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Prevalence of Refractive Errors among Adolescents and Young age groups attending Outpatient Department in a Tertiary Care Hospital in Assam

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ABSTRACT

Aims & Objectives: - To study the prevalence of the Refractive Errors among the patients attending O.P.D. of Assam Medical College & Hospital, Dibrugarh.
Materials & Methods: - This is a Prospective Study conducted on **1,000** participants from **September ,2023 to October, 2024**.The study was executed based on the OPD procedures, Darkroom procedure, Ophthalmic Examinations and so on.
Result: - A total numbers of **1,000** patients were enrolled in the study, out of which **414 (41.4%)** patients were having myopia,**198 (19.8%)** had astigmatism, **104 (10.4%)** having combined myopia and astigmatism, **102 (10.2%)** patients had hypermetropia and **42 (4.2 %)** patients were having combined hypermetropia and astigmatism. The prevalence of Refractive Errors was observed to be elevated in the **20-29** years of age group. The prevalence of Refractive Errors was observed to be elevated among the males.
Conclusions: - The prevalence of Refractive Errors is greater in males than in female and myopia is the most type of refractive error in this study.

Keywords*: Refraction, Refractive Errors, Myopia, Astigmatism, Assam*

1. INTRODUCTION:

The human eye is an Optical device [1] that is comparable to a camera as it is a shutter of the camera[2,3]. the cornea and crystalline lens function as the eye's focusing apparatus, the iris act as diaphragm that regulates the amount of light that entering the eye by controlling the pupil's size[2,4], the choroid contributes to creating the darken interior of the camera and the retina works like a light-sensitive medium, forming images on it[4,5].

Together, these components make up a homocentric system of lenses that, when activated, provide a powerful system with a small focal length[6,7]. The cumulative dioptric power of the eye is approximately **+58 D**, out of which the crystalline lens contributes **+15 D** and the cornea contributes around **+43 D**.

Definitions of Refractive Error: -

Problems in properly directing light onto the retina as a result of the eye's shape are known as refractive errors.[1] Myopia (nearsightedness), hypermetropia (farsightedness), and astigmatism are the three most prevalent forms of refractive error. By definition, emmetropia is a refractive condition in which the accommodation is at rest and the retina is focused on by parallel beams of light from infinity [2,3].

A distant object can be clearly seen by an emmetropic eye without the need for correction of internal optics[4,5]. Most of the emmetropic eyes have an axial length of about **24 mm.** If the optical components of a larger eye are weaker, an eye may be emmetropic; conversely, if the optical components of a smaller eye are stronger, it may also emmetropic.

Myopia, hypermetropia, and astigmatism are all forms of ametropia, a refractive disorder in which parallel light beams from infinity, with accommodation at rest, concentrate either front or back on the retina along one or both meridian lines.[2,3] As the eye adjusts to nearsightedness, nearsightedness causes parallel beams of light from infinity to concentrate in front of the retina.

Symptoms of asthenopia might manifest in patients with mild myopia. Eyes with myopia tend to be big and noticeable, with a deep anterior chamber, a slow-moving pupil, a normal fundus, an occasional crescent in the middle of the eye, and an error of no more than **6** to **8** diopters.[2,3]

Variable refraction along one meridian characterizes astigmatism, a refractive defect. As a result, the arrival of light into the eye is not possible at a point focus but rather requires a focal lens. The symptoms of regular astigmatism include blurred vision, things looking proportionally longer than they really are, dull eye discomfort, headaches, early eye fatigue, nausea, and sleepiness, as well as frequent shifts in the uniform from one refractive power meridian to another[3,5].

The right to sight initiative of Vision 2020 was mentioned that in 1999 the goal of eliminating avoidable blindness by prioritizing a few particular cases of vision impairment and blindness based on their distribution, impact on the community, management potential, and affordability. Refractive error is a major cause of blindness out of priority issues.[9] Refractive error is one of the most common cause of visual impairment, accounting for 47% of all cases of vision impairment in developed countries. In developing countries, refractive error is one has a substantial impact, perhaps resulting in decreased economic production.[10]

Refractive error affects people's lives in all age groups. It causes difficulties in performing regular tasks, decreasing their vision and eventually causing blindness.

Children are reported to be the most vulnerable segment of the population, with many suffering from vision impairment throughout their lives. Refractive error has gotten a lot of attention in the last two decades, with school-aged children being at a larger risk than the rest of the population.[9]

Epidemiology: - According to the most recent global estimates, **12.8** million children between the ages of **9** and **15** suffer from refractive error related visual impairment.[9]

In India, around **17.43%** of cases include myopia, hyperopia, or astigmatism; however, the incidence is **22.14%** in urban areas and **12.71%** in rural areas.[11]

In the Western countries, the incidence of refractive error among young individuals and adolescents ranges from **16.4%** to **26.6%,** whereas in Asian countries it ranges from **19.4%** to **48.1%.**[12]

Purpose of the Study: -To identify and diagnose the type of Refractive Errors in this region. After diagnosis it can be enhanced patient comfort and can be prevented blindness. In this study it can also be identified the possible causes of refractive error as some causes of refractive error are preventable. Preventable causes of refractive error can be controlled by awareness and by other preventive measures. It will help to protect the patients from potential consequences, such as irreversible vision loss if left untreated.

2. MATERIALS AND METHODS: -

Aims and Objectives: -

a. To determine the Prevalence of refractive error.
b. To evaluate the distribution of refractive error according to age and sex.
c. To identify the different types of refractive errors among Research groups.

Methodology: - We randomly selected **1,000** patients from the Out Patient Department of Ophthalmology of Assam Medical College & Hospitals, Dibrugarh, Assam. The patient attending in the Outpatient department of Ophthalmology were taken for sample of the study after fulfilling inclusion and exclusion criterias. The diagnosis confirmed by history and clinical examination. Diagnosed cases of refractive error were tabulated according to age, sex, laterality, education, occupation, type of refractive error, type of management and visual outcome after correction.

Inclusion Criteria: -

d. Various Categories of Refractive Errors.
e. Patients aged between 10 and 39 years.
f. Both genders.
g. Informed consent.

Exclusion Criteria: -

h. Individuals under 10 years and over 39 years of age groups.
i. Patients with corneal ulcers, corneal opacities, fundus pathologies, ocular injuries and cataract.
j. Any additional diseases that impact visual dysfunctions including neurological visual impairment.
k. Any infectious conditions.
l. Any tumours and malignant conditions.
m. Patients undergone any intra-ocular and extra ocular surgery.
n. Allergic to **1%** Atropine, **2%** Homatropine and **1%** Cyclopentolate, among others.

Type of study: - Hospital Based Prospective Study.
Place of Study: - Department of Ophthalmology, Assam Medical College & Hospital; Dibrugarh, Assam.
Study Duration: - **14** Months.

Patient Population: - Total **1,000** Patients attending O.P.D. (Out Patient Department) of the Ophthalmology Department of the Assam Medical College & Hospital, Dibrugarh; Assam.

Screening Of Patients: - Individuals at the age groups of 10-39 years who presented with the Symptoms and Signs of the Refractive Errors without Presbyopia like Headache, Eye ache, Difficulty of vision for both the distance and near, blurring of vision, watering, tiredness, diplopia, irritation, ocular discomfort and foreign body sensation were selected.

Patient History: - Symptoms: -

a) Current Symptoms: - Dizziness, blurred vision, headache, eye pain, redness, discharge, burning feeling, itching, irritation, foreign body sensation, blurred vision (both far and near), amblyopia, diplopia, etc.
b) Factors that Make Things Worse: - using computers and laptops for long spans of time, using smartphones too much, reading in low light, traveling by air, wind, decreased humidity, working indoors with dim light, etc.
c) Details of the patient's eye history, including: - the use of any topical drugs, the use of contact lenses, any history of allergic ocular disorders, any cataract surgery, refractive operations, keratoplasty, etc.
d) Information Regarding Past Medical Conditions: - Double vision, amblyopia, diabetes, hypertension, Sjogren's syndrome, bell's palsy, seizures, tumors, fundus pathology, eyelid hygiene, adnexal illnesses, and any neurological or endocrine abnormalities.
e) Details of Your Work History: - Educational background (elementary, middle, and high school), graduation, post-graduation coursework, and any other credentials you may have.

Examination of Refractive Errors: -

Refractive error was diagnosed by visual acuity assessment, external ocular examination, Slit Lamp Examination, fundus examination, tonometry, pin hole test and autorefraction. All the diagnosed cases were done refractive correction in the refraction room.

3. RESULT AND OBSERVATIONS: -

We included a thousand participants in our research who were showing signs of refractive error. There were **860** patients that tested positive for refractive error out of **1,000** patients during the screening process.
The greatest proportion among them About 39.53% of the patients were in the age group 20-29, 36.04% were in the age group 30-39, and 24.41% were in the age group 10-19.

Table1: - Age Distribution.

Age groups	Total samples	Affected samples	Affected percentage
10-19 years	284	210	24.41
20-29 years	390	340	39.53
30-39 years	326	310	36.06
TOTAL	**1,000**	**860**	**100**

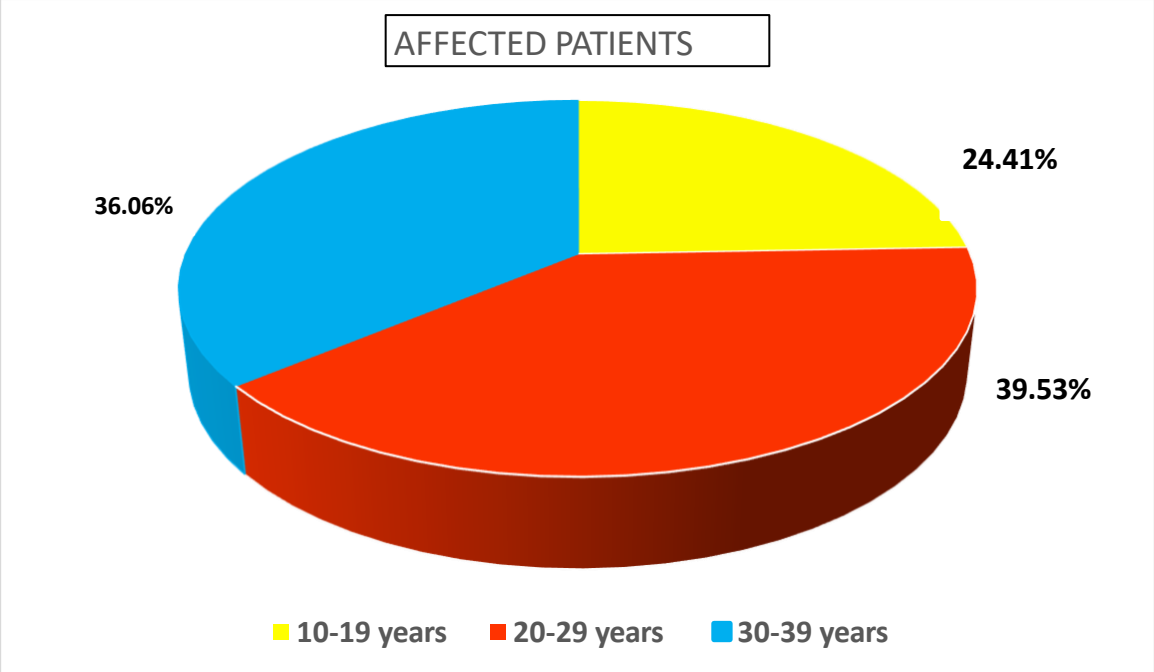

Fig.1:- Distribution of affected samples with Refractive Error among the various age groups

Among all patients, **519** patients were male and **481** patients were female (**M: F= 1.07: 1**). Among the impacted patients **483** were male and **377** were female (M: F=**1.28: 1**).

Table 2: -Gender Distribution.

Gender	**Total sample**	**Affected sample**	**% (Percentage Affected**	**RATIO M:F**	
				Total sample	Affected sample
Male	519	483	56.17	1.07:1	1.28:1
Female	481	377	43.83		
Total	**1,000**	**860**	**100 %**		

Statistical Analysis:-

Chi-square test was performed to compare the prevalence between males and females.

Chi-square (χ^2) = **45.21** Degrees of freedom = **1** p-value = **1.77×10^{-11}**

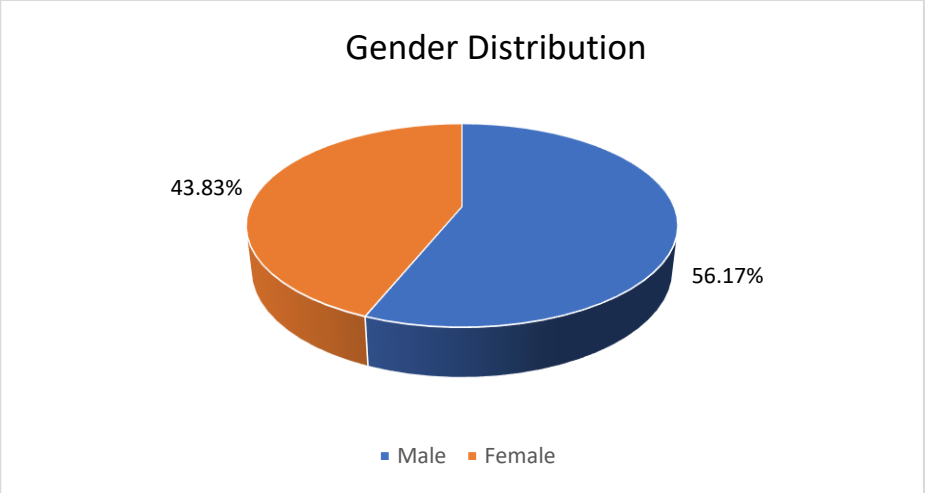

Fig. 2. Distribution of affected samples with Refractive Error among the various gender groups.

Among the study patients, **344 (34.40 %)** had headache, **52 (5.20 %)** had eye ache, **228 (22.80 %)** blurring of vision, **282 (28.20 %)** watering, **49 (4.90 %)** foreign body sensation, **27 (3.56 %)** E.N.T. problems, etc.

Table 3: -Frequency of symptoms among the affected populations with Refractive Error at first presentation.

Symptoms	Total numbers	% (Percentage)
Diminution of vision	495	49.50%
Headache	344	34.40%
Eye ache	52	5.20%
Blurring of vision	228	22.80%
Watering	282	28.20%
Foreign body sensation	49	4.90 %
Any E.N.T. Problem	27	3.56 %

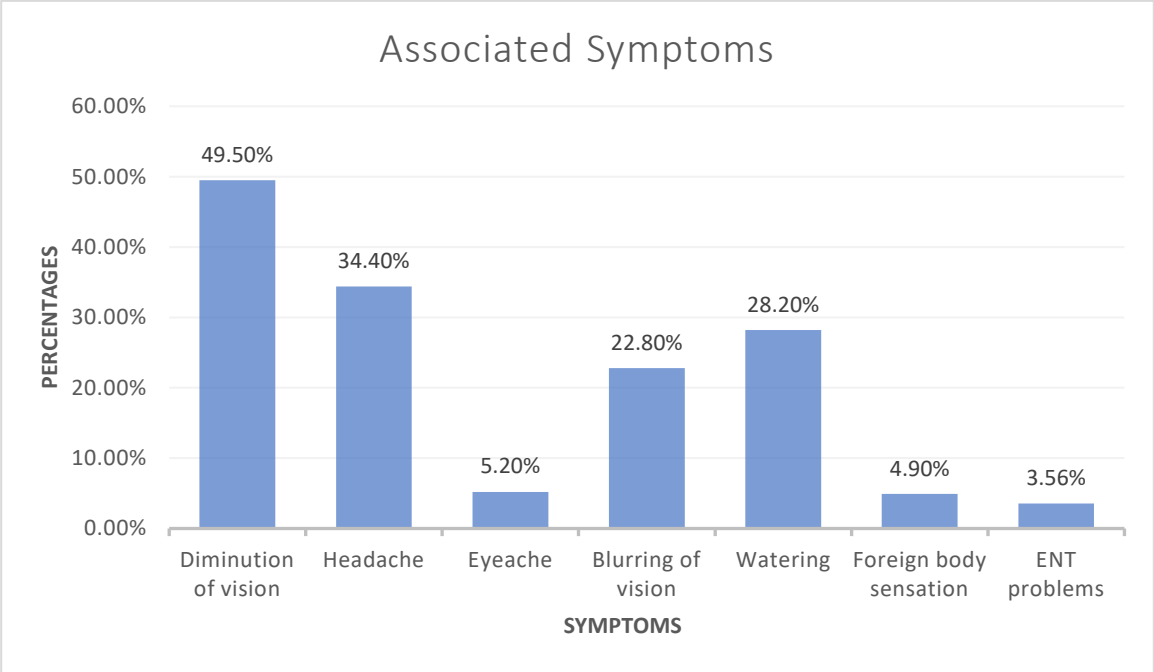

Fig. 3:- Frequency of symptoms among the affected populations with Refractive Error at first presentation.

Among the study patients, **38.00%** were Graduate, followed by **23.20%** had secondary schooling, **15.0%** had higher secondary Education, **9.90%** were post graduate, **7.90%** had primary education.

Table 4: Educational status among the affected patients.

Educational status of the patients	No. of total Sample	% (Percentage)
Elementary Education	79	7.90 %
Secondary Education	232	23.20%
Senior secondary	150	15.00 %
Graduation	380	38.00%
Post -graduation	99	9.90%
Others	60	6 .00%
TOTAL	**1,000**	**100**

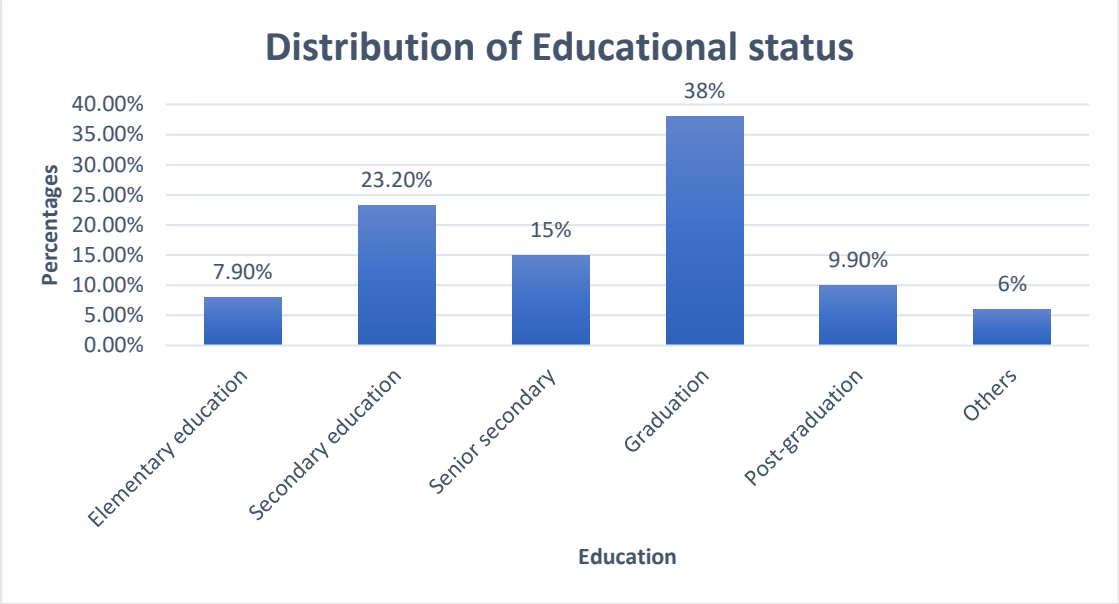

Fig. 4: - Educational attainment of the affected patients.

Among the study patients, majority were homemakers (**10.00%**), followed by Teachers (**5.70%**), Businessmen (**5.20%**), Professionals (**6.90%**), Labourers (**3.30%**), Shopkeepers (**4.80%**) and Cultivators (**3.10%**)

Table 5: -Occupational status among the affected patients.

Occupational status	**No. of total sample**	**% (Percentage)**
Professional	69	6.90%
Teachers	57	5.70%
Cultivator	31	3.10%
Labourer (daily earner)	33	3.30%
Homemaker	100	10.00%
Businessman	52	5.20%
Shopkeeper	48	4.80%
Others	610	61.00%
TOTAL	**1,000**	**100%**

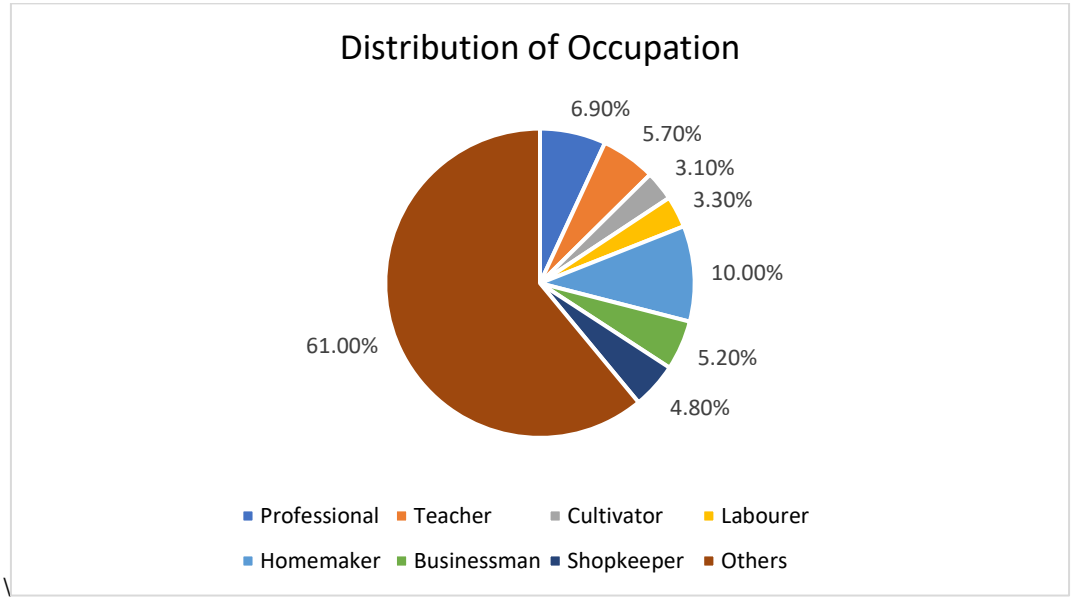

Fig. 5: - Occupational status among affected patients.

In this study distribution of Refractive error according to Occupation were- Professional (6.90%), Teachers (5.70%), Cultivator (3.10%), Labourer (daily earner) (3.30%), Homemaker (10.00%), Businessman (5.20%), Shopkeeper (4.80%) and Others (61%)

Table 6: -Distribution of Refractive Error

Type of refractive errors	Affected patients		Total	% (Percentage)
	Male	Female		
Emmetropia	36	104	140	14%
Myopia	209	205	414	41.4%
Combined myopia and astigmatism	80	24	104	10.4%
Hypermetropia	60	42	102	10.2%
Combined hypermetropia and astigmatism	24	18	42	4.2%
Astigmatism	110	88	198	19.8%
Total	**519**	**481**	**1,000**	**100%**

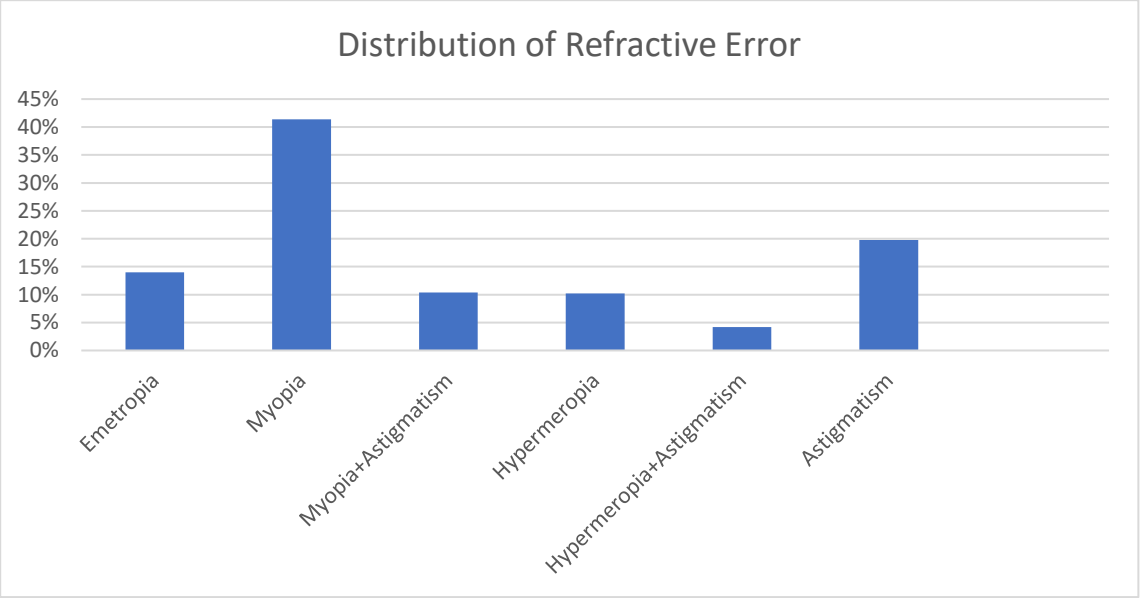

Fig. 6: - Distribution of types of Refractive Error.

Among the total, **14.00%** (**140** out of **1,000**) of patients exhibited Emmetropia, followed by **10.40%** (**104** out of **1,000**) with Combined Myopia and Astigmatism. Additionally, **41.40%** (**414** out of **1,000**) had Myopia, **10.20%** (**102** out of **1,000**) presented with Hypermetropia, **4.20%** (**42** out of **1,000**) had Combined Hypermetropia and Astigmatism, and **19.80%** (**198** out of **1,000)** were diagnosed with only Astigmatism.

Table 7: -Distribution according to most preferred Leisure time activities.

Leisure time Activity	No of total sample	% (Percentage)
Smart phone	905	90.50%
PC/ Laptop	352	35.20%
TV	614	61.40%
Embroidery	17	1.70%
Reading	781	78.10%
Sports	580	51.00%

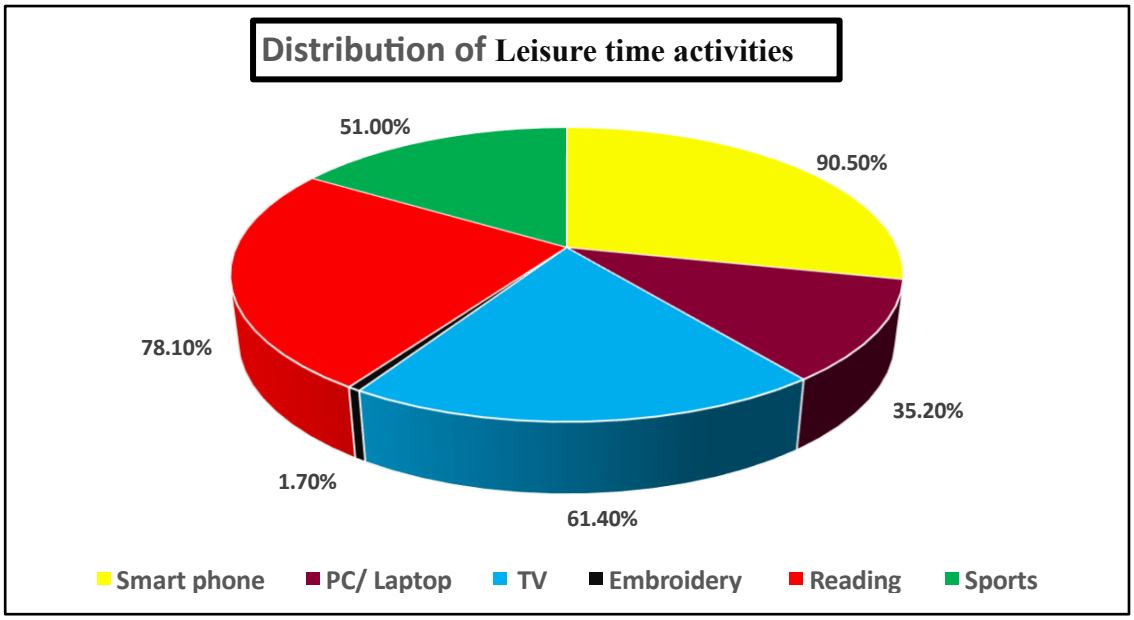

Fig. 7: -Most preferred Leisure Time Activities Among the Study Patients.

Among the study patients, (**90.50%**) preferred the usage of smart phone during their leisure time, followed by TV (**61.40%**), Embroidery (**1.70%**) Laptop/PC (**35.20%**) Reading (**78.10%**) and Sports (**51.00%**).

Table 8: - The distribution showing a statistically significant difference between genders in terms of type of refractive error.

Refractive Error Type	Male (n=519)	Female (n=481)	Total (N=1000)
Emmetropia	36 (6.9%)	104 (21.6%)	140 (14.0%)
Myopia	209 (40.3%)	205 (42.6%)	414 (41.4%)
Combined Myopia + Astigmatism	80 (15.4%)	24 (5.0%)	104 (10.4%)
Hypermetropia	60 (11.6%)	42 (8.7%)	102 (10.2%)
Combined Hypermetropia + Astigmatism	24 (4.6%)	18 (3.7%)	42 (4.2%)
Astigmatism	110 (21.2%)	88 (18.3%)	198 (19.8%)

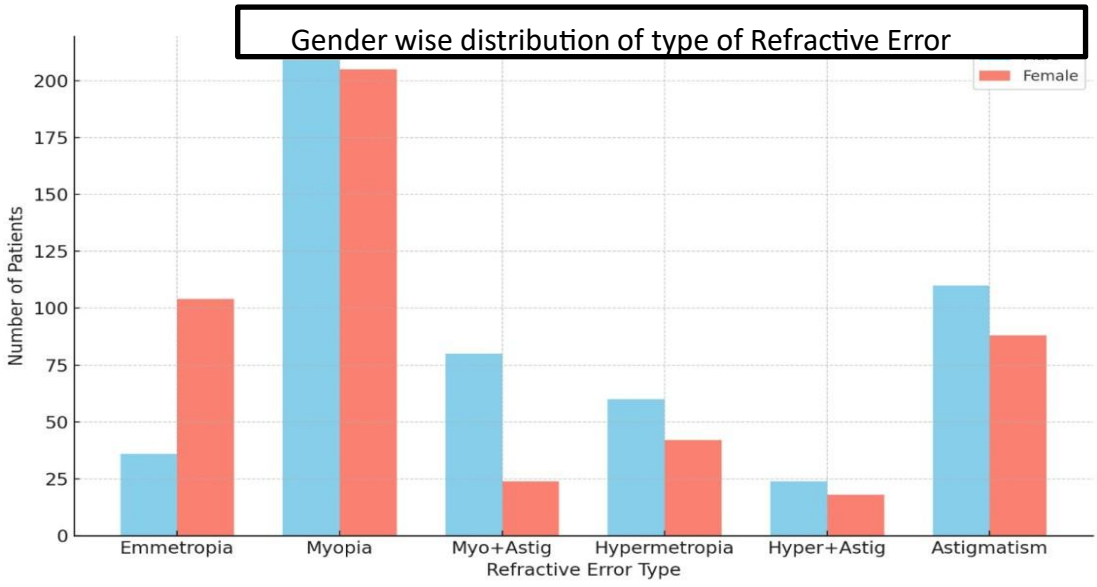

Fig. 8:- The chart displays the number of patients with various refractive errors including Myopia, Hypermetropia, Astigmatism, and combinations, categorized by sex.

Statistical Analysis: -
Chi-square test was performed to assess the association between gender and severity/type of refractive error.
Chi-square (χ^2) = **68.35**
Degrees of freedom = **5** p-value = **2.25×10^{-13}**

4. DISCUSSION: -

Refractive errors are the leading cause of visual impairment at global level. It is reported that 101.2 million people have visual impairment worldwide due to refractive error[13,14]. Uncorrected refractive errors are the second leading cause of blindness globally. It is estimated that 6.8 million people are blind globally due to refractive errors[13,14]. The prevalence of refractive errors is 56% in India[15] and in Saudi Arabia the prevalence of refractive error is 58.6%[16]. Based on our findings, **86.00%** of patients have refractive error. A study conducted by Muthu (2015) where mentioned 84.49% refractive error of among studied populations which is almost similar to our study.[17]

Refractive errors vary across different nations and regions which is likely due to differences in lifestyle, environmental factor, genetic predispositions and ethnicity.

In this study patients with the refractive error were more likely to be male. It was observed that **56.16%** were male and **43.83%** were female and male female ratio was 1.28:1. Muthu (2015) also observed refractive error in 46.4% young female and 53.6% young male.[17] In a study conducted in general population in the north of Portugal where gender distribution found as 48% males and 52% females.[18] There is another study done by Mohammad (2023) on refractive error in relation to age and sex where reported refractive error 57.5% in male and 42.5% in female.[19] According to a national blindness survey conducted in Ethiopia in 2006, refractive error was found to be the second leading cause of visual impairment, accounting for 33.4%.[20] It was observed that there was no significant gender differences in this study as well as different studies.

In the present study refractive error were most common in the age groups **20–29** years **(39.53%),** followed by **30-39 (39.53%)**. Kumarswamy et al (2016) was conducted a study on refractive error where mentioned large number refractive error cases in age group between 20 to 35 years (33.33%) and 31 to 35 years (33.33%).[21] Mohammad (2023) was mentioned the mean age of female was 25.5 years and female was 24.4 years. In this research as well as in different researches it has been observed that maximum cases middle aged person has higher percentage of refractive error.[19]

For patients with refractive error, this research indicated that blurred vision (**49.50%** of patients) was the most common symptom at the time of presentation followed by headache (**34.40%** of patients). Patients with a secondary education level of **30.89%** had the most severe refractive error in this research, followed by those with a graduation level of **30.89%**. Patients with a refractive error of **10.00%** had the largest concentration of housewives in our research. In our research, among individuals with refractive error, the most popular pastime was using a smartphone **(90.50%),** followed by reading **(78.0%)** and watching television **(61.40%).**

The prevalence of myopia is very high particularly in East Asia which is increasing and similar trends.[22,26] As per different studies the hot spots of myopia are East and South East Asia and involved countries such as Korea[23], Taiwan[24], Singapure[25], China[26], and Japan[27] have significant number of myopia where prevalence is 80 to 90%. Our results show that myopia accounts for **41.40%** of cases, with astigmatism coming in at **19.80%** and combined myopia and astigmatism at 10.40 percent. Myopia prevalence is rising and the USA has reported a prevalence of myopia **42%** which is almost doubling in three decades.[28] There is a clear gender-based variation in refractive errors, with males than females showing higher rates of myopia, hypermetropia and astigmatism.

The prevalence of myopia is increasing globally and myopia is reaching epidemic proportions and emerging public health challenges[29]. It has been estimated in recent projects that by 2050 around 5 billion (50%) people of the world will suffer from myopia.

5. CONCLUSION: -

Ultimately, among the people surveyed, refractive error is the leading cause of visual impairment. Among refractive errors, myopia with astigmatism is the most common, followed by myopia alone and astigmatism alone. Myopia and other forms of refractive error are more prevalent in females than men among young individuals, especially among students. As a result, people may experience a decline in their quality of life, financial stability, and access to education. The early onset or worsening of refractive error is a major worry, and younger generations may be at increased risk due to their propensity to work closely together or use smartphones and other high-tech gadgets in low light.

The difference in prevalence of refractive errors between males and females is statistically significant, with males having a higher prevalence in the studied population. There is a strong and statistically significant association between gender and the type of refractive error.

Squint and amblyopia (lazy eye), which are problems that are difficult to address once they have established, may be caused by uncorrected refractive error. Thus, it is crucial to promptly detect and treat refractive errors, which can cause blurred vision and other symptoms like headaches and ocular discomfort, in order to prevent future cases of blindness. Regular vision and refractive error exams should be conducted on school-aged children, adults in service, and working women.

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