

### ABSTRACT

**Aim:** This study aimed to determine teachers' perceptions about the difference in school children behaviors and academic performance after the correction of refractive error with spectacles.

**Study Design:** Observational prospective study.

**Duration and Settings of the Study:** The study lasted one year and was conducted at Islamabad Model College for Girls (IMCG) Thanda Pani, a public sector higher secondary school/college in Islamabad, Pakistan.

**Methods:** In-depth interviews (IDIs) were conducted with 22 class teachers regarding 66 students identified with a refractive error during phase I of school screening. These interviews were held at the beginning of the academic session and after the annual examination to assess the impact of the correction of refractive error and the provision of spectacles. Academic performance was categorized as above average, below average, and failed.

**Results:** Due to several reasons, 9 students were not using their spectacles, while 57 were wearing spectacles daily for 6-10 hours. Following refractive correction and provision of spectacles, improvements were observed in academic performance. Among the 57 students who were using spectacles, 26 (45.6%) students were in category 1 (above average); 22 (38.6%) students were in category 2 (below average), while 9 (15.8%) students were in category 3 (failed).

**Conclusion:** Timely detection and correction of refractive errors significantly improve students' behaviors and refractive errors.

**Keywords:** Academic performance; Refractive errors; Spectacles

### INTRODUCTION

School Screening programs enable early detection, diagnosis, correction of refractive error, provision of glasses and low vision services, ensuring inclusive education and overall development. Screening for refractive errors in schools identifies potential problem areas, including academic and health concerns. Undetected vision problems can lead to academic and behavioral issues, affecting students' engagement and performance.

Students identified through this process are subsequently offered interventions designed to prevent or mitigate the identified concerns. In

reeducational settings, screening can serve to uncover a variety of potential challenges, encompassing academic difficulties, disabilities, or health-related issues. For instance, students experiencing minor vision or hearing impairments may remain undetected, and without timely and effective intervention, these individuals may experience a decline in academic performance and the emergence of behavioral issues. Consequently, nearly all educational institutions mandate vision and hearing screenings to identify students with even slight impairments, ensuring that such issues are addressed before they lead to adverse outcomes.<sup>1</sup>

For more than a hundred years, school health services have served as a crucial safety net for children, identifying disorders that may not be easily recognized by parents, teachers, or even the children themselves. Over time, these services have evolved in sophistication, transitioning from

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general medical examinations to formal screenings targeting specific age groups for particular disorders. Currently, screening tests are standard practice within all school health services, encompassing a broad spectrum of health issues. Among the various concerns addressed by school health screening systems are growth and development, hearing and vision, speech and language, as well as dental health.<sup>2</sup>

According to a Rapid Assessment of Refractive Error (RARE) study conducted in Pakistan, the prevalence of refractive error is 5.4% in the age of 5-15 years.<sup>3</sup> In the age group 5-15 years, non-correction of refractive errors arises from a variety of factors, with the most significant being the absence of screening and the accessibility and cost of refractive corrections. Additionally, cultural disincentives contribute to this issue, as evidenced by surveys conducted in countries where routine screening and the provision of corrections are either free or readily available, yet compliance remains notably low.<sup>4</sup>

Different research concluded that the prevalence of refractive errors in school-going children was found 19.8% and 8.9%, respectively.<sup>5,6</sup> Refractive errors, especially, myopia is a great problem in school-going children. This ocular morbidity can have a serious impact on child participation and learning in class and this can adversely affect children's education, occupation, and socioeconomic status.<sup>7</sup> Myopia is reported as the most common refractive error in children when comparing groups of refractive errors.<sup>8</sup> It is observed that the academic performance of students with hyperopia tends to be lower than that of students with myopia. The hyperopic group had 26% of students below the basic level, whereas the myopic group had 16% of students below the basic level.<sup>9</sup> The relationship between vision and academic achievement has been a subject of

debate, with several visual factors being associated with learning-related problems. These factors include reduced visual acuity, uncorrected refractive error, binocular vision dysfunction, and delayed development of visual information processing skills.<sup>10</sup>

On a typical school day, approximately half of academic-related tasks are conducted at near distance, and on average, it has been demonstrated that children typically engage in continuous near fixation tasks (such as continuous reading or undertaking tasks at near) for 23 minutes at a time.<sup>5</sup> This suggests that in addition to the visual acuity demands imposed by many classroom activities, conditions that do not inherently impair vision quality, such as uncorrected hyperopia, also have potential to impede comfortable access to visual information presented in the classroom.<sup>11</sup>

Among students with low visual acuity, 25% exhibited fair or poor academic performance, which was more compared to students with fair or poor academic performance but normal visual acuity (10.5%) ( $p = 0.015$ ).<sup>12</sup> The average mean academic performance of the pupils with uncorrected refractive error (URE) ( $49.54\% \pm 10.49\%$ ) was statistically significantly lower than those without refractive error ( $71.08 \pm 10.09$ ), mean difference = 21.55 (95% confidence interval, 15.18-27.92) ( $t = 6.70$ ,  $P = 0.000$ ).<sup>13</sup> A study reported that among 214 myopic students, 65% demonstrated improvement in their scholastic performance following subjective correction, while 35% showed no improvement.<sup>14</sup> In another study, out of 350 students, 28.29% had compromised vision (less than 90% on the Snellen chart). It reported that 57.58% of those with reduced visual acuity exhibited poor academic performance and a higher probability of repeating the class.<sup>15</sup> Screening is typically understood as a concise process aimed at distinguishing

individuals who may exhibit early signs of minor issues that could potentially escalate over time, as well as those who are at a high risk of developing complications. This study aimed to assess the impact of the correction of refractive errors on children's academic performance and gather teachers' perspectives on students' eye health.

## METHODS

A total of 1357 students aged 5-15 years were enrolled in this school. During phase 1, sixty-six students were identified with uncorrected refractive errors and were provided spectacles after subjective refraction. Individual in-depth interviews (IDIs) were conducted with 22 class teachers about these 66 students' cohorts. These IDIs were conducted at the beginning of the academic session. Class teachers were inquired about their perception and observation of the behavior and academic performance of this cohort of 66 students. After the annual examination, IDIs were again conducted to assess the impact of the intervention (refraction and spectacles provision) on their behavior and academic performance. Academic performance was assessed in 3 categories: category 1 Students showing above average grades, Category 2 Students showing below average grades, and category 3 Students failed. Interviews were recorded, with the consent of the teachers, reviewed, summarized and manually analysed using an inductive method of thematic analysis through Microsoft Word.

## RESULTS

The interviews explored the following themes: (1) teachers' perceptions about students' health, (2) students' class/academic performance and extracurricular activities, and (3) the impact of refractive errors on academic performance.

### **Teachers' perceptions about students' health**

Despite the large number of students in the public sector school in a peri-urban area, generally,

teachers were satisfied with their students' health. It was repeatedly mentioned that a healthy student is someone who takes part in class activities as well as sports and takes good care of their hygiene. Some teachers believe students should be given health education as they are great learners and good messengers. One of the class teachers said that a healthy student is one who is socially and physically healthy, alert mentally, and participates actively in all curricular and extracurricular activities. The cohort of teachers showed a vigilant role about their students' health but complained about the parents' involvement in their children's health.

Most of the teachers mentioned that they try to promote healthy habits and advise their students about cleanliness, motivate them to maintain healthy activities and make health a priority ( e.g trim their nails, eat healthy breakfast, bring their water bottle and lunch with them, should not buy things from canteen, wash their hands every time they use toilet.

The objectives of this study were to determine the impact of refractive errors, both corrected and uncorrected refractive errors, on the academic performance of students and to gain the perspective and observations of teachers regarding their students' eye health and academic performance. Seven class teachers mentioned that they give their students health education once in a month. Almost half of them mentioned that they advise their students not to touch their eyes with dirty hands.

Teachers highlighted the need for health education to be integrated into the primary and secondary level curricula. Teachers encouraged the use of posters and painting competitions, debate competitions about health and hygiene and expert medical teams from nearby hospitals to visit

schools and deliver health talks. Teachers stressed upon the annual general health screening, infirmary in the public sector schools, counsellors for regular students and parents counselling, regular supply of safe drinking water, toilets with hand wash facilities and playgrounds.

### **Student's class/academic performance and extracurricular activities**

According to teachers, 71% of students identified with uncorrected refractive errors were regular and 29% were frequently absent. Most of them had a common excuse that they were not well. One teacher mentioned that her student she mostly has an eye allergy, and her eyes are red and sticky. Almost all of the class teachers showed satisfaction about the behavior of the students with other classmates and teachers; however, three teachers shared observations like “she does not talk a lot, shy, has low self-confidence, tilts her head while looking at the board, seems sleeping, and doesn't have many friends”.

Of all the teachers, 50% showed satisfaction with the students' class participation while others were not satisfied with their students' involvement in the class activities. One class teacher mentioned that her student is “Attentive but not in all subjects. She takes an interest in mathematics” Upon inquiring she said that “there is no reading in mathematics and digits appear clearer to me”. According to the class teachers, half of these students like to sit in the middle seats, whereas other students prefer to sit in the front-row seats and only 5 of them are on the back benches. Overall, all the teachers mentioned that there are not many extracurricular activities conducted at the school due to the lack of a playground or auditorium.

Most of the class teachers complained about the neglectful behavior of parents toward their

children's health. A teacher shared that one of her students' mother talked about the “eye patching” of her daughter but discontinued after a while because her classmates and friends made fun of her and stigmatized her for the “black patch on her eye”.

### **Impact of refractive errors on academic performance**

Academic Performance of 66 students, with refractive errors was assessed in 3 categories as category 1: 26 students in this category showing above average. Category 2: 26 students showing below average grades while in category 3: 14 students failed, including 4 who are repeating their classes/academic sessions. All these students were satisfied with their spectacles and had no complaints.

### **Thematic analysis of the follow-up interviews after one year of academic sessions:**

IDI's were conducted with the same cohort of teachers about their perception and observation of the 57 students who were regularly wearing their prescribed and provided spectacles. An intervention of eye health education and spectacle care sessions were also conducted during the second phase.

### **Teacher's perception and observation after intervention (eye health education, refraction, and spectacles provision)**

Most of the teachers were satisfied with the performance of their students after they received spectacles. Total of 84% of students were found regularly attending school as compared to 71% in the beginning of the session (before correction and spectacles). They shared that most of their students are active, while a few were still not satisfied.

A teacher talked about one of her students who had amblyopia and whose performance improved after

receiving spectacles correction. The teacher who mentioned that her student seems to be sleeping in the classroom participates very actively in class and also gets good grades now. Another teacher who told about her student's eye deviation told that she visited an eye hospital after school eye screening and is using her spectacle correction and her classroom performance is satisfactory. Four students still prefer to sit in the front seats because they do not use their spectacles, and hence, they cannot see clearly from the back seats. One of the students loved mathematics but could not perform well in other subjects like English.

### **Spectacles compliance**

According to the teachers' observations, most of the students were satisfied with their spectacles and were wearing them regularly. Nine students were not wearing their spectacles. Spectacles compliance was higher among female as compared to male. Reasons for non-compliance were loose frames, color and style of frame, lens fitting, and fellow students making fun of them and calling them different names to bully them. Some students were not wearing their spectacles because of their parents. The students' parents didn't want their daughters to wear spectacles as their relatives would make fun of them.

### **Impact of Eye health education**

Eye health education had an impact on teachers, students, and indirectly, parents. Teachers showed enthusiasm to share that they now observe their students very closely in their classrooms about how they look at the white board, how they write in their notebook, whether they squeeze their eyes or rub their eyes, are their eyes watery or sticky or is there any redness. All of them said that now they not only take care of students' eye health but also their general health. Some teachers said that their students are now aware of the importance of healthy eyes, and they keep

themselves and their eyes clean. They also mentioned that students tell them and their parents whenever they have any watering, itching, discharge, or redness. Also, students are now familiar with uncorrected refractive errors and the importance of their timely management.

A teacher mentioned that one of her students who was absent in the screening week told her vision gets blurry while looking at far things like white, and as she got her vision checked, she had uncorrected refractive error, and now she is regularly using spectacles. Three other teachers said that their other students have eye allergies and they have got their eyes checked and also using eye drops.

### **Impact of Corrected Refractive Errors on Students' Academic Performance**

After refraction and the provision of spectacles to 66 students, 57 regularly wore spectacles. Among 26 students in category 1, 15.2% improved their grades, while among 22 in category 2, 59% improved their academic performance after spectacle correction. Among 9 students in category 3, 25.7% still failed their final annual exams. There are other confounding factors involved and were beyond the scope of this study to investigate.

## **DISCUSSION**

This study highlights the impact of refractive errors on academic performance and emphasizes the role of teachers in the early detection of refractive errors and intervention. Consistent with literature, these findings suggest integrating eye health into school programs and ensuring follow-up on spectacles compliance.<sup>16</sup>

It is evident from the findings of this study that children experiencing vision impairments exhibit various signs and symptoms indicative of these challenges, which can be discerned through their



classroom behavior and expressed concerns at home. Consequently, educators, parents, and family members play a crucial and often pivotal role in the prompt identification of children facing vision issues. Findings from this study necessitate educational initiatives aimed at equipping them with strategies to manage these difficulties effectively.

Consistent to findings from our study, a study conducted in Lahore in 2022 public and private sector results were compared. It was reported that in the public sector, the average score of academic results before the intervention was  $56.39 \pm 13.24$  which was increased to  $60.27 \pm 14.94$  after the intervention while in the private sector, before the intervention, the average score was  $63.53 \pm 17.50$  which was improved to  $67.12 \pm 18.48$ .<sup>17,18</sup> A multi-center study with an increased number of participants may result in a more precise and accurate outcome but the feasibility and resource management will be an uphill task, whereas the current study was conducted in a public sector school with overall compromised facilities.

In a study conducted in California aimed at comparing groups of refractive error, researchers found that the academic performance of students with hyperopia tended to be inferior to that of students with myopia.<sup>9</sup> The hyperopia group had 38% of students above basic level, whereas the myopia group had 62% of students above basic level. The hyperopia group had 26% of students below the basic level, whereas the myopia group had 16% of students below the basic level. However, this study determined the impact of corrected and uncorrected refractive errors on academic performance. Students from fifth, eighth, ninth, and tenth grades (n=1053) from Pomona Unified School District, California, USA, were screened for refractive errors using an auto-refractor. The current study also involved students

of the same grades from a public sector school.

In a randomized control trial, the study focused on over 19,000 primary school students in rural China, who were divided into two groups: 103 schools provided eyeglasses to students in grades 3-5, while 62 schools served as control groups without eyeglasses.<sup>19</sup> After one year of providing eyeglasses, the results demonstrated a significant improvement in academic performance. Test scores increased by 0.15 to 0.30 standard deviations compared to the control group. This indicates that access to eyeglasses positively influenced the students' ability to perform academically.

## CONCLUSION

Teachers play a significant role, alongside parents, in students'/children's lives. Refractive errors have a significant impact on students' academic performance. Those who wore spectacles regularly showed significant improvement in their academic performance. School eye health programme plays an important role in the identification of students with uncorrected refractive errors at an early age so that their refractive errors can be prevented from developing into learning disabilities.

## Recommendations:

It is recommended that school eye health be a regular part of all school health programmes, not only including screening, but eye health education for teachers and students, referrals, refractive correction, provision of spectacles and follow up on the compliance of spectacles as well.

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## Conflict of Interest

No financial interests are involved.

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**Patient Consent:** Informed consent was obtained from all patients involved in this study.

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### Author(s) Contributions

**SAAS:** Conceptualization and design of the study, drafting, review and final approval of the final manuscript and agrees to be accountable for all aspects of the work.

**AQ:** Data analysis, review and final approval of the final manuscript and agrees to be accountable for all aspects of the work.

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