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Original article

An Observational Study to Evaluate the Pattern of Refractive Error in Navi Mumbai.

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ABSTRACT

Context: To see the Refractive error status in different age groups in Navi Mumbai. Aims: This study aimed to assess the refractive error status in the Navi Mumbai populationof different age groups. Settings and Design: It is an observational, non-interventional study. Medical records of patients who came for an eye examination at the campsite in Navi Mumbai from May 2022 to December 2023 were evaluated. Methods and Material: 1496 eyes of 748 patients were included in the study with a mean age of 40.64 ± 16.80 years old. All patients underwent comprehensive eye examinations, including objective and subjective eye examinations, and anterior and posterior eye examinations. The type of refractive error was diagnosed. Statistical analysis used: The study presented the number of cases with different types of refractive error. The statistical analysis was performed using SPSS software version 19.0. In addition, the Chi-square test was used to compute the exact count of refractive error. Results: Out of 1496 eyes, 594 (39.71%) of eyes from 317 patients were Emmetropic. 29.14% (95% CI 26.84%-31.44%) of eyes had Myopia, Furthermore, 31.14% of eyes had Hyperopia, and of these 15 eyes 15 patients were referred for cataract surgery opinion. The distribution of astigmatism was shown in different age groups. In children from 0 to 14 years old, more cases of with the rule astigmatism. Conclusions: This study provides baseline data on the prevalence of refractive error in Navi Mumbai in all age groups. Myopia is the most common refractive error in children in India. Moreover, the prevalence of presbyopia in the adult age group. Key Messages: The refractive error should be corrected at an early age to help slow down the global burden of blindness. This observational study helps to spread awareness of refractive error in the Navi Mumbai population and to find out the prevalence of myopia in children and presbyopia in the adult age group.

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Introduction

Refractive error is the most common ocular disorder and can affect people of all ages. Uncorrected refractive error is one of the leading causes of visual impairment. Previous studies showed that uncorrected refractive errors were the cause of visual impairment in 101.2 million people and blindness in 6.8 million people in 2010.[1]Refractive error occurs when light rays do not reach the retina. They may fall in frontof or behind the retina and can develop at any age. There are multiple causes of refractive error, such as genetic and environmental factors, corneal curvature changes, etc. [2]

Uncorrected refractive errors may negatively impact a patient's quality of life.Uncorrected myopia can cause difficulty in seeing distant objects, whereasuncorrected hyperopia can cause accommodation and strabismus-related effects on the eyes.[3] If we correct refractive error at an early age, there's the possibility of regaining visual acuity. In younger age groups, tasks related to playing, writing, and reading may be affected because they require good-quality vision. [4] Uncorrected refractive error may result in visual impairment and impact restrictions in selecting career opportunities and employment. [5]

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There are different types of refractive errors, such as myopia, hyperopia, and astigmatism. Myopia is globally increasing and is a major cause of visual impairment. It is the most common refractive error in children under 6 years of age, adolescence, and young adulthood. The prevalence of myopia has been increasing worldwide and continuously increasing in recent years. There is a prediction that by 2050, 5 billion people worldwide will be myopic.[7]

Refractive errors can be corrected with spectacles, contact lenses, and surgical options. In recent years, many studies have been published related to refractive error in India in the pediatric population. To date, no study has reported on the prevalence of refractive error in Navi Mumbai. This study aims to evaluate the pattern of refractive error in Navi Mumbai in all age groups and to see the prevalence of myopia in children.

Methods:

Study population:

The cross-sectional study was conducted as part of the SN Vision Screening Program in Navi Mumbai. Data was collected between January 2022 and 2023 and stored in an Excel sheet. All participants who were willing to participate in the vision screening program were included in the study.

Patients with ocular infection, trauma, corneal ulcers, etc., were excluded from the study. All participants underwent a complete ocular examination, including visual acuity, objective and subjective refraction, torchlight examination, and slit-lamp examination. The study was approved by the Institutional Ethics Committee (ITMIHSCON/081123/1878) and was conducted in strict adherence to the tenets of the Declaration of Helsinki.

Refractive error screening method:

A team consisting of a camp coordinator, social worker, optometrist, counselor, and optician visited the campsite in Navi Mumbai. The participants visiting the screening program and fulfilling the inclusion criteria were included in the study. Data regarding each participant, including age, gender, and occupation, were noted by social workers. Further preliminary eye examination was done by a trained optometrist.

The with and without correction visual acuity was calculated. Visual acuity was evaluated with Snellen's visual acuity chart with normal room illumination and later converted to the Logarithm of the Minimum Angle of Resolution (LogMAR) for analysis. Patients using contact lenses were asked to discontinue contact lenses after evaluating the visual acuity. Followed by objective and subjective refraction done to understand the significant refractive error status such as myopia and astigmatism.

The torchlight eye examination, done to evaluate the external health of the eye, consists of adnexa and any other ocular abnormalities like pupillary defect and squint. Patients with cataracts, pterygium, strabismus, and other ocular abnormalities were referred for detailed eye examination in nearby eye hospitals.

Refractive error classification:

The spherical equivalent was calculated by using the algebraic sum of spherical power and half of the cylindrical power. Myopia is defined as ≤-0.5 D of spherical equivalent. We classified myopia from 0.0D to -1.5 D as mild, -1.50D to -6.0D as moderate, and more than -6.0D as severe. Hyperopia of 0.0D to <2.00 D is mild, 2.25D to 5.00D is moderate, and more than 5.00D is severe.

Astigmatism was classified as simple myopic astigmatism (zero spherical refractive error with negative cylinder), compound myopic astigmatism (negative spherical and cylinder refractive errors), simple hyperopic astigmatism (zero spherical refractive error and positive cylinder), compound hyperopic astigmatism (positive spherical and cylinder refractive error), and mixed astigmatism (positive spherical error and negative cylinder).

Statistical analysis:

The prevalence of different refractive errors was calculated. Data were distributed according to age and gender. The amount of myopia, hyperopia, and astigmatism and their 95% confidence intervals were calculated within age groups. The Chi-square test was performed to find the association between refractive errors in different age groups. The SPSS software (version 29.0 for Windows; SPSS Inc., Chicago, IL, USA) was used for statistical analysis. A two-tailed P-value of less than 0.05 was considered statistically significant.

Results:

A total of 1496 eyes of 748 patients underwent primary eye screening. It includes 349 male and 399 female patients. The mean age of the participants was 40.64 ± 16.80, ranging from 24 years to 56 years. Out of 1496 eyes, 594 (39.71%) of eyes from 317 patients (288 right eyes and 293 left eyes) were emmetropic, with no presence of any refractive error. 29.14% (95% CI 26.84%-31.44%) of eyes had myopia. 409 (27.34%) (95% CI 25.14%-29.50%) eyes from 247 patients had mild myopia (SE 0 to -1.50D). 20 (1.34%) (95% CI 0.76%-1.90%) eyes from 15 patients had moderate myopia (SE -1.75D to -6.00D). 7 (0.47%) (95% CI 0.08%-0.71%) eyes from 5 patients had severe myopia (SE more than -6.00D). Furthermore, 31.14% of eyes had hyperopia. 431 (28.81%) (95% CI 26.61%-31.10%) eyes from 423 patients had mild hyperopia (SE 0 to +2.00D), 34 (2.27%) (95% CI 1.50%-3.00%) eyes from 28 patients had moderate hyperopia (SE +2.25 to +5.00D), and 1 (0.07%) (95% CI 0.06%-0.20%) eye had severe hyperopia. (Fig. 1)

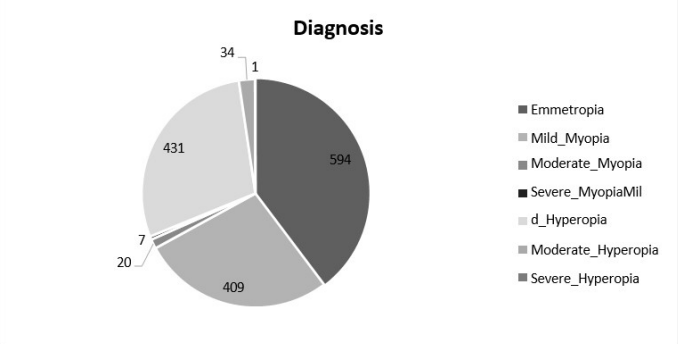


Fig1:Refractive error diagnosis classification.

In these 15 eyes, 15 patients were referred to cataract surgery opinion. We categorized the data into four different age groups: Group 1, aged between 0 to 14 years, Group 2 aged between 15 to 35 years old, Group 3 aged between 36 to 60 years, and aged more The distribution of astigmatism was shown in different age groups. In age groups 2 and 3, simple myopic astigmatism was seen in most cases compared to age

groups 1 and 4. Compound myopic astigmatism was seen only in age groups 2 and 3. Simple and compound hyperopic astigmatism and mixed astigmatism were noticed more in age group 3, the age range between 36 to 60 years old. (Fig. 2)

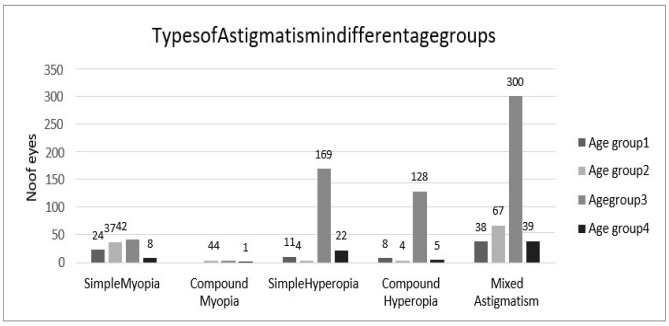


Fig2:Types of Astigmatism in different age groups.

Age group 3, ranging between 36 to 60 years old, showed more cases of against-the-rule astigmatism, with-the-rule astigmatism, and oblique astigmatism. In children from 0 to 14 years old, more cases of with-the-rule astigmatism were observed. (Fig. 3)

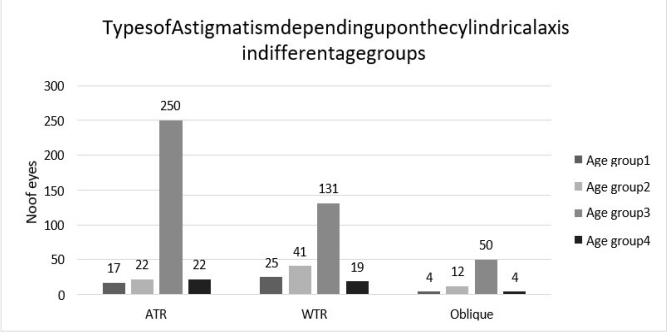


Fig3:Type of astigmatism depending upon the cylinderaxis in different age groups.

In Figures 4a and 4c, the diagnosis of astigmatic refractive error presents as per the order in both the male and female populations in age group 3 (i.e., the range between 36 to 60 years old): compound hyperopic astigmatism (20.83%), simple hyperopic astigmatism (26.60%), and mixed astigmatism (44.87%) in the male population, and compound hyperopic astigmatism (19.03%), simple hyperopic astigmatism (25.98%), and mixed astigmatism (48.33%) in the female population, respectively.

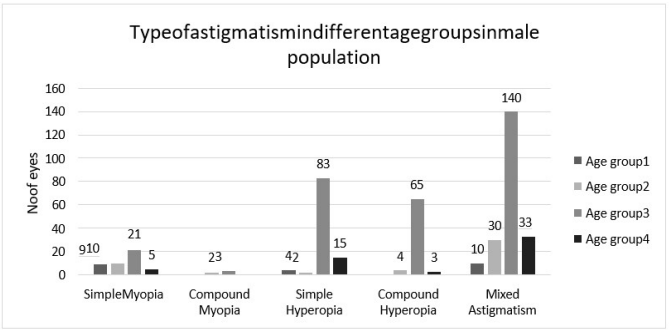


Fig 4a: Types of astigmatism in different age groups in the male population.

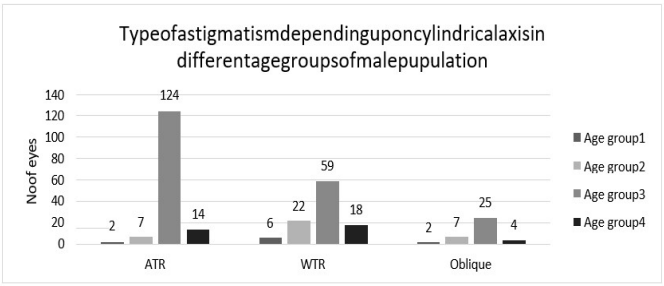


Fig 4b : Types of astigmatism depending upon cylindrical axis in different age groups of the male population.

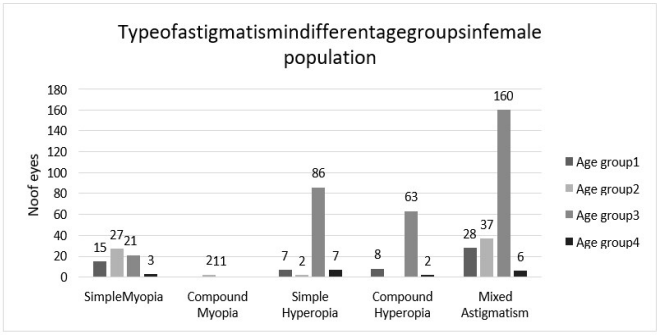


Fig 4c : Types of astigmatism in different age groups in the female population.

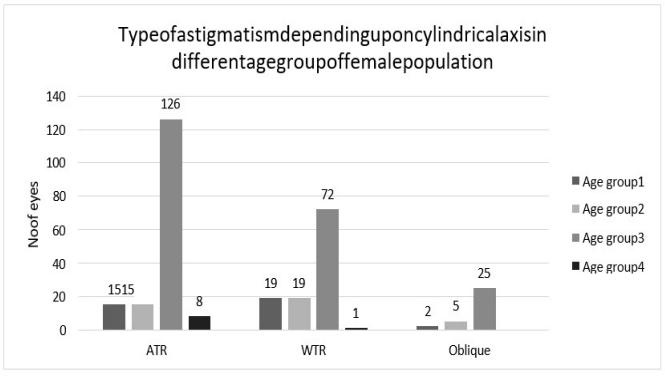


Fig 4d: Types of astigmatism depending upon cylindrical axis in different age groups of the female population.

In Fig 4b &d, the diagnosis of astigmatic Refractive error is made depending on the cylindrical axis. Against the rule, astigmatism is found in both the male (59.61%) and female (56.50%) population in the age group 3 (i.e. range between 36 to 60 years old). The distribution of refractive error was done by the spherical equivalent of the eye. The types of astigmatism was classified according to the astigmatism types and depending on the cylindrical axis. (Table 1) The prevalence of mild myopia and hyperopia was 23.6% and 35.8% in the age group 3.

Distribution of Refractive error by age						
	Age (years)					
	0-15 (n=104)	15-35 (n=241)	36-60 (n=993)	60&more (n=158)	Total (1496)	p-value comparing different ages
	n(%)	n(%)	n(%)	n(%)	n(%)	
Emmetropia	23 (22.1%)	125 (51.9%)	362 (36.5%)	84(53.2%)	594 (39.7%)	
Mild Myopia	50 (48.1%)	101 (41.9%)	234 (23.6%)	24(15.2%)	409 (27.3%)	
Moderate Myopia	04 (3.8%)	05(2.1%)	08(0.8%)	03(1.9%)	20 (1.3%)	
Severe Myopia	05 (3.8%)	01(0.4%)	01(0.1%)	00(0.0%)	00 (0.0%)	
Mild Hyperopia	21 (20.2%)	09(3.7%)	355 (35.8%)	46(29.1%)	46 (29.1%)	
Moderate Hyperopia	01 (0.1%)	00(0.0%)	32(3.2%)	01(0.6%)	01 (0.6%)	
Severe Hyperopia	00 (0.0%)	00(0.0%)	01(0.1%)	00(0.0%)	01 (0.1%)	<0.001

Distribution of Astigmatism Refractive error by age						
	0-15 (n=81)	15-35 (n=116)	36-60 (n=643)	60&more (n=75)	Total (915)	p-value comparing different ages
	n(%)	n(%)	n(%)	n(%)	n(%)	
Simple Myopia	24 (29.6%)	37(31.9%)	42(6.5%)	08(10.7%)	111 (12.1%)	
Compound Myopia	00 (0.0%)	04(3.4%)	04(0.6%)	01(1.3%)	9(1.0%)	
Simple Hyperopia	11 (13.6%)	04(3.4%)	169 (26.3%)	22(29.3%)	206 (22.5%)	
Compound Hyperopia	08 (9.9%)	04(3.4%)	128 (19.9%)	5(6.7%)	145 (15.8%)	
Mixed Astigmatism	38 (8.6%)	67(15.1%)	300 (67.6%)	39(8.8%)	444 (48.5%)	<0.001

Distribution of Astigmatism Refractive error by age						
	0-15 (n=46)	15-35 (n=75)	36-60 (n=431)	60&more (n=45)	Total (597)	p-value comparing different ages
	n(%)	n(%)	n(%)	n(%)	n(%)	
ATR	17 (37.0%)	22(29.3%)	250 (58.0%)	22(48.9%)	311 (52.1%)	
WTR	25 (54.3%)	41(54.7%)	131 (30.4%)	19(42.2%)	216 (36.2%)	
Oblique	04 (8.7%)	12(16.0%)	50(11.6%)	04(8.9%)	70 (11.7%)	<0.001

Table1: Distribution of Refractive error in different age groups.
*ATR -Against the rule of astigmatism, WTR-With the rule of astigmatism.

Discussion:

This study provides the prevalence of percentage refractive error in New Panvel. The data provides the association between age and gender with different types of refractive error. Uncorrected refractive error is the most common problem worldwide. The cross-sectional study was done about the prevalence of refractive error in Indian five different states among 5-18-year-old school-going children.

The spherical equivalent of myopia was significantly more likely to occur in children aged 10-14 and 15-18 than in those aged 4-9 years, in girls, in private compared with government schools, and in more densely populated areas. It also shows that compared with the state of Kerala, the risk of myopia was significantly higher in Tamil Nadu but significantly lower in Madhya Pradesh, Maharashtra, and West Bengal. [3]

In this study, the prevalence of myopia in age group 1, from 0 to 15 years, was found to be 13.53%. The data on the prevalence of myopia and its risk factors has already been discussed in previous studies worldwide. [9] Previous studies provide data on the prevalence of myopia depending upon uncorrected myopia and ocular pathologies regarding high myopia. [10] Another study reported the prevalence of myopia over the last four decades in India to be 7.5% in the 5-15-year age group, 8.5% in urban, and 6.1% in rural children. [11]

A systematic review of the prevalence of uncorrected refractive error in the adult population was done in south,western, and north India. The prevalence of RE of at least 0.50 D of spherical equivalent ametropia was 53.1%, of which myopia and hyperopia were 27.7% and 22.9%, respectively. The prevalence of URE was 10.2%, but heterogeneity in these estimates was very high. The prevalence of uncorrected presbyopia was 33%. [12-15] In this study, the prevalence of 61% of the adult population had refractive error. 23.47% of the adult population had myopia, and 37.79% of the adult population were hyperopic. 68% of the adult population were presbyopic.

The previous study reported the prevalence of refractive error in school-going children in north Kashmir. The prevalence of refractive error was 8.5%. 5.1% were females, and 4.72% were male. Myopia was the most common with 46.15% (n = 30), followed by astigmatism at 36.9% (n = 24), and the remaining 16.9% (n = 11) with hyperopia. [16]

The prevalence of refractive error study was conducted on school-going children in Kerala in 2018. They found myopic astigmatism in 68.3%, simple myopia in 13.8%, hyperopic astigmatism in 13.1%, and simple hyperopia in 1.20%. [17] In this study, the prevalence of astigmatism is 47.99%. In children aged 0-15 years old, 77.88% of the patients had myopia followed by astigmatism.

Conclusions

This study provides baseline data on the prevalence of refractive error in Navi Mumbai in all age groups. Myopia is the most common refractive error among school-going children in India. This study helps to understand the prevalence of myopia in both the young and adult age groups, and moreover, the prevalence of presbyopia in the adult age group.

This study also reported the prevalence of astigmatism in different age groups in male and female genders. Early detection of uncorrected refractive error at the primary screening level for school-going children as well as the adult population is useful to avoid further myopic progression and blindness.

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