction, we focused on emmetropic individuals who had never worn spectacles. Upon their initial contact, the patients were greeted kindly and given a comfortable environment. To further comprehend the patient's concerns, we looked into any presenting vision-related difficulties or symptoms. Following that, both distance and near visual acuities were carefully evaluated to determine the patients' visual abilities. Advanced instrumentation, like as retinoscopy and an auto refractometer, and was used to objectively measure refractive errors. Following that, subjective refraction was conducted using a trial box to precisely determine and correct the patients.

3.9 DATA ANALYSIS

The statistical program SPSS 21.0 was used to examine the data.

Results

5.1: Age of the patients

Table 5.1: Shows the descriptive statistic in which there is mean deviation shown there and not to mention the standard deviation of the age group.

Table 5.1: Age-related descriptive statistics

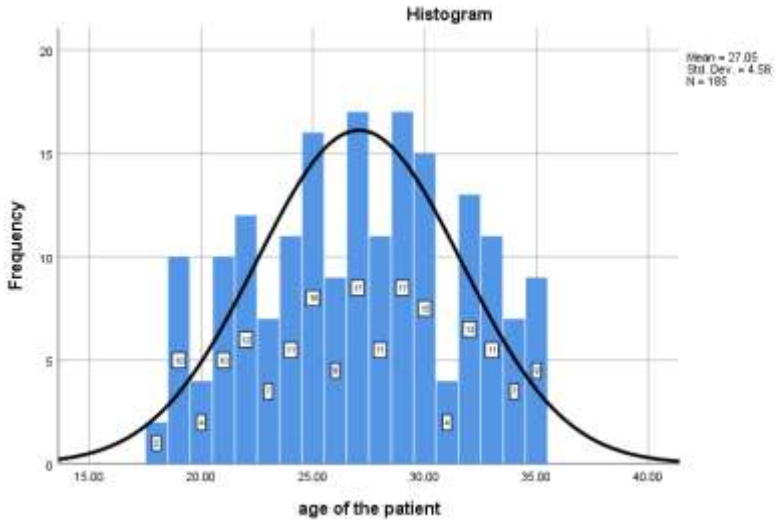
	Total numbers	Minimum	Maximum	Mean	Std. Deviation
Patients Age	185	2.00	35.00	26.9189	4.93643

Table 5.2 shows the stats on the age of the patient which range from 18 to 35 years of age.

Table 5.2: Frequency / Percentage of age of the patients

Age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18	2	1.1	1.1	1.1
	19	10	5.4	5.4	6.5
	20	4	2.2	2.2	8.6
	21.00	10	5.4	5.4	14.1
	22.00	12	6.5	6.5	20.5
	23.00	7	3.8	3.8	24.3
	24.00	11	5.9	5.9	30.3
	25.00	16	8.6	8.6	38.9
	26.00	9	4.9	4.9	43.8
	27.00	17	9.2	9.2	53.0
	28.00	11	5.9	5.9	58.9
	29.00	17	9.2	9.2	68.1
	30.00	15	8.1	8.1	76.2
	31.00	4	2.2	2.2	78.4
	32.00	13	7.0	7.0	85.4
	33.00	11	5.9	5.9	91.4
	34.00	7	3.8	3.8	95.1
	35.00	9	4.9	4.9	100.0
	Total	185	100.0	100.0	

Graph 5.1: Shows the histogram of the age of the patients



Graph 5.1: shows the histogram of the age of the patient with the normal curve.

5.2: Gender of the patients

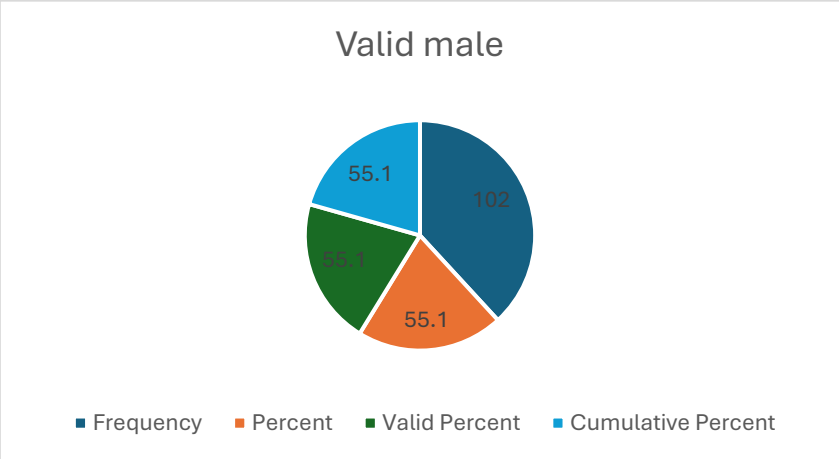
Table 5.3: Shows the frequency of the patients in which there were total of 185 patients among which there were 102 male patients and the numbers of females were 83. Total of 102 males made up the 55.1 percent of the total value and females made up the remaining 44.1 percent.

Table 5.3: Frequency of the gender of patients

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	M	102	55.1	55.1	55.1
	F	83	44.9	44.9	100.0
	T	185	100.0	100.0	

Figure 5.2 shows the pie chart of the total gender of the patients which include 55.1 percent of the males and 44.86 percent of the females.

Figure 5.2: Pie Chart of the gender of the patients



5.3: Refractive Errors

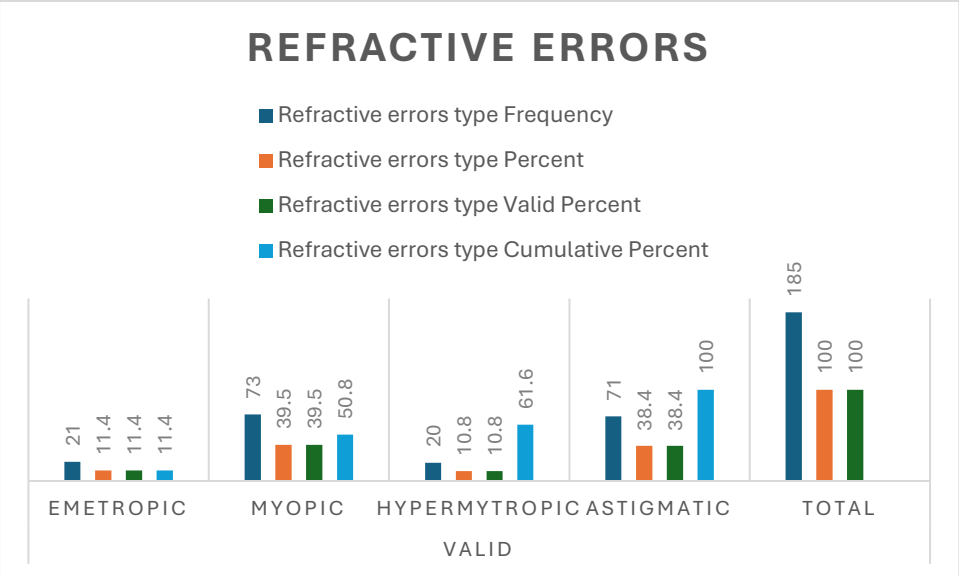
Table 5.4 shows the frequency of the refractive errors in which the total patients were 185 out of which there were 21 emmetropic patients, 73 were myopic patients, 20 were hypermetropic patients,71 was astigmatic patient's.

Table 5.4: Percentage and frequency of the refractive errors type

Refractive errors type					
Types		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Emmetropic	21	11.4	11.4	11.4
	Myopic	73	39.5	39.5	50.8
	Hypermetropic	20	10.8	10.8	61.6
	Astigmatic	71	38.4	38.4	100.0
	Total	185	100.0	100.0	

Figure 5.3 shows the frequency of the refractive errors. Total patients were 185 out of which it shows 21 were emmetropic, 73 were myopic, 20 were hypermetropic and 71 were astigmatic.

Figure 5.3: Bar chart of the refractive errors



5.4: Refractive errors and Gender of the patient

Table 5.5 shows the frequency of the refractive errors in which the total patients were 185 out of which there were 21 emmetropic patients, 73 were myopic patients, 20 were hypermetropic patients,71 were astigmatic patient's.

Table 5.5: Types of the refractive errors

Types		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Emmetropic	21	11.4	11.4	11.4
	Myopic	73	39.5	39.5	50.8
	Hypermetropic	20	10.8	10.8	61.6
	Astigmatic	71	38.4	38.4	100.0
	Total	185	100.0	100.0	

Table 5.6**:** Shows the gender of the patient in which there were total 185 people out of which 102 were male and 83 were female.

Gender of the patient					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	M	102	55.1	55.1	55.1
	F	83	44.9	44.9	100.0
	T	185	100.0	100.0	

Table 5.6: Gender of the patient

Figure 5.4: shows the clustered column chart of the frequency / percentage of the genders of the patient.

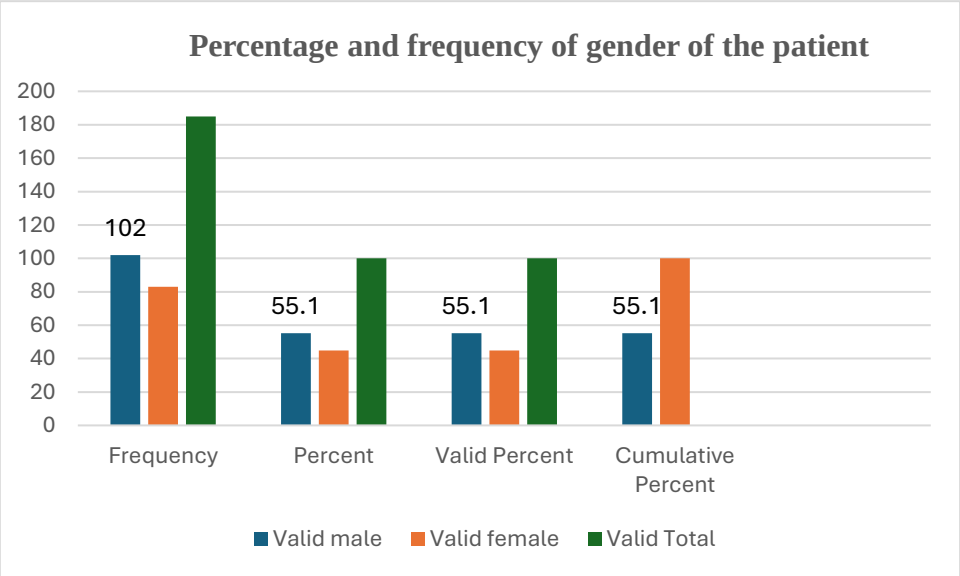
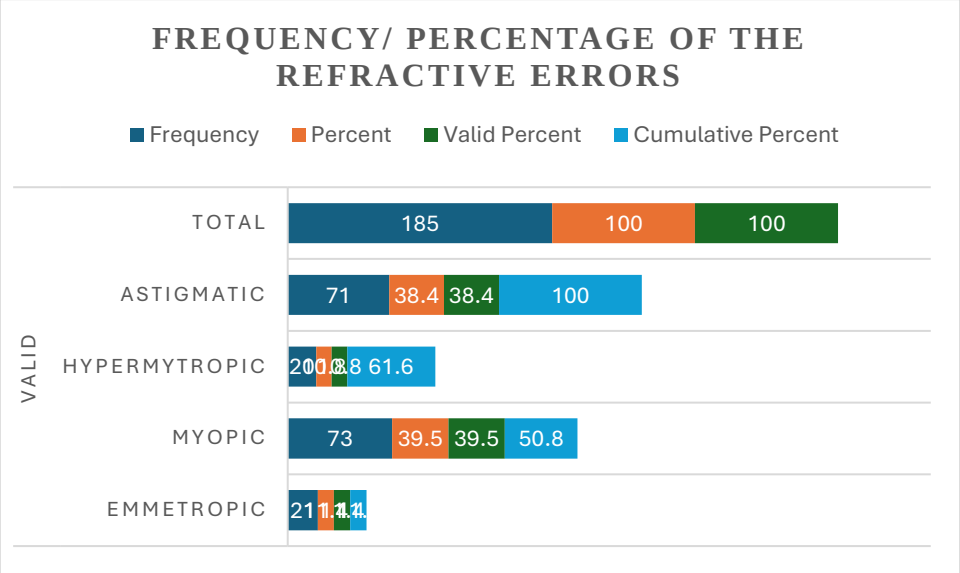


Figure 5.4: Column chart of the frequency / percentage of gender of the patient

Figure 5.5: shows the bar chart of the frequency / percentage of the refractive errors including valid percent and cumulative percent of both.

Figure 5.5: Bar chart of the frequency / percentage of the refractive errors.



Discussion

Refractive error is one of the most common result of vision impairment worldwide, and the biggest cause like the second biggest but curable (19). Refractive errors are widespread disorders that come at a significant expense to rectify, causing public health and economic problems. Myopia, astigmatism and hyperopia, the most frequent types of refractive error, are complicated multifactorial disorders whose incidence varies between groups of diverse ancestral origins (20).

In 2002 Eang-Mei Saw and colleagues conducted a about the prevalence of refractive errors in adults in Riau Province, Sumatra, Indonesia, including myopia, hyperopia, astigmatism, and anisometropia, 1043 adults aged 21 and over from five small towns in the countryside and one town in the province. The prevalence rates for myopia (as a spherical equivalent of at least -1.0 D), hyperopia (a SE of at least +1.0 D), astigmatism (a cylinder of at least -1.0 D), and anisometropia (diff in SE of 1.0 D) were found to be 26.1%, 9.2%, and 15.1%, accordingly, after age adjustment. Additionally, it was discovered that the adjusted prevalence rate of high myopia (defined as a spherical equivalent of at least -6.0 D) was 0.8%. Particularly, a multiple logistic regression model revealed that myopia rates varied with age and rose with increasing income levels. Furthermore, there was a significant increase in the rates of ametropia, astigmatism, and hyperopia among older persons (21).

Another study was carried out in 2021 by Faiz-Ur-Rab on refractive errors, ocular problems, and related risk factors among medical students. There were 377 participants in the study. The Chi-square when applied, with a significance level of p=0.05. 72 percent of the subjects had siblings or parents who had refractive defects. Myopia (52.3%) was the most common refractive defect among students, followed by hypermetropia (9.5%) and astigmatism (5.3%) (22).

Another study was conducted by Viviane Fernanda in Brazil investigating the relationship between electronic screen usage and eye health among Brazilian population. Among 200 questionnaires, the majority were from individual 18 to 35. Daily electronic devices usage varied across the patients. Mostly patients having Myopia and/or Astigmatism. This study examined the frequency of refractive errors in 185 patients, of whom 21 were emmetropic, 73 were myopic, 20 were hypermetropic, and 71 were astigmatic. Of the

entire value, 102 men accounted for 55.1 percent, while 44.1 percent of the value was made up of females (23).

Another study was carried out in 2021 by Faiz-or-Rab on refractive errors, ocular problems, and related risk factors among medical students. There were 377 participants in the study. To find out whether there was any correlation between the variables, the Chi-square test was applied, with a significance level of p=0.05. 72 percent of the subjects had siblings or parents who had refractive defects. Myopia (52.3%) was the most common refractive defect among students, followed by hypermetropia (9.5%) and astigmatism (5.3%). This study examined the frequency of refractive errors in 185 patients, of whom 21 were emmetropic, 73 were myopic, 20 were hypermetropic, and 71 were astigmatic. Of the entire value, 102 men accounted for 55.1 percent, while 44.1 percent of the value was made up of females. The patients which are older than 35 years or presbyopic , are excluded from this study (24).

A one-year prospective observational study in 2020 was conducted by Chi-wai Do, among children and adolescents in Hong Kong to examine the relationship between the amount of time spent on smart devices and changes in refractive error. ≤2 hours per day are advised for both gadgets. Participants, ages 8 to 14, from 15 schools in Hong Kong filled out questionnaires and had their health examined. Statistics on demographics, MVPA, and smartphone/tablet usage were collected. Biometry and an auto refractor are used to measure refraction. Sample: 10.87 years old, gender balanced. 40% of people used tablets for more than an hour a day, and the majority used cellphones for more than four hours. Baseline SER: left eye -1.64D, right eye -1.69D; follow-up after a year: left eye -1.84D, right eye -1.90D. The baseline and 1-year SER were adversely correlated with smartphone time (ps<0.001). Tablet use is related to 1-year SER (ps<0.05), with 2–3 hours per day being most strongly correlated with negative SER. There is no discernible correlation between the baseline device time and the SER change (25).

A study carried by Saoirse McCrann and his associates looked at the relationship between student's use of smartphones in elementary, secondary, and postsecondary education and myopia. Nearly all 418 of the total students questioned have smartphones (more than 99%). Students used their smartphones for around 265.5 minutes a day on average and consumed 800. 37 MB of data on them. When it came to smartphone data

usage, myopic pupils used almost twice as much as their non-myopic colleagues. On average , myopes used 1,130.71 MB per day, whereas non-myopes used 613.63 MB (26). This research demonstrates a correlation between myopic refractive error and increased daily digital device use, or increased screen time for patients who also have astigmatic patients. Numerous people reported feeling tired, red, and having blurry vision, among other symptoms. Unaware of their condition. Despite this, there was no significant difference in the amount of time the myopic and non-myopic patients spent on smartphones. There were approximately 73 myopic patients, 71 astigmatic individuals, and approximately 20 hyperopic patients. Furthermore, many of the patients expressed concerns about potential eye damage from digital technologies.

Conclusion

The study's findings showed that participants had a high prevalence of both myopia and astigmatism, with 39.5% and 38.4% of them affected, respectively. These findings indicate that nearly 80% of the cohort experienced either myopia or astigmatism, reflecting a significant burden of these refractive errors within the studied population. In contrast, emmetropia and hyperopia were less prevalent, affecting only 11.4% and 10.8% of participants, respectively.

The gender distribution slightly favored males, who constituted 55.1% of the sample. This demographic detail, while not the primary focus, provides context for understanding potential variations in visual health trends within different gender groups.

The high rates of myopia and astigmatism highlight the urgent need for targeted interventions, including regular eye examinations and preventive measures, to address these common refractive errors. The results also highlight the significance of additional investigation into the effects of extended screen time on eye health. Such research could inform strategies to reduce the prevalence of these conditions and improve visual outcomes, potentially by exploring factors such as screen time duration, ergonomics, and lifestyle adjustments.

Recommendation

- Encourage regular eye checkup for individuals with prolonged screen exposure.
- Educating the public, especially the parents, about the importance of monitoring screen time for children to prevent eye issues.

- Research ought to be done to determine the benefits of anti-reflective coating and blue light filters for various refractive errors.
- Study on 20-20-20 rule should be carried out to understand its effect on different refractive errors.
- Proper interval of rest after prolonged use of eye in front of the screen must be monitor to observe its effect on the eyes visual acuity and contrast.
- A prolonged study must be carried out to deeply understand the frequency of different refractive errors.
- A study on the administration of different artificial eye drops must be conducted to monitor their effect on different refractive errors.
- Keep a good distance, posture from the screen of 20 to 40 inches or use large monitors.

Limitations

- Given that this study was done over a four-month period, longer-term results may be more encouraging.
- This study only included age group of 18 to 35 years as the age increases presbyopia might developed which effect this study.
- The data was self-collected based on eye camps held by undergraduates so the data reported might have some errors.
- This study exclude strabismus, cataract and presbyopic patients and also diabetic patients were excluded.

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