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Distribution of refractive errors among younger population in Rohilkhand area of Uttar Pradesh

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Abstract
Introduction: Refractive error is among easily detectable cause of visual impairment. It constitutes bulk of avoidable and easily treatable causes of blindness in younger population. Aim of this study was to know the distribution of refractive errors.
Method: This study was conducted on patients aged between 5 to 35 years in Rohilkhand region, U.P. 2404 subjects of refractive error were studied 964 Male and 1440 Female. Statistical Analysis was done using Chi Square test and SPSS version 22.
Results: Mean age of Male and Female patients were 22.44 and 24.28 years respectively. Refractive error was more common in females 59.9% as compared to males 40.1% in a ratio 3:2. Females were having myopia in higher percentage 46.26% in comparison to males where percentage was 33.79%. Maximum refractive error cases were noticed in age group of >10-20yrs (39.3%) followed by >20-30yrs (28.3%), then >30-35yrs (26.1%) and least in 5-10yrs age group (6.4).
Conclusion: Overall refractive errors were more common in Females than Males in our study. This can be due to Females being more exposed to screen and involved in finer work like knitting. According to our study, groups with maximum Refractive error cases are our future generation of >10-20 yrs age group (39.3%) followed by high productive age group >20-30 yrs (28.2%). Both these groups jointly cover bulk of studied sample i.e. 67.5%. Thus by providing them with regular eye checkups and refractive errors correction, we can help in raising socio-economic status of our society.

Keywords: refractive error, hypermetropia, myopia, astigmatism

1. Introduction
Refractive error is among one of the causes of avoidable blindness in the world. In India it has become the second most common cause of preventable blindness. Here it is knowingly or unknowingly neglected people in our society. It is of three types: Myopia, Hypermetropia and Astigmatism [1] Most refractive errors are correctable with glasses, contact lens etc.
Worldwide around 2.3 billion people are living with this disorder. The impact of Refractive error in physical and mental development cannot be ignored. Keeping this in mind this study was carried out to determine age wise distribution of refractive errors among younger population.

2. Materials and Methods
A prospective study of 2404 (964 Male and 1440 Female) subjects aged between 5 to 35 years having any type of Refractive error was carried out in Ophthalmology department from 01-09-2018 to 29-02-2020. Demographic indices including age, sex, address, educational and socioeconomic status were recorded. Relevant personal and family history was taken. Cases having Refractive error who have given consent for examination were included in the study.
An optometrist took visual acuity of the patient first with naked eye, then with pinhole or glasses in those wearing glass. Snellen's chart was used for distant visual assessment. Then auto-refractometry and wet retinoscopy was done for objective Refraction followed by subjective refraction. Subsequently, fundus examination, extra ocular movements, cover test and pupillary reaction were done in all the cases.

2.1 Inclusion criteria
Age 5-35 years
Cooperative patient
Patients having purely refractive error (to exclude Presbyopia age group chosen 5-35 years)

2.2 Exclusion criteria
Any other causes of diminution of vision like corneal opacity, Squint, Cataract, Iridocyclitis, Glaucoma, Retinopathy, Aphakia, Pseudophakia, Presbiopia.
The following definitions were used to classify the refractive error
A-Hypermetropia: This was further classified as low Hypermetropia (≤+2.00 D), moderate Hypermetropia (+2.00 D to + 5.00 D) and high Hypermetropia (≥+5.00 D)
B-Myopia: This was further classified as low Myopia (≤-3.0 D), moderate Myopia (-3.00 D to -6.00 D) high Myopia (≥-6.00 D).
C-Astigmatism: Any cylindrical error. It was further classified as simple Astigmatism, compound Astigmatism and mixed Astigmatism.
Astigmatism was further divided as 'with the rule' Astigmatism when Myopic Astigmatism at $180^0 \pm 20^0$ or Hypermetropic Astigmatism at $90^0 \pm 20^0$ and 'against the rule' Astigmatism when Myopic Astigmatism at $90^0 \pm 20^0$ or Hypermetropic Astigmatism at $180^0 \pm 20^0$. Astigmatism at

$>20^0$ to $<70^0$ or $>110^0$ to $<160^0$ was considered as oblique Astigmatism.

Prior approval of Institutional Ethics Committee was taken. Interpretation and analysis of obtained data was carried out using SPSS version 22. For descriptive statistics Chi Square test was used to explain qualitative data. Data with value less than 0.05 were considered statistically significant.

3. Results

Mean age of Male patients was 22.44 years +0.62 SD and that of Female subjects was 24.28 years +0.50 SD. As shown in Table -1 Refractive error was more common in Females (59.9%) as compared to Males (40.1%) in a ratio 3:2. Females were having Myopia in higher percentage 46.26% in comparison to males where percentage was 33.79%. Similarly, Hypermetropia was common in females 12.15% against Males where it was 5.66%. as shown in Figure -1 Maximum percentage of Refractive error cases were noticed in age group of >10-20yrs (39.3%) followed by >20-30yrs (28.3%), then >30-35yrs (26.1%) and least in 5-10 yrs age group (6.4%). Only in age group of 5-10 years Male child had more Refractive error than Females. The results thus obtained were statistically significant <0.05 by chi square test and SPSS version 22.

Table 1: Age wise and sex wise Distribution of Refractive Errors

Age group (years)	Male	Female	Total
5- 10	88(3.7%)	64(2.7%)	152(6.4%)
>10-20	380(15.8%)	564(23.5%)	944(39.3%)
>20-30	280(11.6%)	400(16.6%)	680(28.2%)
>30-35	216(9%)	412(17.1%)	628(26.1%)
Total	964(40.1%)	1440(59.9%)	2404(100%)

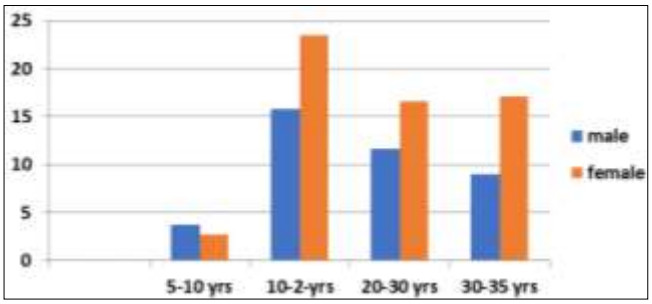

Fig 1: Age wise and Sex wise distribution of Refractive Errors

As shown in Table-2 Myopia were the most common Refractive error (80.03%) which most commonly occur during adolescent period (20.30%) and simple in nature. Mixed Astigmatism (2.16) was least common Astigmatic error.

Table 2: Distributions of Various Refractive Errors in Different Age Group

Age group (Years)	Myopia			Hypermetropia			Mixed Astigmatism	Total
	SM	SMA	CMA	SH	SHA	CHA	MA	
5-10	48 (2%)	28 (1.20%)	Nil	40 (1.66%)	8 (0.33%)	16 (0.67%)	12 (0.50%)	152 (6.36%)
>10- 20	488 (20.30%)	188 (7.80%)	128 (5.32%)	104 (4.33%)	16 (0.67%)	12 (0.50%)	8 (0.33%)	944 (39.25%)
>20- 30	344 (14.31%)	176 (7.30%)	84 (3.50%)	56 (2.33%)	12 (0.50%)	Nil	8 (0.33%)	680 (28.26%)
>30-35	160 (6.65%)	180 (7.49%)	100 (4.16%)	136 (5.66%)	16 (0.67%)	12 (0.50%)	24 (1.00%)	628 (26.3%)
Total	1040 (43.26%)	572 (23.79%)	312 (12.98%)	336 (13.98%)	52 (2.16%)	40 (1.67%)	52 (2.16%)	
Grand total	1924 (80.03%)			428 (17.81%)			52 (2.16%)	2404 (100%)

As shown in figure-2 the simple Myopia (43.26) was most commonly and compound Myopic Astigmatism (12.98) was least one occur in myopic patient.

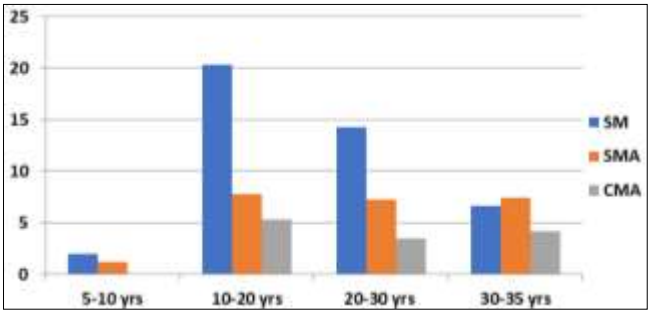

Fig 2: Distribution of type of Myopia with age

As shown in Figure-3 the simple Hypermetropia (13.98) was most commonly and compound Hypermetropic Astigmatism (1.67) was least one occur in Hypermetropic patients.

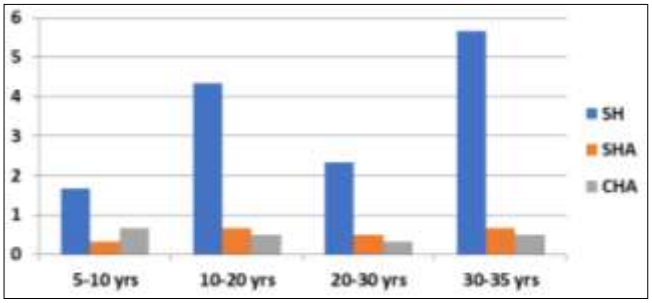

Fig 3: Distribution of type of Hypermetropia with age

As shown in Table-3 and Figure -4 simple Myopia and simple Myopic Astigmatism was more common in male but compound Myopic Astigmatism was more common in Male.

Table 3: Gender-wise distribution of Myopia

Refractive error	Type of error	Male	Female	Total
Myopia	Simple Myopia (SM)	404 (16.80%)	636 (26.46%)	1040 (43.26%)
	Simple Myopic astigmatism (SMA)	216 (8.98%)	356 (14.81%)	572 (23.79%)
	Compound myopic astigmatism	192 (7.99%)	120 (4.99%)	312 (12.98%)

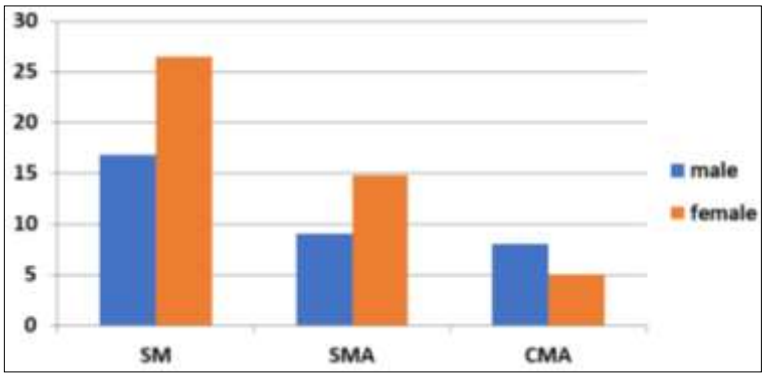

Fig 4: Gender-wise distribution of Myopia

As shown in Table-4 and Figure - 5 all type of Hypermetropia was more common in Female.

Table 4: Gender-wise distribution of Hypermetropia

Refractive error	Types of error	Male	Female	Total
Hypermetropia	Simple Hypermetropia (SH)	104 (4.33%)	232 (9.65%)	336 (13.98%)
	Simple Hypermetropia Astigmatism (SHA)	20 (0.83%)	32 (1.33%)	52 (2.16%)
	Compound Hypermetropia Astigmatism (CHA)	12 (0.50%)	28 (1.17%)	40 (1.67%)

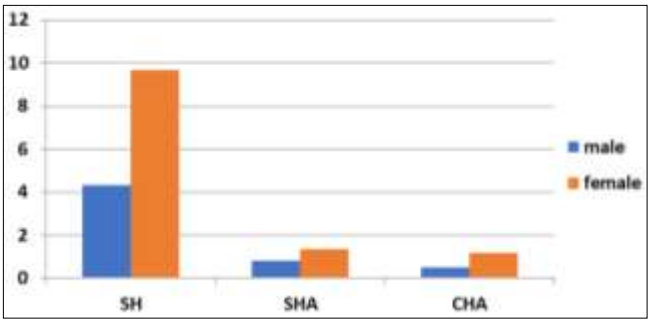

Fig 5: Gender-wise distribution of Hypermetropia

As shown in Table -5 mixed Astigmatism was least entity in Refractive error (2.16%) and it is more common in Female.

Table 5: Gender-wise distribution of Astigmatism

Refractive error	Male	Female	Total
Mixed Astigmatism	16 (0.67%)	36 (1.49%)	52 (2.16%)

Discussion

Our study of distribution of Refractive error among population in Rohilkhand area of Uttar Pradesh showed the predominance of refractive error in Females (59.9%) than Males (40.1%). As out of 2404 studied cases 1440 subjects were Females while 964 cases were Males. This may be due to Females being more health conscious and aware of their visual acuity. Also, Females are now getting more opportunity to study thus more Female cases could be detected. There are evidences for both Genetic and Environmental influence on Refractive error development [2, 3, 4]. Though specific risk factors are still unknown, few studies suggested influence of excessive reading & writing on Hypermetropia [5, 6, 7]. Worldwide around 2.3 billion people are living with this disorder [8] (uncorrected Refractive error) Realizing the need of early detection of Refractive error, World health organization (W.H.O) has adopted Refractive error correction of needful population in all the countries as main priorities in its goal of "vision 2020: the right to sight" initiative [9, 10].

In a population-based study done by Dulani N *et al* in Jaipur Rajasthan [11] female preponderance was seen. Other population-based studies done by Pavithra MB *et al* in Banglore [12] and Prema N *et al*. in Tamilnadu [13] also reported that females were more affected by refractive errors justifying present study. It may be due to tendency of Males to show superiority that I don't require any visual aid and neglecting their problem.

Regarding age distribution maximum percentage of Refractive error cases were reported in >10 -20 years age group 39.3% (Males 15.8% & Female 23.5%). This age group is affected much due to maximum growth and development of body parts in childhood coupled with more study burden and larger exposure to electric gadgets (mobile & smartphone) and screens (Television, LED TV., Laptop etc.). It may also be related with malnutrition in the form of fast food in urban population and poor nutrition in rural population. Comparable results were reported by KALIKIVAY V *et al* in Hyderabad [14], Yamamah GA *et al* in Egypt [15]. Pavithra MB *et al* in Bangalore [12] and Hashem H *et al* in Iran [16]. This association was found to be statistically significant.

The association of refractive error especially Hypermetropia with parents education was also found. This matches the New Delhi survey [17, 18]. As studied area is a big industrial and educational hub, the parent's here are more aware so more children are examined and more cases of Refractive error are detected.

In the present study the prevalence of Hypermetropia was 80.03%, Hypermetropia 17.81% while mixed astigmatism 2.16%. Many studies done in several Countries throughout the world including India reported Hypermetropia as the most common refractive error [1, 17] as in existing study. Similar results showing Hypermetropia as the most common refractive error (68.2%) followed by Hypermetropia (27.4%) seen in Nepal medical college study [19] and study of south India [20].

In our study Hypermetropia was more common among females (46.26%) while males were having Hypermetropia in 33.77% cases. On the other hand Hypermetropia was

more common in Females (20.2%) against Males (14%). Similar results were claimed in studies of Singapore [21, 22].

5 Conclusion

Overall Refractive error was more common in Females than Males in our study. This can be due to Females being more health conscious and Males often neglect their problems. Also, now parents are more educated and thus girls are getting more opportunity to study thus more female cases could be detected. Routinely all patients with complain of headache should be advised to consult Ophthalmologist to rule out Refractive error. Refractive errors are also most common in 11-20 years age group. This is result of more study burden over this age group and their larger exposure to electronic gadgets and screens. According to our study, groups with maximum Refractive error are our future generation of 11-20 yrs age group and high productive group of age between 21-30 yrs. Thus, if we could provide them with regular eye checkups and correct their Refractive errors, we can help in their studies as well as increase economy of our society. Most of the subjects were suffering from mild to moderate degree of Refractive error in all categories. No Refractive error shift, either from Myopia to Hypermetropia or vice versa was detected with changing age group.

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