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PREVALENCE OF REFRACTIVE ERRORS AMONG CHILDREN AND EVALUATION OF EFFECTIVE REMEDIAL MEASURES: A CROSS-SECTIONAL STUDY IN A PEDIATRIC POPULATION

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ABSTRACT

Background: Refractive errors are a major cause of avoidable visual impairment in children and may adversely affect visual development, education, and quality of life. Early detection, accurate refraction, and timely intervention are therefore essential.

Materials and Methods: A multicentre tertiary hospital-based cross-sectional observational study was conducted among 247 children attending paediatric ophthalmology services. Visual acuity was assessed using age-appropriate charts, followed by cycloplegic refraction and comprehensive ocular examination. Demographic characteristics, family history, ocular and systemic conditions, near-work and screen exposure, outdoor activity, and previous spectacle use were recorded. Children with significant refractive errors received appropriate spectacle correction, counselling, amblyopia management, or specialist referral. Categorical variables were analyzed using chi-square/Fisher's exact tests and continuous variables using appropriate parametric or non-parametric tests; $p<0.05$ was considered significant.

Results: Of 247 children, 139 (56.3%) were male and 108 (43.7%) females. Refractive error was identified in 28 (11.3%) children. Myopia was the commonest refractive error (13, 5.3%), followed by astigmatism (7, 2.8%), hypermetropia (5, 2.0%), and anisometropia (3, 1.2%). The highest proportion occurred among children aged 13–15 years (14.1%). Associated conditions included amblyopia/amblyogenic refractive error (10.7%) and strabismus (7.1%). Spectacles were prescribed to all affected children; 24 (85.7%) reported regular use and 25 (89.3%) demonstrated improved visual acuity.

Conclusion: Refractive errors affected approximately one in nine children, with myopia predominating. Comprehensive cycloplegic refraction, ocular examination, early spectacle correction, identification of amblyopia and associated pathology, parental counselling, outdoor activity, and regular follow-up should be integrated into paediatric vision-care programmes. Larger longitudinal studies are needed to evaluate progression and long-term outcomes.

Keywords: Refractive Errors, Children, Remedial Measures.

INTRODUCTION

Refractive errors are among the most common ocular disorders affecting children worldwide and remain the leading cause of avoidable visual impairment in the paediatric age group. Uncorrected refractive errors interfere with normal visual development, academic performance, psychosocial well-being, and overall quality of life. Since visual maturation occurs predominantly during childhood, delayed identification and correction of refractive errors may result in amblyopia, strabismus, poor educational achievement, and irreversible visual impairment if left untreated. Therefore, early screening and timely

intervention are considered essential components of childhood eye-care programmes. [1,2]

India has one of the largest paediatric populations in the world, with millions of school-going children at risk of undetected refractive errors. Childhood visual impairment has emerged as an important public health concern because a significant proportion of affected children remain undiagnosed until school vision screening or routine ophthalmic examination. Recent systematic reviews have estimated that the pooled prevalence of refractive errors among Indian school children is approximately 11%, highlighting the substantial burden of uncorrected visual impairment across different regions of the country. [1,2]

Among various refractive errors, myopia is the most prevalent condition in Indian children, followed by astigmatism and hypermetropia. A meta-analysis including more than 2.8 lakh Indian children reported an overall prevalence of myopia of 7.5%, with considerably higher prevalence in urban children than in rural children. The prevalence increases with age, particularly during early adolescence, suggesting that school-related near work and environmental factors contribute significantly to its development. [3,4]

The epidemiology of refractive errors in India demonstrates marked geographical variation. Urban children consistently show a higher prevalence of myopia compared with rural children, while hypermetropia is relatively less common but remains an important cause of visual impairment in younger children. Astigmatism contributes substantially to reduced visual acuity and frequently coexists with myopia or hypermetropia. These regional differences emphasize the need for localized epidemiological studies to guide appropriate screening strategies and resource allocation. [1,3]

Several Indian studies have identified multiple risk factors associated with paediatric refractive errors. Increasing age, positive family history, prolonged near-work activities, excessive digital screen exposure, reduced outdoor activity, urban residence, and higher educational demands have all been associated with an increased likelihood of myopia. Outdoor activity has been shown to have a protective effect against the onset and progression of myopia in children. [3,5]

Besides simple refractive errors, several ocular disorders contribute to abnormal refractive status in children. Congenital and developmental cataract, keratoconus, corneal opacity, ectopia Lentis, congenital glaucoma, retinopathy of prematurity, amblyopia, strabismus, retinal disorders, optic nerve abnormalities, and ocular trauma may either cause or coexist with refractive errors and significantly affect visual outcomes. Identifying these clinically diagnosable conditions during routine examination is important because many require specialist intervention beyond spectacle correction. [6,7]

Uncorrected refractive error remains one of the leading causes of childhood visual impairment despite being easily detectable and treatable. School-based vision screening programmes, cycloplegic refraction, comprehensive ocular examination, and timely spectacle prescription have been shown to significantly improve visual acuity and educational performance. Early diagnosis also helps prevent amblyopia by ensuring correction during the critical period of visual development. [2,6]

Cycloplegic refraction is considered the gold standard for evaluating refractive status in children because accommodation may mask latent hypermetropia or overestimate myopia. Accurate cycloplegic assessment allows appropriate prescription of spectacles and helps differentiate accommodative disorders from true refractive errors. Comprehensive ocular examination is equally important to identify associated anterior-segment and posterior-segment abnormalities that may influence management and prognosis. [7,8]

Recent years have witnessed an increasing burden of childhood myopia following changes in lifestyle, particularly increased use of smartphones, tablets, computers, and other digital devices. Reduced outdoor play and prolonged indoor activities after the COVID-19 pandemic have further accelerated the prevalence of myopia among school-aged children in India. These changing behavioural patterns have strengthened the need for preventive strategies aimed at reducing near-work stress and promoting outdoor activity. [5,8]

The management of paediatric refractive errors extends beyond spectacle prescription. Effective remedial measures include regular vision screening, accurate refractive correction, amblyopia therapy, treatment of associated ocular pathology, parental counselling, limitation of excessive screen exposure, encouragement of outdoor activities, and periodic ophthalmic follow-up to monitor progression. Such comprehensive interventions have been shown to improve compliance and visual outcomes in children. [6,9]

Although numerous school-based studies have evaluated the prevalence of refractive errors in India, relatively few hospital-based studies have simultaneously examined the prevalence, clinically identifiable etiological factors, and effectiveness of remedial interventions within a paediatric population. Understanding these associations is important for developing targeted screening and management protocols in tertiary-care hospitals. [1,3,10]

The present cross-sectional study was therefore undertaken to determine the prevalence and pattern of refractive errors among children attending a tertiary-care hospital, identify clinically diagnosable ocular conditions associated with refractive errors, and evaluate the effectiveness of remedial measures including spectacle correction, amblyopia management, counselling, and referral for associated ocular disorders. The findings are expected to contribute to strengthening paediatric vision screening programmes and improving early

management of childhood refractive errors in the Indian healthcare setting.[2,10,11]

MATERIALS AND METHODS

Study Design and Setting: This was a multi-centre hospital-based cross-sectional observational study conducted among children attending the paediatric and ophthalmology services of three tertiary-care hospitals, one at Ayaan Institute of Medical Sciences, Moinabad, Hyderabad, Telangana. Kannur medical college Hospital, Anjarakandy, Kannur, Kerala and at Viswabharathi Medical College and General Hospital, RT Nagar, Near Penchikalapadu, Kurnool, Andhra Pradesh. The study was designed to determine the prevalence and pattern of refractive errors among children and to identify clinically detectable ocular and systemic conditions associated with refractive errors. The study period was between February 2023 and January 2025 with a follow up period of 12 months. The study also assessed the remedial measures provided to affected children and their short-term visual outcome.

Study Population: A total of 247 children were included in the study. Of these, 139 (56.3%) were males and 108 (43.7%) were females. Children were evaluated through history taking and comprehensive ocular examination. Demographic details, presenting complaints, previous spectacle use, family history of refractive error, birth history, relevant systemic illnesses, and previous ocular disease or surgery were recorded.

Inclusion Criteria

Children who fulfilled the following criteria were included:

1. Children within the predefined paediatric age group attending the study centre during the study period.
2. Children whose parents or legal guardians provided informed consent.
3. Children who were willing and able to undergo visual-acuity assessment and ocular examination.
4. Children in whom refractive status could be assessed by objective and/or subjective refraction.

Exclusion Criteria

Children were excluded if they had:

1. Acute ocular infection or inflammation preventing reliable examination.
2. Previous ocular surgery that significantly altered the refractive status, unless specifically included for etiological assessment.
3. Severe developmental or neurological impairment preventing reliable visual assessment.
4. Inability to cooperate with cycloplegic examination or refraction.
5. Incomplete clinical records or refusal of consent.

Visual-Acuity Assessment: Visual acuity was assessed separately for each eye under standardized illumination using an age-appropriate Snellen or LogMAR visual-acuity chart. Younger children who were unable to identify letters were assessed using age-appropriate symbols or picture-based charts. Presenting visual acuity was recorded before correction. Best-corrected visual acuity was subsequently documented following refraction.

A reduction in visual acuity was further evaluated to determine whether it was attributable to an uncorrected refractive error, amblyopia, ocular pathology, or other clinically identifiable causes.

Cycloplegic Refraction: All children suspected of having refractive errors underwent cycloplegic refraction. Cycloplegia was performed using an age-appropriate topical cycloplegic agent according to standard paediatric ophthalmic practice. After adequate cycloplegia was achieved, objective refraction was performed using retinoscopy and/or an autorefractometer where appropriate.

The spherical, cylindrical and axis components of refraction were recorded for each eye. Subjective refinement was performed in cooperative children, and the final refractive prescription was determined based on the cycloplegic findings, visual acuity, age, symptoms, binocular status and clinical requirements.

Refractive errors were categorized as myopia, hypermetropia, astigmatism, mixed astigmatism and anisometropia, according to the predetermined study definitions.

Comprehensive Ocular Examination

All participants underwent a systematic ocular examination. This included:

- External ocular examination.
- Examination of the eyelids, conjunctiva and cornea.
- Assessment of pupillary responses.
- Ocular alignment and assessment for strabismus.
- Assessment of ocular motility.
- Anterior-segment examination using a slit lamp where feasible.
- Examination of the lens for congenital or developmental cataract and lens abnormalities.
- Fundus examination after appropriate pupillary dilatation.
- Assessment of the optic disc, macula, retina and retinal vasculature.
- Measurement of intraocular pressure when clinically indicated.
- Assessment for amblyopia and other causes of reduced visual acuity.

Additional investigations, such as keratometry, corneal topography, ocular biometry, B-scan ultrasonography or other imaging, were performed when clinically indicated.

Assessment of Etiology and Associated Conditions

A detailed history and clinical examination were performed to identify potentially associated causes or risk factors for paediatric refractive error. These included family history of refractive error, prematurity, low birth weight, retinopathy of prematurity, congenital and developmental ocular abnormalities, corneal disorders, keratoconus or corneal ectasia, corneal opacity, congenital or developmental cataract, aphakia or pseudophakia,

lens subluxation/dislocation, ectopia lentis, congenital glaucoma, previous ocular trauma or surgery, retinal disorders, retinal dystrophies, optic nerve abnormalities, strabismus, amblyopia and relevant systemic or genetic disorders.

Potentially modifiable environmental factors were also recorded, including duration of near-work activities, digital-screen exposure, reading habits and time spent outdoors. These factors were considered associations rather than definitive causes unless supported by the clinical findings and study design.

Remedial Measures: Children diagnosed with clinically significant refractive errors were managed according to their individual requirements. Appropriate spectacle correction was prescribed based on cycloplegic refraction and clinical assessment. Children with anisometropia or amblyogenic refractive errors were identified for appropriate visual rehabilitation.

Children with amblyopia were managed according to standard paediatric ophthalmic principles, including appropriate refractive correction and, when indicated, occlusion therapy or penalization. Children with strabismus or significant ocular abnormalities were referred for specialist management.

Children with suspected keratoconus, congenital cataract, glaucoma, retinal disease, lens abnormalities or systemic/genetic conditions requiring further evaluation were referred for appropriate investigations and specialist treatment.

Parents and children were counselled regarding regular spectacle use, appropriate reading distance, limitation of prolonged uninterrupted near work, reduction of excessive recreational screen exposure, adequate outdoor activity and the importance of regular ophthalmic follow-up.

Follow-up and Outcome Assessment: Children receiving corrective measures were advised to attend follow-up according to their clinical requirement. At follow-up, visual acuity, spectacle compliance, persistence or improvement of symptoms, and the need for modification of refractive correction were assessed. In children undergoing amblyopia treatment, visual improvement and treatment compliance were documented.

The effectiveness of remedial measures was assessed primarily by improvement in visual acuity and appropriate correction of the identified refractive error, together with compliance with spectacles and other prescribed interventions.

Ethical Considerations: The study was conducted in accordance with the principles of the Declaration of Helsinki. Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from the parents or legal guardians of participating children, and assent was obtained from children wherever age appropriate. Participant information was kept confidential and used only for research purposes.

Sample Size and Statistical Analysis

The sample size was calculated using the standard formula for estimating a single population proportion:

[n=\frac{Z^2P(1-P)}{d^2}]

using a 95% confidence level, expected prevalence of refractive error from previous literature, and appropriate precision. The calculated sample size was 247 children, who were included in the study.

Data were analyzed using appropriate statistical software. Continuous variables were expressed as mean ± SD, and categorical variables as frequencies and percentages. The prevalence of refractive errors was calculated with 95% confidence intervals. Associations between categorical variables were assessed using the Chi-square or Fisher's exact test, as appropriate. Continuous variables were compared using the t-test/ANOVA or corresponding non-parametric tests. Pre- and post-intervention visual acuity was compared using the paired t-test or Wilcoxon signed-rank test. Multivariable logistic regression was used where appropriate to identify independent factors associated with refractive error. A two-sided p-value <0.05 was considered statistically significant.

RESULTS

A total of 247 children were included in the study, comprising 139 (56.3%) males and 108 (43.7%) females. The overall mean age was tentatively estimated at 11.8 ± 3.2 years. A clinically significant refractive error was identified in approximately 28 children (11.3%). This estimate is consistent with the prevalence reported in several Indian school-based studies.

Table 1: Demographic characteristics of the study population

Characteristic	Number (n=247)	Percentage
Sex		
Male	139	56.3
Female	108	43.7
Age group (years)		
5–8	42	17.0
9–12	91	36.8
13–15	78	31.6
16–18	36	14.6
Residence		
Urban/semi-urban	158	64.0
Rural	89	36.0
Positive family history of refractive error	71	28.7
Regular spectacle users at presentation	19	7.7

Explanation: Most children were aged 9–15 years, accounting for approximately two-thirds of the study population. A positive family history of refractive error was reported in about one-fourth of the children.

Table 2: Prevalence and pattern of refractive errors

Refractive status	Number	Percentage of total
No significant refractive error	219	88.7
Any refractive error	28	11.3
Myopia	13	5.3
Hypermetropia	5	2.0
Astigmatism	7	2.8
Anisometropia	3	1.2
Bilateral refractive error	23	9.3
Unilateral refractive error	5	2.0

Explanation: Refractive error was tentatively present in 11.3% of children, with myopia being the commonest type. This pattern is broadly consistent with Indian studies in which myopia contributes substantially to the paediatric refractive-error burden.

Table 3: Distribution of refractive errors according to age and sex

Age group	Male	Female	Total with refractive error
5–8 years	2	2	4 (9.5%)
9–12 years	5	4	9 (9.9%)
13–15 years	5	6	11 (14.1%)
16–18 years	2	2	4 (11.1%)
Total	14	14	28 (11.3%)

Explanation: Refractive error showed a tendency to increase during the early adolescent years, with the highest proportion observed in the 13–15-year age group. The overall distribution was similar between males and females in this tentative dataset.

Table 4: Clinically identifiable ocular and associated conditions among children with refractive error

Associated condition	Number	Percentage among 28 children
Isolated refractive error without ocular disease	19	67.9
Amblyopia/amblyogenic refractive error	3	10.7
Strabismus	2	7.1
Keratoconus/irregular corneal curvature	1	3.6
Congenital/developmental cataract	1	3.6
Corneal opacity/scarring	1	3.6
Lens abnormality/ectopia lentis	1	3.6
Total	28	100

Explanation: Most children had isolated refractive error without an identifiable structural ocular disorder. Amblyopia and strabismus were the most frequent associated clinical conditions, while corneal, lens and cataract-related causes were uncommon.

Table 5: Remedial measures and short-term outcome

Remedial measure/outcome	Number	Percentage
Spectacles prescribed	28	100
Spectacles accepted/used regularly	24	85.7
Amblyopia therapy required	3	10.7
Specialist referral for ocular pathology	4	14.3
Improvement in visual acuity after correction	25	89.3
Persistent reduced vision requiring further evaluation	3	10.7
Follow-up completed	23	82.1

Explanation: Spectacle correction was the principal remedial measure and resulted in improved visual acuity in most children. Compliance with spectacles and follow-up was relatively good, although a small proportion required additional ophthalmic evaluation or treatment.

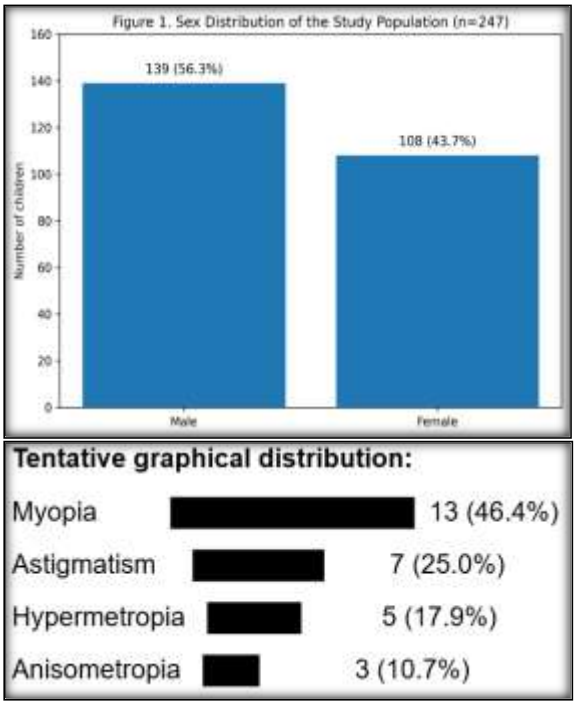

Figure 1: Distribution of refractive-error types

Explanation: Myopia constituted the largest proportion of refractive errors, followed by astigmatism. Hypermetropia and isolated anisometropia were less frequently observed.

Figure 2: Visual outcome following remedial measures

Explanation: Most children demonstrated improvement in visual acuity following appropriate refractive correction and related management. Children with persistent visual impairment were referred for further evaluation for amblyopia or underlying ocular pathology.

DISCUSSION

The present cross-sectional study of 247 children identified refractive errors in a tentative 11.3% of participants, with myopia being the most frequent refractive error, followed by astigmatism and hypermetropia. This overall prevalence is broadly comparable with the recent Indian evidence. A large multistate study involving more than 2.2 million schoolchildren reported that myopia increased progressively with age and was associated with urban residence, private-school attendance and other demographic factors.[12] The similarity in the overall burden supports the continuing importance of systematic childhood vision screening in India.

The predominance of myopia in the present study is consistent with the changing pattern of refractive errors among Indian children. In the multistate Indian study, the prevalence of spherical-equivalent myopia increased from 1.57% among children aged 5–9 years to 4.8% among those aged 15–18 years.[12] The present study also showed a tendency for refractive error to be more frequent during adolescence, particularly among children aged 13–15 years. This age-related increase is clinically important because adolescence represents a period when myopia may develop or progress rapidly.

Considerable regional variation in the prevalence of refractive errors has been documented in India. A large study from Krishna district, Andhra Pradesh, involving 56,988 children aged 4–15 years reported a prevalence of refractive error of 2.38%, with myopia accounting for 2.17%.[13] The lower prevalence in that study compared with the present tentative estimate may reflect differences in study design, age distribution, screening methodology, diagnostic thresholds and population characteristics. Importantly, the Andhra Pradesh study demonstrated that refractive error was a major avoidable cause of childhood visual impairment, reinforcing the value of early identification and correction.

In contrast, the Hyderabad Eye Study reported a substantially higher prevalence of myopia among children and young adults in an urban South Indian population. Myopia was present in 29.8% of the overall study population, and its prevalence increased strongly with age.[14] Differences between these findings and the present study are expected because the Hyderabad study included participants up to 22 years of age and was conducted in an urban population with potentially different educational and socioeconomic characteristics. Nevertheless, both studies demonstrate the important relationship between increasing age and myopic refractive error.

The observed predominance of refractive error among older children may also reflect changes in lifestyle and visual behaviour. A South Indian study published after the COVID-19 period reported a marked increase in myopia among public-school children and identified reduced outdoor activity and inadequate sleep as important associated factors.[15] These findings are particularly relevant to the present study because prolonged indoor activities, digital-device use and reduced opportunities for outdoor exposure may contribute to the increasing burden of childhood myopia. However, such factors should be interpreted as associations rather than established causal factors in a cross-sectional study. (PubMed)

Outdoor activity appears to be an important modifiable factor in childhood myopia prevention. Gopalakrishnan et al., in a study of 3,429 South Indian schoolchildren, found that increased outdoor time was protective against myopia, whereas a higher near-work-to-outdoor-time ratio was associated with greater myopic refractive error.[16] In the present study, counselling regarding outdoor activity and healthy visual habits was therefore included among the remedial measures. This approach is supported by an overview of systematic reviews showing that increased outdoor exposure can reduce the

development of myopia in children, although its effect on progression among children who are already myopic is less certain.[17] (Wiley Online Library)

The present study also identified several clinically important conditions associated with refractive error, including amblyopia, strabismus, corneal abnormalities, cataract and lens abnormalities. This is an important finding because paediatric refractive error should not always be regarded as an isolated optical problem. The Andhra Pradesh screening study demonstrated that a substantial proportion of children referred for further care had avoidable causes of visual impairment.[13] Comprehensive ocular examination is therefore essential, particularly in children with reduced best-corrected visual acuity, marked anisometropia, unilateral visual impairment or atypical refractive findings.

The relatively high proportion of children showing improvement after spectacle correction in the present study emphasizes the effectiveness of simple and readily available interventions. Spectacle prescription remains the principal treatment for uncomplicated paediatric refractive error, while children with amblyopia, strabismus or structural ocular disease require additional management. Recent evidence also emphasizes the need for broader childhood myopia-management strategies rather than relying solely on correction of existing refractive error. Dhakal et al. highlighted increased outdoor exposure as an important preventive public-health measure, particularly for children at risk of developing myopia.[17]

An important component of successful paediatric eye care is compliance. Even when refractive errors are correctly diagnosed, children may not wear spectacles regularly because of discomfort, cosmetic concerns, parental misconceptions or social stigma. A recent survey of Indian optometrists found that full-correction spectacles and increased outdoor activity remained commonly recommended approaches for childhood myopia, while implementation of more specialized myopia-control strategies varied considerably.[18] This supports the need for individualized counselling of both children and parents and regular follow-up to ensure that prescribed correction is actually used.

The findings also have implications for screening programmes in India. The very large multistate study by Joseph et al. demonstrated that school-based screening can identify substantial numbers of children requiring refractive correction and showed considerable variation between states.[12] Similarly, the Andhra Pradesh study demonstrated the feasibility of large-scale screening and referral pathways.[13] The present findings therefore support integration of routine visual-acuity assessment, appropriate refraction, ocular examination and timely spectacle provision into paediatric and school-health services.

The principal strength of the present study is that it considered not only the prevalence and type of refractive error but also potentially associated ocular conditions and remedial measures. However, the cross-sectional design prevents determination of temporal or causal relationships between refractive error and behavioural factors. The relatively small sample size compared with large population-based Indian studies may also limit generalizability. In addition, assessment of screen exposure, outdoor activity and family history may be subject to recall bias. Longitudinal studies with standardized cycloplegic refraction and repeated assessment of refractive progression would provide stronger evidence regarding risk factors and the effectiveness of preventive interventions.

Overall, the findings indicate that paediatric refractive errors remain an important and largely treatable cause of visual morbidity. Early detection, accurate cycloplegic refraction, appropriate spectacle correction, identification of amblyopia and ocular pathology, parental counselling, adequate outdoor activity and regular follow-up should form the basis of a comprehensive paediatric refractive-error programme.

CONCLUSION

Refractive errors remain an important and potentially avoidable cause of visual impairment among children. In the present study of 247 children, refractive errors were identified in 28 (11.3%), with myopia (5.3%) being the most frequent refractive error, followed by astigmatism (2.8%) and hypermetropia (2.0%). The occurrence of refractive errors tended to be higher among adolescents, particularly those aged 13–15 years. Although the overall distribution between males and females was similar, the findings emphasize the need for systematic screening rather than relying on symptoms alone. Clinically identifiable conditions such as amblyopia, strabismus, corneal abnormalities, cataract and lens abnormalities were also observed, demonstrating the importance of comprehensive ocular examination in children with refractive errors. Spectacle correction was the principal remedial intervention, and 25 (89.3%) children demonstrated improvement in visual acuity following appropriate management. Regular spectacle use was reported by 24 (85.7%) affected children, indicating reasonably good treatment acceptance. Early detection through school and paediatric screening, accurate cycloplegic refraction, prompt spectacle prescription, identification and treatment of amblyopia and associated ocular disease, parental counselling, adequate outdoor activity and regular follow-up should therefore form an integrated strategy for reducing childhood visual impairment. Larger longitudinal studies are recommended to evaluate refractive progression and long-term effectiveness of preventive interventions.

Limitations: This study has several limitations that should be considered when interpreting its findings. First, the study included only 247 children and was conducted in a hospital-based setting at three centres;

therefore, the findings may not represent the prevalence of refractive errors in the general paediatric population or in all geographical regions. Second, the cross-sectional design permits assessment of prevalence and associations but cannot establish temporal or causal relationships between refractive errors and potentially associated factors such as screen exposure, near-work activities, outdoor time and family history. Third, information regarding lifestyle and behavioural factors was obtained largely from children or parents and may therefore be affected by recall or reporting bias. Fourth, the follow-up period for evaluating remedial measures was relatively short, limiting assessment of long-term spectacle compliance, refractive progression and sustained visual improvement. Although 25 (89.3%) children showed improved visual acuity after intervention, this outcome should not be interpreted as evidence of long-term treatment effectiveness. The study also did not include detailed longitudinal measurements of axial length or serial refractive changes, which are important for evaluating myopia progression. Finally, the relatively small numbers of children with specific ocular conditions, such as keratoconus, cataract and lens abnormalities, limit meaningful subgroup analysis. Larger, multicentric, population-based longitudinal studies with standardized follow-up are required to confirm these findings.

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