International Journal of Research in Medical Sciences
Ali J et al. Int J Res Med Sci. 2025 Sep;13(9):3734-3740
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20252784

Original Research Article

Estimation of progression of pediatric myopia in school going children among 4-15 years of age

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Received: 03 July 2025
Revised: 05 August 2025
Accepted: 20 August 2025

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ABSTRACT

Background: Pediatric myopia, or nearsightedness in children, has become a growing public health problem in globally. The increasing prevalence, in rural populations, because lack of eye awareness and, is linked to lifestyle changes such as increased screen time, not proper maintain hygienic condition and reduced outdoor activity.
Methods: A prospective study was conducted among 350 school going children aged 4-15 years attending the primary school in rural area. Comprehensive ophthalmic examinations and binocular vision assessment including subjective refraction were performed. Demographic data and family history were collected using structured questionnaires.
Results: A total of 350 students of primary school Chandikhera were assessed for this study. Of those 57 students come under these criteria (Pediatric myopia). Of these patients, 61% of patients were male, while 39% female. Overall, 16.28% of total patients had pediatric myopia. The prevalence of myopia increased by the time of 6 months (March to August 2023) from 16.28% to 22.85% (57-80 pediatric myopia patients) in which male pediatric myopic increment about 11.14% to 14.28%, (39-50 male) while in female about 5.14% to 8.57% (18-30 female).
Conclusions: The study found a significant association between lack of eye education, increased screen time, not proper diet maintain and higher myopia prevalence in children. Early detection and lifestyle modification are crucial for pediatric myopia control. Promoting outdoor activities, regular eye checkup, maintain diet and hygienic condition and important eye awareness may help reduce progression in pediatric myopia populations especially in rural area.

Keywords: Pediatric myopia, Childhood myopia, Myopia progression, Refractive error in children, School-age myopia, Outdoor activity, Myopia control, Rural area

INTRODUCTION

Myopia, commonly known as nearsightedness, is a prevalent eye condition where the image is focused in front of the retina. This causes a blurred image on the retina, resulting in a lack of clarity for the patient (Figure 1).[1] Myopia is a widespread ocular issue globally, particularly prevalent in Asian countries. Reports indicate that the prevalence among Asian populations can reach between 37% and 60%.[2,3] In urban Asian communities, the annual incidence has exceeded 14%.[4,5] Pediatric myopia impacts around 23% of the global population, with a prevalence rate ranging from 0.9% to 3.1%.[6] Ocular morbidity is associated with axial growth, serving as a significant cause of lasting vision impairment.[7,8] Myopia often presents during childhood, usually between the ages of 7 and 10, and typically progresses over the subsequent 10 to 15

years.[9] Nevertheless, due to the lack of an established treatment protocol, there is considerable variation in treatment approaches among pediatric ophthalmologists and trained optometrists aimed at reducing myopia progression.[10] Myopia can be classified into two main types: Refractive myopia occurs when the eye's focusing ability is excessively powerful, causing the image to be projected in front of the retina. Axial myopia, which is the more prevalent type, happens when the eye's axial length is excessively long, measured from the cornea to the rear of the eye. The cornea and lens have typical focusing power, yet the retina is positioned further back than where the image is focused.[1] The global rise in myopia prevalence is contributing to an increasing public health challenge, as severe levels of myopia (≤6 D) can result in sight-threatening issues such as myopic macular degeneration, retinal detachment, glaucoma, and choroidal neovascularization.[11-13] Factors associated with high myopia in adulthood include an early age of onset and a rapid progression during childhood. [14-16] Myopia typically begins during childhood, the teenage years, or adolescence.[14-17] The typical age at which myopia begins can differ based on gender, ethnicity, and whether the parents have myopia.[18] Other known risk factors associated with myopia include increased educational demands, reduced outdoor activity, and more time spent on near work, which tend to coincide with an earlier onset.[19-22] The most significant growth in the eyes occurs during early childhood, while stabilization might not be seen until late adolescence.[23,24] Research indicates that having one myopic parent raises the likelihood of juvenile myopia. It has also been noted that the risk of juvenile-onset myopia increases by more than six times if both parents are myopic.[25]

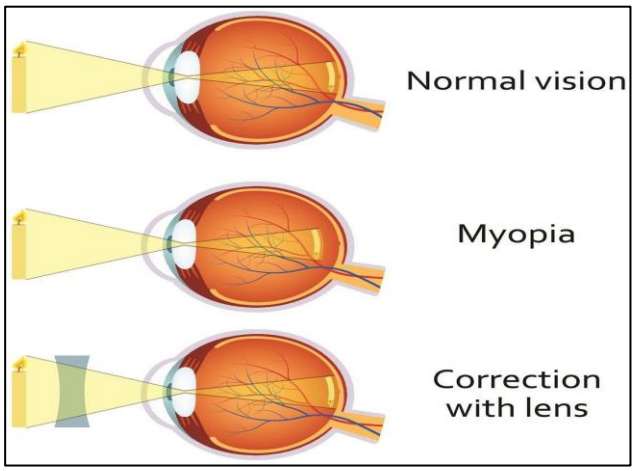

Figure 1: Myopia: symptoms, causes and treatment.[26]

Myopia is also an important cause of ocular morbidity especially in younger generations like school-going children and young adults.[26] It has become a major public health problem globally, with a prediction of up to 50% of the world population will be myopic by 2050.[27] Uncorrected myopia can have huge social, psychological, economic, and developmental implications.[26] In addition, due to the degenerative changes in the retina and the optic disc, the irreversible vision-threatening sequel seems inevitable. Myopes read more and scholastically perform better than emmetropes or hyperopes, so accommodative effort and myopia may be associated.[27-30] Myopic patients also have a higher accommodative lag than emmetropic patients and the lag of accommodation focuses light behind the retina during near work, potentially acting as a putative cue for increased myopia progression. Reduced accommodative effort in under corrected myopia has shown to slow its progression.[31-34] It has also been observed that, under-correcting a child's refractive error can either increases or have no effect on itsprogression.[35,36] In view of conflicting observations by previously performed studies, performed a retrospective /prospective study to analyze the progression of myopia over one year in children (school going boys and girls) diagnosed as simple myopia having a rural background, who were given full refractive correction. To investigate the progression of the p ediatric myopia over a period of 1 year in school going children between age group of 04-15 years.

METHODS

To establish this research project is to prospective analysis of data in school going children, primary school Chandi Khera Goswa Dilawar Nagar, Malihabad Lucknown, U. P. within 6 months (March 2023 to Augst 2023). The institutional review board and ethics committee approved the methods of medical data collection. All patients provided written informed consent. In this analysis we consider about 350 Students as the subject which is the subject data of respective. In the given subject data in the methodology there are about 214 male and 134 female as the gender consideration. Content for the screening. In the following screening we used many Optotypes tools like-torch light, Snellen chart (Distance vision), trail box, with accessories like Trial frame, lenses, Ocluder, pin hole, Maddox rod, red and green fitters, Intra pupillary distance scale (IPD), Snellen chart (Near vision), retinoscope etc. By Using there tools and charts we go through the test like-Torch light examination, visual acuity test (Unaided, with pin hole, aided), subjective refraction, near visual acuity test, IPD test, ocular motility test (OM), confrontation test, cover test (Distance/near), near point of convergence (NPC) with the help of tip of the pen.

Inclusion criteria

Patients with age-4-15 years old, gender-male and females, occupation-School student and residence-rural areas were included.

Exclusion criteria

Children with other ocular pathologies (e. g. cataract, glaucoma), children with a history of eye surgery, Children with systemic disease and uncooperative children were excluded.

Testing procedure

Torch light examination

Now we will discuss about the test's procedures. The torch light examination helps to inspect alignment and position of the eyes, lid examination, eye lashes examination, conjunctiva (palpebral/ bulbar), cornea examination, sclera examination, anterior chamber examination, pupil examination, iris examination, lens examination.

Distance visual acuity test

Measurement of distance visual acuity test, how clearly a patients can see at distance so using the test, visual acuity test, patient is seated at the distance of 6 meter from Snellen's chart (Distance of about 6 meters exert minimum accommodation). The chart should be properly illuminated and then patient is made to wear trial frame. The trial frame should be adjusted according to patients IPD. Ask the patient to read the chart with one eye from the top letter and closes the other eye with the occluder the in-trial frame. Now ask the patients to read the Snellen's chart and depending upon the smallest line which the patient can read is recorded as 6/6, 6/9,6/12,6/18,6/24,6/36,6/60. If the patient is not able to read the top line Snellen's chat from 6 meter, then ask him to come towards Snellen's chart step by step and vision is recorded at 5, 4, 3, 2, 1, meters and noted as 5/60,4/60,3/60,2/60,1/60 respectively. Now if the patients are unable to read the top line from 1 meter, then ask to count the finger of the examiner and vision is recorded as CF 3 feet, CF 2 feet, CF 1 feet, CF close to face. If the patient is not able to count finger closed to face, then the examiner waves or moves the hand and ask the patient whether he is able to see hand movement or not and recorded as HM+ and HM- when a patient cannot distinguish hand movement then the examiner notes whether the patient can perceive light (PL) or not and recorded as PL+ and PL-. Similarly, if the examiner through the light from 4 directions (Nasal, superior, temporal, inferior) and marked as PR (Projections of rays) present or positive or else mark as absent or negative. The test is repeated for the other eye in similar fashion.

Near visual acuity test

Measurement of near visual acuity test, how clearly someone can see at a short distance within 25 cm to 33 cm, ask the patient to sit with his back towards the light. If the patient is using glasses for distance the same correction number will be put on the trail frame. Ask the patient to hold the Snellen's near vision chart by his/her hand at a distance of 25 cm to 33 cm. Note the near visual acuity as per letter read. N6, N8, N10, N12, N18, N24, N36. IPD test-measurement of IPD. We used millimeter scale to take IPD from one center of pupil to other center then we instructed the patient not to move his/her head while doing procedure we will sit at the same level of patients eye, the distances of 40 cm (16 inch) and closed our right eye and instructed the patient to fix on our left eye then hold mm scale in-front of patient's eyes and lined up the zero point on patient's right eye at the pupil center now instructed the patient's look at our right eye with are left eye closed finally read of scale directly in line with left pupil center.

Ocular motility test

Ocular motility test to assess movement and function of extraocular muscles with help of measurement of Ocular motility test. We sat at same level with the patient and ask him/her to not move his/ her head while procedure then we ask the patient to fixate on our finger and ask him to move his/ her eyes along with our finger then we moved our finger in "H" pattern in all "9" quadrant positional gaze.

Confrontation test

Assesses peripheral visual fields with help of measurement of confrontation test. We say the same eye level with one arm the distance from patient and asked the patient to fix at the central target (Nose) that we asked the patient to close his/ her right eye and focus with the left one on nose and also close our left eye and firstly ask the patient is our face clear to him/her then we assess with finger counting method i.e. showing finger in all four quadrant and ask him to count finger and same is done with other eyes.

Cover test

Measurement of cover test for (near/distance), to checks how well your eyes work together, specifically to identifying and measure any types of misalignments or deviation in your eyes. Cover test is done to check tropia. We will cover one eye and check other eye movement. Ensure that there is sufficient light so that the examiner can see patient's eyes. Sit approximately 30 cm away from patient We will then explain the patient about the procedure to check how well their eye movement is working together. Cover one eye and tell the patient to look at this letter at near and keep watching the letter while cover your eye. The examiner observes.

Orthotropia: If there is no movement normal.

Exotropia: If there is from outward to inward movement.

Esotropia: If there is inward to outward movement.

Hypertropia: If there is upward to downward movement.

Hypotropia: If there is upward to downward movement.

Convergence test

Measurement of convergence test. Assesses the how well your eyes can turn inward together when focusing on nearby fine or thin object. Convergence test is done to check the near focusing ability by the method of NPC. We will explain and council the patient about procedure of checking of their near power convergence or near focusing

ability. There are 2 type methods, (objective/subjective). Objective-Examiner should be observing patient eye. Subjective-Patient response. Objective-hold the pen/pencil tip in front of patient's eye and keep moving slowly towards their eye. (Keep ideal measurement to break the fusion). Observer the any one of eye drift outwards when moving the pen tip closer and take measurement from temporal canthus to target. Subjective- Follow the same process with pen/pencil. Ask the patient to tell at which point they see double image then you can take the further measurement. Indication-Less than 12 cm is considered normal, between 12 and 15 cm considered suspect, greater than 15 cm is awareness. Orthoptics testing is indicated we can advise there pen push up therapy.

Table 1: Represent the normal and abnormal values of tests use in screening of patients for data collection.

Tests	Normal	Abnormal
Torch light examination	Adnexa are normal	Adnexa are abnormal
Visual acuity	6/6	6/9-6/12
Near V/A	N-6	N-8
IPD test	63 mm	75 mm
Ocular motility	9-Quadrants Full	7-8 Quadrants
Confrontation test	4-Quadrants	2-3 Quadrants
Cover test	Orthophoria	Hyper, hypo, eso, exo
NPC test	6-12 cm	15-18 cm

RESULTS

A Total of 350 students of primary school Chandikhera were assessed for this study. Of those 57 students come under these criteria (Pediatric myopia). Of these patients, 61% of patients were male, while 39% female. Overall, 16.28% of total patients had pediatric myopia. The prevalence of myopia increased by the time of 6 months (March to August 2023) from 16.28% to 22.85% (57-80 pediatric myopia patients) in which male pediatric myopic increment about 11.14% to 14.28%, (39-50 male) while in female about 5.14% to 8.57% (18-30 female).

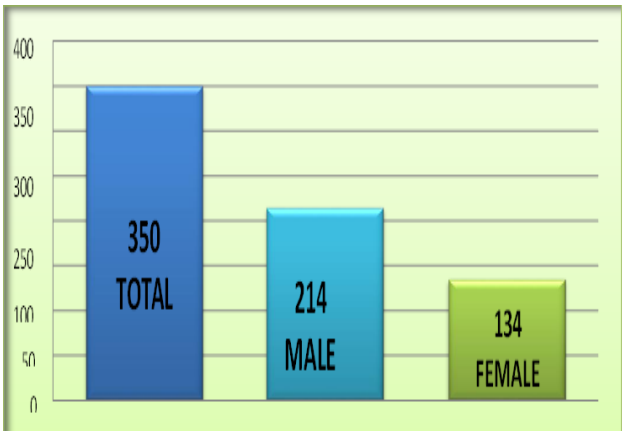

Figure 2: Gender distribution at first day analysis.

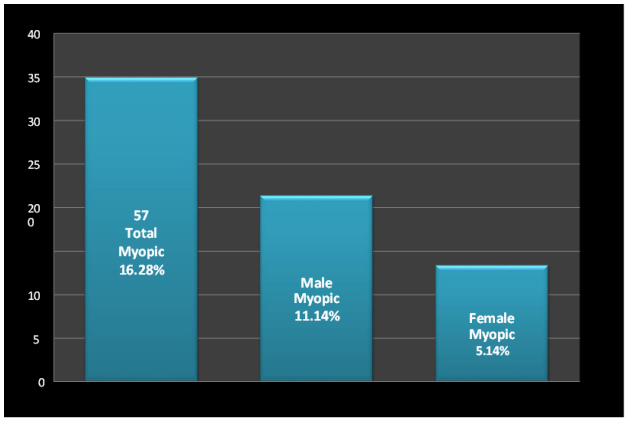

Figure 3: Percentage of male and female paediatric myopic patients, at first day analysis.

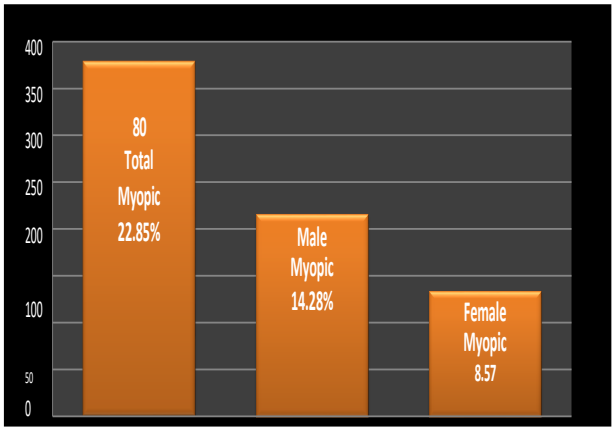

Figure 4: Increase percentage of male and female pediatrics myopic patients after six months analysis.

DISCUSSION

This study described pediatric myopia progression in 350 schools going children who all are not able to get proper evaluation and finding for the condition. Many clinics and hospitals offering myopia control all over the globe by the help of many strategies. Our study is unique as it determined the causes of pediatric myopia progression until the age of below 4 to 15 years and is giving the valuable information or idea to deal with the growing children to stop the pediatric myopia to happen or grow at mild stage. Potential limitation of our study should also be mentioned as it designs as retrospective and included the school going children between the age groups of 4 to 15th years in urban area condition. Myopia progression held with more age students as the cross the age limit for the study unfortunately it cannot be explained by this study due to lack of data on these age group and other risk factors for myopia progression in that age groups. We think the degree of refractive error can serve as the professionals to maximize myopia control as that first decade of 10 years are the development state of the student which may easily reduce the final refractive error unfortunately with higher attempts at the age of 10 years did not exclude development of higher myopia in children hence all

children with initial development of body in the first 10 years with first myopia progression should be followed with case.

The purpose of the study was to find out how common myopia is in Indian schools and what variables contribute to it. In some Asian populations, myopia prevalence has been reported to be as high as 70-90%, with Taiwan reporting an 84% prevalence among 16-18 year old high school students.[37,38] Myopia was found to be present in 4.79% of school pupils in Chandigarh in the first survey undertaken in India in the 1970s by Jain et al in comparison to the rural population, it was higher in city population (6.9%), (2.77%).[39] Murthy et al investigated the prevalence of refractive error and accompanying visual disability in school-aged children aged 5 to 15 in a New Delhi metropolitan community, finding a prevalence of 7.4% myopia.[40] The commonly reported risk factor of myopia is working near a computer, and various observations confirm this notion. In recent years, environmental variables like a more competitive school system have further added to the risk factor. Furthermore, environmental factors including as education, occupation, and personal income have been linked to the occurrence of myopia. Because students in higher classes spend more time studying, a link between myopia with age and the rising prevalence of myopia with increased studying offers more support to the close work theory in myopia development. In this study, 18.53% of myopic cases had a parent with ametropia and 12.92% had a sibling with ametropia.[41,42]

Limitations

One of the primary limitations of this study on pediatric myopia is the relatively short duration of follow-up, which may not fully capture the long-term progression patterns and treatment outcomes in school going children. Additionally, the sample size was limited to a specific geographic region and demographic, which may reduce the generalizability of the findings to broader populations. Variability in compliance with prescribed interventions (e. g., spectacle wear, outdoor activity, reduces excessive use of electronic devices and maintain hygienic conditions, recommendations) among children and parental reporting bias also present potential sources of error in the data. Furthermore, environmental and genetic factors influencing myopia development were not comprehensively analyzed, which could impact the interpretation of associated risk factors.

CONCLUSION

Myopia is regarded as major public health problem in India, most commonly in children which is the most worried aspect of our country. The national programme for the central of blindness give the top attempt with much government and private hospital while spreading awareness with the help of eye screening camps federal funded and also by the help of hospitals many schools eye screening programme has been very victorious in many state of the nation which much refractive error in children also called paediatric myopia. The detection and evaluation of these youngsters is very important in our field as it impacts with learning difficulties and poor academic performance and with decrease in psychological development as well.

Recommendations

Based on the findings of this study, it is recommended that early eye screening and regular monitoring of refractive error status in school going children in rural area to be prioritized to detect the onset and progression of pediatric myopia at an early stage. Schools and pediatric healthcare providers should be encouraged to integrate vision screening programs, especially targeting children between the ages of 4 and 15, when pediatric myopia typically begins to develop over the time of period. It is also advisable to promote increased outdoor activity and limit prolonged near work, including reduces excessive screen time, as part of public health education for parents and especially in school teachers. Further research is recommended to explore the long-term effectiveness of various pediatric myopia control interventions, such as regular eye checkups, proper use of prescribe glasses, low-dose atropine, orthokeratology, and specially designed pediatric myopia control lenses, across diverse populations.

ACKNOWLEDGEMNTS

Authors would like to thank to Dr. Komal D. Singh (Cataract and glaucoma specialist) Charak hospital and research center and Dr. Gaurav Mohan Kohli (Vitro-retinal surgeon/retina specialist) Era's Lucknow Medical college and hospital for their valuable suggestions and guidance.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Ali J, Siddiqui DH, Gupta SK, Mahmood W, Abbas M, Nisar MM, et al. Estimation of progression of pediatric myopia in school going children among 4-15 years of age. Int J Res Med Sci 2025;13:3734-40.