

# A study on the refractive status of school going children between age group of 10 to 15 years

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## Abstract

**Background:** Refractive error is one of the most common cause of visual impairment around the world and 2<sup>nd</sup> most common cause of treatable blindness. Undetected and uncorrected refractive errors are significant in school children. **Aims and Objective:** To find out the prevalence of refractive errors in school going children, its different types and visual outcome after correction of refractive errors. **Materials and Method:** A cross sectional study was conducted on 3000 children between 10 to 15 years from secondary schools in Solapur during the period of September 2017 to August 2019. Students were screened for defective vision with the help of Snellen's chart. Students with refractive errors brought to of Shri Chhatrapati Shivaji Maharaj Sarvopchar Rughalay, Solapur and underwent retinoscopy under cycloplegia followed by post mydriatic test. Corrective glasses were prescribed. **Results:** The prevalence of refractive error was 16.4% Myopia was most common 83.5% followed by astigmatism 14.1% and hypermetropia 2.4%. Overall prevalence was higher among older children with female preponderance 19.4% Vs 13.5% in males. Among them only 13.8% wearing spectacles. **Conclusion:** Present study highlights refractive errors as important hidden problem in school going children as majority of them were new cases and unaware of their problem which can be easily dealt by simple screening and prescription of proper glasses.

**Keywords:** Refractive error, school children, prevalence, myopia

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## INTRODUCTION

Eyes are mirror of the soul and the body's window to the outside world. The objective of learning begins in childhood and the accuracy of a child's vision can immensely affect or alter their learning capacity. School going years are considered as wonder years and formative years in person's life. Any problem in vision during formative years can hamper the intellectual development, maturity and performance of a person in future life.<sup>1</sup> Refractive error is an optical defect intrinsic to the eye

which prevents light from being brought to a single point focus on the retina, thus reducing the normal vision. It is the second largest cause of impaired vision after cataract.<sup>2</sup> Different study reveals that refractive errors are usually present in childhood and continue to adult life.<sup>3</sup> Undetected and uncorrected refractive errors are significant problem in school going children in India. Most of the children with such diseases are apparent and hence, screening helps in early detection and correction with spectacles.<sup>4</sup> Early detection and treatment of ocular diseases has got prime importance. In India overall incidence of refractive errors has been found to vary between 21% and 25%.<sup>5</sup> The various studies conducted in different parts of India had reported the prevalence of refractive errors between 20% and 25% among school children.<sup>6</sup>

## MATERIALS AND METHODOLOGY

**Study design:** Prospective cross-sectional study

**Sample size:** 3000

**Sample:** School going children in the age group of 10 to 15 years from secondary schools in Solapur.

**Study period:** September 2017 to August 2019

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**Inclusion criteria**

All students studying in 5 th to 10 th standard belonging age group of 10 to 15 years.

**Exclusion criteria**

- 1) Children in whom refraction could not be performed due to media opacity
- 2) Children with retinal diseases
- 3) Children not willing for examination were excluded.

**DETAILED RESEARCH PLAN**

Different secondary schools from Solapur were selected randomly. After prior permission from respective authorities, all students were interviewed in friendly manner and examined. Visual acuity recorded unaided and aided (if spectacles+) using standard techniques for measurement of distant vision.

Visual acuity was taken using of Snellen’s chart placed at 6 meters distance and those who have failed to read 6/60 line at 6 meters distance were asked to count examiners fingers. The distance at which student counted fingers was recorded as visual acuity – finger counting, followed by visual acuity with pinhole was taken to look for improvement with pinhole. After taking ethical clearance from institutes and informed consent from students, those with visual acuity less than 6/6 for distant vision and those who had improvement in vision on pinhole were taken for reexamination in outpatient department of Shri Chhatrapati Shivaji Maharaj Sarvopchar Rughalay, Solapur for further evaluation and correction of refractive errors.

The **parameters** studied were;

1. Visual acuity measurement with Snellen’s chart.
2. Gross examination of the anterior segment with a torch light.
3. Autorefraction and subjective correction
4. Streak retinoscopy and refraction
5. Examination of media and fundus by direct ophthalmoscope.

Retinoscopy was performed using a self-illuminating streak retinoscopy, dilating the pupil with tropicamide (0.8%) + phenylephrine (0.5%), at 2/3rd meter distance, in a dark room using distant fixation target and trial lens box. The autorefractometry was done using an autorefractor. 3 values were taken, the average of which was calculated. Detailed fundus examination of both eyes was done using direct ophthalmoscope. These tests were followed by post mydriatic test as applicable, until best corrected visual acuity was achieved.

**RESULTS AND DISCUSSION**

**Table 1:** Distribution of total population according to age

Age(years)	Total number of students screened	Percentage(%)
10	457	15.23
11	534	17.80
12	589	19.63
13	451	15.05
14	545	18.16
15	424	14.13
<b>Total</b>	<b>3000</b>	<b>100</b>

In the present study age distribution of study subjects showed out of 3000 students, majority were of age 12 years (19.63%). Mean age in our study group is 11.79 which is similar to study by Saha, *et al.*<sup>7</sup> where it was 12.4 years, also similar to study by Karavadi Sri Sai Vidusha and Damaanthi M. N<sup>8</sup> where it was 11.28 years. Mean age was slightly more in study by Sonam Sethi *et al.*<sup>9</sup> where it was 13.22 years, and by Dr. Mehzabeen Rahman *et al.*<sup>10</sup> where it was 12.99 years.

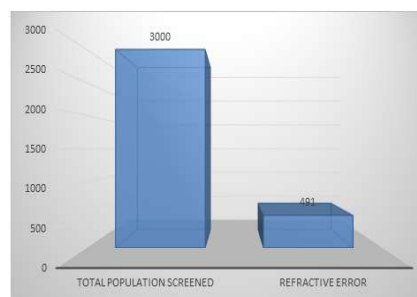
**Table 2:** Distribution of total population according to gender

Gender	Number	Percentage
<b>Female</b>	<b>1451</b>	<b>48.36%</b>
<b>Male</b>	<b>1549</b>	<b>51.64%</b>
<b>Total</b>	<b>3000</b>	<b>100</b>

Out of 3000 students screened, 1451(48.36%) were females and 1549(51.64%) were males. similar distribution of males and females in study population observed by Saha, *et al.*<sup>7</sup> where out of 1840 children 53.6% were boys and 46.4% were girls. In study by Karavadi Sri Sai Vidusha and Damaanthi M. N<sup>8</sup> where Total 1140 subjects were studied. Out of which 577 (50.6%) were males and 563 (49.4%) were females.

**Table 3:** Distribution of results of total population screened

Variables	N
Total Population Screened	3000
Refractive error	491
Prevalence	16.4%
Already wearing Spectacles	68
New Diagnosed	423
Percentage of new cases	14.4%



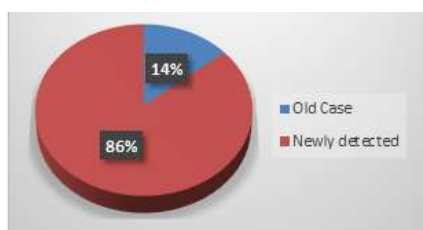
**Graph 1:** Screening Findings

In present study, a total of 3000 adolescent children were screened and 491 of those were observed as having refractive errors out of which 68 students were already using spectacles. This indicates that only 13.84% of study population with refractive errors wore glasses and rest 86.16% were unaware of their problem.

**Table 4:** Distribution of type of case in study children

Type of Case	N	%
Old Case	68	13.8%
Newly detected	423	86.2%
<b>Total</b>	<b>491</b>	<b>100.0%</b>

Out of the total 491 cases of refractive errors, 13.8% were old cases while 86.2% were newly diagnosed cases.



**Graph 2:** Type of Cases

Similar observations found by Sarma *et al.*<sup>11</sup> where 24.47% of study population were using spectacles and rest 75.53 % were unaware of their problems. While N Prema<sup>12</sup> found only 7.26% of children using spectacles and rest 92.74% students were unaware of their refractive errors.



**Graph 3:** Screening Findings

The prevalence of refractive error among study group was 16.4% while prevalence of newly diagnosed cases was 14.4%. Similar prevalence of refractive errors was found by Seema *et al.*<sup>13</sup> where they conducted a research on magnitude of refractive errors among school children in rural block of Haryana. Out of 1265 students tested, 172 children (13.6%) were found to have defective vision. Zhao J *et al.*<sup>14</sup> conducted similar study on school-age children in Shunyi District, China and found prevalence of refractive error as 12.8% which is similar to our study. Different studies to find out prevalence of refractive errors in school going children showed prevalence similar to our

study. Al Wadaani FA, *et al.*<sup>15</sup> found prevalence of refractive error as 13.7%. Harpal Singh *et al.*<sup>16</sup> observed prevalence of refractive errors as 13.09%. Saha, *et al.*<sup>17</sup> found prevalence of refractive error as 13.86%. While prevalence of refractive errors was found to be slightly higher in study by Gupta *et al.*<sup>18</sup>; 22%, El Bayoumy, B. M., Saad, A. and Choudhary, A.H<sup>19</sup>, 22.1%; Sonam Sethi and Kartha<sup>20</sup> 25.32%. Prevalence of refractive errors in our study is consistent with other studies ranging from 12.8 % to 25.32% which indicates refractive errors as a major cause of visual impairment.

**Table 5:** Distribution of refractive errors as per age

Age Group	Refractive Error		Total
	No	Yes	
10	404	53	457
	88.4%	11.6%	100.0%
11	466	68	534
	87.3%	12.7%	100.0%
12	505	84	589
	85.7%	14.3%	100.0%
13	376	75	451
	83.4%	16.6%	100.0%
14	430	115	545
	78.9%	21.1%	100.0%
15	328	96	424
	77.4%	22.6%	100.0%
<b>Total</b>	2509	491	3000
	83.6%	16.4%	100.0%

**p-value <0.05**

Overall a significantly high prevalence of refractive errors was reported in cases of 13 (16.6%), 14 (21.1%) and 15 (22.6%) years as compared to younger children. The prevalence of refractive error among cases of 10, 11 and 12 years was 11.6%, 12.7% and 14.3% respectively. So it showed, prevalence increases with increasing age. Similar study findings seen by El Bayoumy, B. M., Saad, A. and Choudhary, A.H<sup>19</sup>. where prevalence of refractive errors was greatest among school children aged 12+ years. Our findings are consistent with study by Al Wadaani FA, *et al.*<sup>15</sup> where higher prevalence of refractive errors was disproportionately more among 12 to 14 years. Similarly, study by M.B. Pavithra, R. Maheshwaran and Rani M.A. Sujatha<sup>21</sup> and by Saha *et al.*<sup>17</sup> observed similar trends of refractive errors distribution that is between age group of 13 to 15 years.

**Table 6:** Mean age comparison among subjects with and without refractive errors

Variables	Refractive error	N	Mean	SD	p-value
Age (years)	Yes	491	12.85	1.64	<0.01
	No	2509	11.79	1.70	

Mean age of cases with refractive error was significantly higher as compared to cases without refractive errors (12.85 vs 11.79 years; p<0.01).

**Table 7:** Distribution of refractive errors as per Gender

Gender	Refractive Error		Total
	No	Yes	
Female	1169	282	1451
	80.6%	19.4%	100.0%
Male	1340	209	1549
	86.5%	13.5%	100.0%
Total	2509	491	3000
	83.6%	16.4%	100.0%

**p- value <0.05**

Prevalence of refractive error was significantly higher among females as compared to males (19.4% vs 13.5%;  $p < 0.05$ ). Similar observations were found in study by Lu B, Congdon N, Liu X, *et al.*<sup>22</sup> where prevalence of refractive errors found to be higher in females as compared to males. Zhao J *et al.* study<sup>14</sup> also found females had a significantly higher risk of both myopia and hyperopia. Consistent with our study results, El Bayoumy, B. M., Saad, A. and Choudhary, A.H<sup>19</sup> found higher prevalence of refractive errors among females than males (21.4% and 13.6% respectively). Other studies by N Prema<sup>12</sup>, Al Wadaani FA, *et al.*<sup>15</sup>, Harpal Singh *et al.*<sup>16</sup>, Ibeinmo Opubiri, Adedayo Adio and Megbelayin Emmanuel<sup>23</sup>, Himanto Nath Hazarika *et al.* study<sup>24</sup>, Hussnain Aabbas, Muhammad Awais, Khalid Naimat<sup>25</sup> also found female preponderance.

**Table 8:** Distribution of type of refractive errors among children

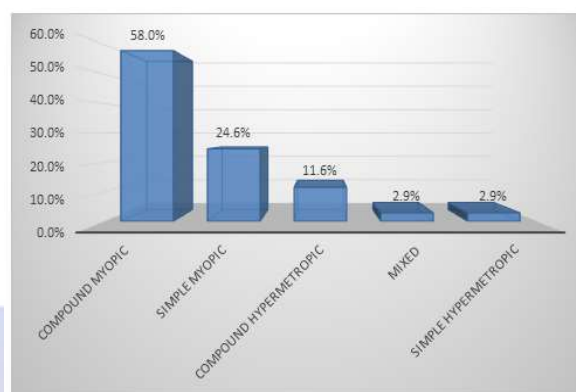
Type of Refractive Error	N	%
Myopia	410	83.5%
Astigmatism	69	14.1%
Hypermetropia	12	2.4%
<b>Total</b>	<b>491</b>	<b>100.0%</b>

Most common refractive error identified in present study was myopia (83.5%) followed by astigmatism (14.1%) and hypermetropia (2.4%). Similar results were seen in study by Matta *et al.*<sup>26</sup> where they found myopia in (55.6%) cases, hypermetropia in (16.9%) cases and astigmatism in (27.4 %) cases. Similarly study by Sonam Sethi and Kartha<sup>20</sup> observed Myopia as most common type of refractive error 265(63.5%), followed by astigmatism in 85(20.4%) and hypermetropia in 47(11.2%) cases. Study by Al Wadaani FA, *et al.*<sup>15</sup> found myopia was the most common type (65.7%) while Pankaj Kumar *et al.*<sup>27</sup> study found that Myopia constitutes for 94.44% of the refractive errors. Astigmatism was seen in only 2.78% of the students and hypermetropia is seen in 2.78% of the students. M.B. Pavithra, R. Maheshwaran and Rani M.A. Sujatha (2013)<sup>21</sup>, Harpal Singh *et al.* (2013)<sup>16</sup>, Rashood AA, *et al.* (2013)<sup>28</sup> showed variable prevalence of different types of refractive error with myopia being the commonest followed by astigmatism and hypermetropia like what we have observed in our study. Present study is found to have myopia as the commonest type of refractive error which is similar to other studies.

**Table 9:** Distribution of type of astigmatism among study children

Type of Astigmatism	N	%
Compound myopic	40	58.0%
Simple myopic	17	24.6%
Compound hypermetropic	8	11.6%
Mixed	2	2.9%
Simple hypermetropic	2	2.9%
<b>Total</b>	<b>69</b>	<b>100.0%</b>

Out of total 69 cases of astigmatism, compound myopic variant was the most common (58%) followed by simple myopic (24.6%).



**Graph 4:** Type of Astigmatism

In our study out of 491 students, 69 were found to have astigmatism. The prevalence is 14.1%. The most common variant found to be compound myopic astigmatism 58%, followed by simple myopic 24.6% and least common type found to be simple hypermetropic and mixed astigmatism as 2.9% only. Consistent with our study Ibeinmo Opubiri, Adedayo Adio and Megbelayin Emmanuel<sup>23</sup> also found Compound myopic astigmatism was the most common type of astigmatic error amongst students with astigmatism.

**Table 10:** Other types of astigmatism

Type	Number	%
With-the rule	62	89.9
Against-the rule	06	9.7
Oblique	01	0.4
<b>Total</b>	<b>69</b>	<b>100</b>

In our study 89.9% children have with-the-rule astigmatism followed by 9.7% against the rule astigmatism and 0.4 % oblique astigmatism. Comparable to our study, Hossein Ziaei *et al.*<sup>29</sup> determined prevalence of refractive errors where they observed prevalence for astigmatism was 53.8%. The prevalence of with-the-rule, against-the-rule and oblique astigmatism was 35.7%, 13.4% and 4.6% respectively.

**Table 11:** Distribution of eyes as per uncorrected visual acuity

Uncorrected Visual Acuity	Eye		Total
	Right	Left	
6/6	48 9.8%	25 5.1%	73 7.4%
6/9	120 24.4%	110 22.4%	230 23.4%
6/12	83 16.9%	107 21.8%	190 19.3%
6/18	55 11.2%	80 16.3%	135 13.7%
6/24	69 14.1%	78 15.9%	147 15.0%
6/36	53 10.8%	41 8.4%	94 9.6%
6/60	45 9.2%	27 5.5%	72 7.3%
CF	18 3.7%	25 5.1%	43 4.4%
<b>Total</b>	<b>491</b> <b>50.0%</b>	<b>491</b> <b>50.0%</b>	<b>982</b> <b>100.0%</b>

p- value &lt;0.05

The above table showed that relatively better visual acuity was reported in right eye (p<0.05). A total of 9.8% and 24.4% cases had visual acuity of 6/6 and 6/9 in right eye as compared to 5.1% and 22.4% in left eye; also 9.2% cases had acuity of 6/60 in right eye as compared to 5.5% in left eye.

**Table 12:** Classification of myopia

Degree of myopia	Number	Percentage%
Low (<-0.50D to -2.00D)	330	80.48
Moderate (>-2.00D to -6.00D)	79	19.28
High (>-6.00d)	01	0.24
<b>Total</b>	<b>410</b>	<b>100</b>

Our study reveals that the maximum students have low degree myopia 80.48% (-0.50 to -2.00D), followed by moderate degree of myopia 19.28% (>-2.00 TO -6.00D) and only 1 female child had high myopia (-11.00D) and her both eyes fundus examination revealed large disc with peripapillary atrophy and large temporal crescent with dull foveal reflex and severe tessellation suggesting classical myopic fundus. Similar to our study, Deshpande Jayant D, Malathi K<sup>30</sup>, 79% students were having mild visual impairment, 19% had moderate and 2% had severe visual impairment.

**Table 13:** Types of myopia among patients

Type	No. of patients	Percentage
Simple	409	99.75
Pathological	01	0.25
<b>Total</b>	<b>410</b>	<b>100</b>

In our study 409 (99.75%) students had simple myopia and only one female child found to have pathological myopia >-6.00D i.e -11.00D with typical myopic fundus findings.

**Table 14:** Distribution of eyes as per corrections given

Power (in Diopters)	Eye		Total
	Right	Left	
-0.50 to -0.75 D	176 41.1%	193 42.8%	369 42.0%
-1.00 D and more	232 54.2%	230 51.0%	462 52.6%
+0.50 to 0.75 D	10 2.3%	12 2.7%	22 2.5%
+1.00 D and above	10 2.3%	16 3.5%	26 3.0%
<b>Total</b>	<b>428</b> <b>100.0%</b>	<b>451</b> <b>100.0%</b>	<b>879</b> <b>100.0%</b>

p- value - 0.624

Overall lesser number of children in right eye required correction of over 1 D as compared to left eye (2.3% vs 3.5%). The difference was however statistically not significant (p=0.624).

**Table 15:** Best corrected visual acuity achieved

Best corrected visual acuity	No. of eyes	Percentage
6/6	959	97.66%
6/9	21	2.14%
6/12	NIL	NIL
6/18	NIL	NIL
6/24	NIL	NIL
6/36	01	0.10%
6/60	01	0.10%
<b>Total</b>	<b>982</b>	<b>100</b>

The above table shows the pattern of improvement of visual acuity on giving correction. It was observed that 97.66% of eyes improved visual acuity at 6/6, 2.14% improved at 6/9 and 0.1% improved to 6/36 and 6/60 only.

## CONCLUSION

we found that every sixth school going adolescent children is suffering from refractive error. Majority of them were new cases who were unaware of their refractive error indicating a hidden problem of serious dimensions. So screening of school children can play an important part in detecting these hidden cases suffering from refractive errors. Prevalence of refractive errors increases with increasing age, with female preponderance and Myopia was the most common type of refractive error identified in present study followed by astigmatism. Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children which can be reflected on school performances. vision screening of school children in developing countries like India will be definitely useful in detecting correctable causes of decreased vision, especially refractive errors by which long term visual disability could be minimized simply by use of glasses. Screening of the children for vision at the time of school admission and periodical eye examination of the children, is recommended for early rectification of

impaired vision. Students, teachers and parents should be educated about signs and symptoms of refractive errors, so that early detection and correction of refractive errors with spectacles can be done to prevent progression of visual impairment and for this screening of school children can play an important part.

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