SRIWIJAYA JOURNAL OF MEDICINE

Characteristics of Refractive Errors at the Pediatric Ophthalmology Clinic of Ramata Eye Hospital

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Abstract

Refractive errors are the leading cause of visual impairment in children. Early detection and correction are essential to prevent long-term effects on visual development and children's learning ability. This was a descriptive observational study with a cross-sectional design, using secondary data obtained from the medical records of pediatric patients aged 0–18 years with refractive errors at the Pediatric Ophthalmology Clinic of Ramata Eye Hospital during the period January–December 2023. The sample was selected using consecutive sampling. Univariate analysis was performed to describe the distribution of patient characteristics. A total of 80 patients were analysed, with the majority in the 6–10-year age group (52.5%) and a female predominance (53.8%). The most common type of refractive error was compound myopic astigmatism (37.5%), followed by myopia (25.0%) and simple myopic astigmatism (21.3%). Most patients had moderate visual acuity (60%). Following correction with spectacles, visual acuity improved, with 57.5% of patients achieving normal vision. This study underscores the importance of early detection and appropriate management of refractive errors in children, as well as the need for public health promotion regarding the impact of refractive errors on children.

Keywords: Refractive Errors, Children, Visual Acuity, Myopia

1. Introduction

Visual impairment remains a global health problem with a substantial burden. The World Health Organization has reported that approximately 2.2 billion people worldwide experience visual impairment, with uncorrected refractive errors as the leading contributor, accounting for 43% of all cases.[1] This indicates that refractive errors are a dominant cause of visual disability that is, in fact, preventable and can be managed effectively.

Refractive error is a disorder of the optical system of the eye that prevents light rays from being focused precisely on the retina, resulting in reduced visual acuity.[2] Clinically, these disorders include myopia, hyperopia, and astigmatism, which are the forms most frequently encountered in the community.[3] In the pediatric population, these disorders carry broader implications because they occur during an ongoing phase of visual development and may therefore affect the maturation of the visual system as a whole.

The prevalence of refractive errors in children varies across regions. Data indicate that approximately 12.7% of visual impairment due to refractive errors occurs in the pediatric population, with the rate among school-aged children in Indonesia reaching around 10%.[4] Several studies have shown that increased near-visual activity is associated with a rising incidence of myopia in school-aged children.[5] This condition has been further influenced by changes in learning patterns during the COVID-19 pandemic, which increased the duration of digital device use in daily learning activities.[6,7]

In addition to environmental factors, genetic factors also play a role in the

development of refractive errors. Inheritance may occur in an autosomal dominant or recessive manner and increases the risk in children with a similar family history.[8] Genetic factors are known to make a strong contribution to the pathogenesis of myopia in children.[9] Local data from Denpasar show a prevalence of refractive errors among primary school–aged children of 31.9%, indicating a high burden of the problem at the community level.[10]

Uncorrected refractive errors can have wide-ranging effects on children. These disorders can cause eye strain, headaches, and reduced concentration during learning.[11] Given that vision is a primary pathway in the learning process, disorders that are not properly addressed can lead to reduced academic achievement and suboptimal visual development.[12,13]

Although refractive errors are relatively easy to correct, early detection in children remains a challenge. Correction can be achieved through the use of spectacles, contact lenses, or refractive surgery, with spectacles as the primary option in the pediatric population owing to their safety and ease of use.[14] Ramata Eye Hospital, as a specialized eye care facility in Denpasar, plays an important role in managing visual impairment in children. Data from 2023 indicate that refractive errors were among the five most common cases at this facility.[15] However, to date there are no data specifically describing the characteristics of refractive errors or visual acuity outcomes after correction in pediatric patients at this facility.

Based on this consideration, the present study aimed to describe the characteristics of refractive errors and changes in visual acuity after correction in pediatric patients at the Pediatric Ophthalmology Clinic of Ramata Eye Hospital, Denpasar, providing data from a clinically representative patient population rather than a school-based cohort. Additionally, the availability of both presenting and best-corrected visual acuity measurements enables a more accurate assessment of visual impairment and the associated ophthalmic care needs.

2. Methods

This was a descriptive retrospective study with a cross-sectional design based on medical records. The data used were secondary data from the medical records of pediatric patients aged 0–18 years diagnosed with refractive errors at the Pediatric Ophthalmology Clinic of Ramata Eye Hospital during the period from January to December 2023.

The sampling technique used was consecutive sampling. A total of 317 patients who met the eligible criteria, 80 patients were used as the study sample who met the inclusion criteria. The variables examined included age, sex, type of refractive error, initial visual acuity, visual acuity after correction, and type of management. Eligible participants may be required to have complete refraction records and documented presenting and best-corrected visual acuity measurements. Patients with a history of ocular diseases other than refractive errors, previous ocular surgery, or organic ocular abnormalities affecting visual acuity should be excluded to minimize potential confounding. Data processing was performed using SPSS version 25. Data analysis was conducted univariately to describe the frequency distribution and percentage of each variable.This study obtained ethical approval under number 0350/UN14.2.2.VII.14/LT/2024. All patient data were anonymized to maintain confidentiality.

3. Results

A total of 80 patients were analyzed in this study. The age distribution showed that the 6–10-year age group was the largest (52.5%), followed by those aged 11–18 years (38.8%) and 0–5 years (8.8%). By sex, the proportion of female patients was higher than that of male patients (53.8% vs 46.3%). The most common type of refractive error was compound myopic astigmatism (37.5%), followed by myopia (25.0%) and simple myopic astigmatism (21.3%). Most patients had moderate initial visual acuity (60.0%), followed by the mild (23.8%), severe (8.8%), and profound (7.5%) categories. After correction with spectacles, the distribution of visual acuity improved. A total of 57.5% of patients achieved normal vision, followed by the mild (37.5%), moderate (3.8%), and severe (1.3%) categories. No patients had profound visual impairment after correction. All patients in this study received spectacles as their management (100%).

Table 1. Characteristics of the Study Sample

Characteristic	Frequency (n = 80)	Percentage (%)
Age		
0–5 years	7	8.8
6–10 years	42	52.5
11–18 years	31	38.8
Sex		
Female	43	53.8
Male	37	46.3
Management		
Spectacles	80	100.0
Contact lenses	0	0%
Refractive surgery	0	0%

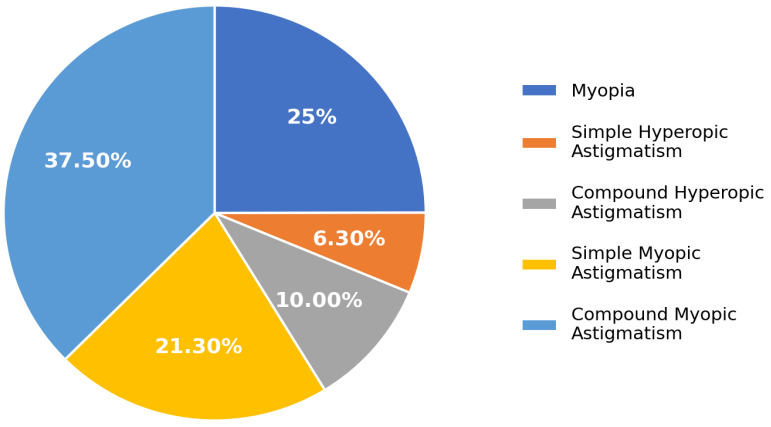
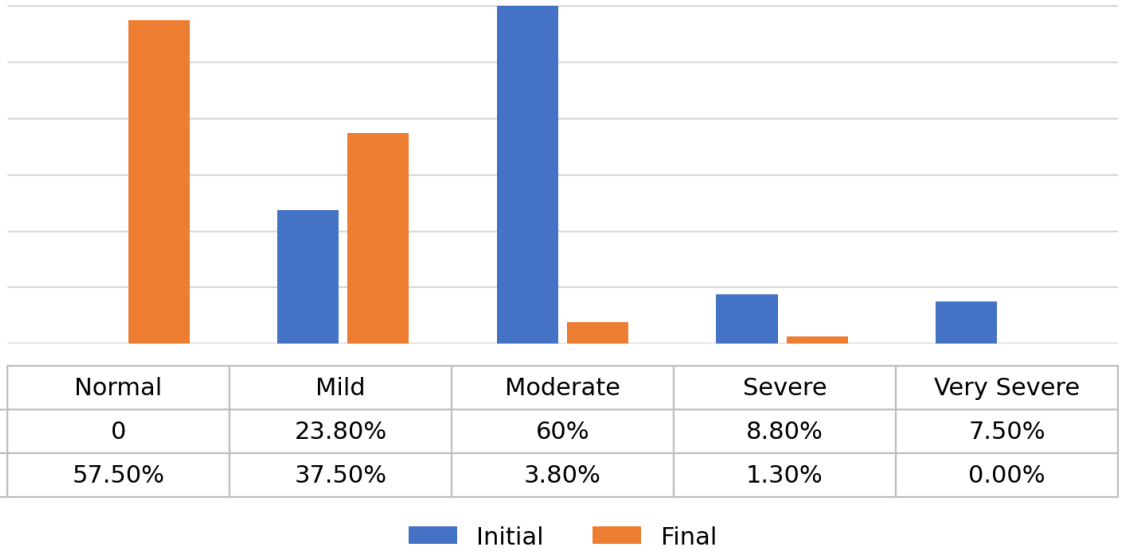


Figure 1. Distribution of Refractive Error Diagnoses



	Normal	Mild	Moderate	Severe	Very Severe
Initial	0	23.80%	60%	8.80%	7.50%
Final	57.50%	37.50%	3.80%	1.30%	0.00%

Figure 2. Distribution of Visual Acuity

4. Discussion

The age distribution in this study showed that refractive errors were most frequently found in the 6–10-year age group. This finding is consistent with previous studies indicating that primary school age is a period of increased risk of refractive errors, particularly in relation to increase near-visual activity and changes in visual behaviour in children.[16,17] During this phase, children begin to face higher academic demands, including reading activities and the use of digital devices, which contribute to the development of refractive errors.

The predominance of compound myopic astigmatism in this study reflects the complexity of refractive errors in the pediatric population. Based on Haarman *et al* study, that suggested the development of myopia related not only to genetic factors but also to environmental factors, such as the intensity of near work and low exposure to outdoor activities.[18] The interaction between these genetic and environmental factors contributes to changes in the structure of the eyeball, including axial elongation, which is the principal mechanism in the development of myopia. Previous studies have also shown that increased near-visual activity without a balancing amount of outdoor activity is associated with an increased risk of refractive errors in children.[5]

The improvement in visual acuity after correction with spectacles demonstrates that conventional optical intervention continues to provide clear clinical benefit in the pediatric population. This finding is consistent with other studies indicating that spectacles are an effective, safe, and most widely used treatment option in the management of refractive errors in the pediatric age group.[14,19] Nevertheless, not all patients achieved normal visual acuity after correction. This condition may be related to the presence of amblyopia or other accompanying disorders that can affect the response to optical correction.[20,21]

The clinical implications of this study affirm the importance of early detection of refractive errors in children. Delayed diagnosis can lead to more severe visual impairment and

affect visual function and academic performance.[11] Therefore, a population-based approach through school-based screening programs is a relevant strategy for improving early detection and reducing the prevalence of uncorrected visual impairment. Integrating screening programs with education for parents and educators may also help raise awareness of the importance of eye health in children.

This study has several limitations that should be considered. The design, based on secondary data, entails limitations related to the completeness and accuracy of the data. In addition, this study did not evaluate important risk factors such as near-visual activity and digital device use, which are known to play a role in the development of refractive errors in children.[5] Biometric parameters such as axial length of the eyeball were also unavailable, so the interpretation of pathophysiological mechanisms could not be performed comprehensively. Future studies are expected to integrate clinical and biometric parameters to provide a more comprehensive picture.

5. Conclusion

In this hospital-based study, refractive errors were most frequently observed among children aged 6–10 years, with compound myopic astigmatism representing the most common diagnosis. Spectacle correction resulted in improved visual acuity in the majority of patients, although a proportion of children did not achieve normal visual acuity, suggesting the presence of additional factors influencing visual outcomes. As this was a single-centre, cross-sectional study conducted at a tertiary ophthalmology referral hospital, the findings reflect the clinical characteristics of children seeking specialist eye care rather than the prevalence of refractive errors in the general pediatric population. Nevertheless, the predominance of school-aged children highlights the importance of timely identification and appropriate refractive correction during this critical period of visual development. Further population-based prospective studies are warranted to evaluate the effectiveness of early screening, the impact of diagnostic delay, and long-term visual outcomes

6. Acknowledgment

None

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