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Prevalence and Pattern of Refractive Errors among Secondary Schools Students in Sulaimaniya city-Kurdistan region-Iraq

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Original Research Article

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Abstract: Awareness of poor visual acuity that can be treated easily and effectively in the student groups can add positively for their quality of life and quality of their study**.** A descriptive cross-sectional study done among students aged 14–19 years in secondary schools in Sulaimani city from six secondary schools both male and female are enrolled. To determine the prevalence and pattern of refractive errors in this students group and determine the prevalence of different types of refractive errors which include (Myopia, Hypermetropia & Astigmatism). The total of 848 students aged 14–19 years, were examined. Examination included visual acuity testing by E chart, and refraction was done for those having visual acuity less than 6/6. The refractive errors of the students' eyes were measured using streak self - luminous Retinoscopy and non-Cycloplegic auto-refraction. Out of 848 students, 737 (86.9%) were emmetropic (normal visual acuity) and 111 (13.1%) were ametropic. Of those 111 students, Myopia with myopic astigmatism was the commonest types: 41(36.9%), and 52(46.8%) students respectively. Hypermetropia found in 14(12.6%) students. Anisometropia was found in seven (6.3%) students, represents (0.8%) of the sample. Amblyopia was found in 11(10%) students, of overall sample (1.3%) had Amblyopia. Only one had bilateral Amblyopia. Bilateral vision correction to 6/6 was found in 81(73%) students, (9.6%) of the study sample, Six (5.4%) students (0.7%) had unilateral correction to 6/6, Nine (8.1%) students (1.1%) had bilateral correction to 6/9, and 15(13.50%) students, overall represents (1.8%) of them, their vision was correctable to less than 6/12. Those having glasses earlier were 35(31.50%) students represent (4.1%) of the sample while 76(68.50%) student need glasses. Prevalence of refractive errors was 13.1% of the sample. Simple myopia was the most prevalent refractive errors that corrected to 6/6, While. Amblyopia was more common in hypermetropic. Anisometropia was the least common of the sample.

Keywords: Refractive errors, Emmetropia, Ametropia, Myopia, Hypermetropia, Astigmatism, Amblyopia.

INTRODUCTION

Emmetropia is the refractive state in which parallel rays of light from a distant object are brought to focus on the retina in the nonaccommodating eye Ametropia refers to the absence of Emmetropia while Astigmatism (a= without, stigmas= point) is an optical condition of the eye in which light rays from an object do not focus to a single point because of variations in the curvature of the cornea or lens at different meridians. In irregular astigmatism, the orientation of the principal meridians or the amount of astigmatism changes from point to point across the pupil [1].

The myopic eyes possess too much optical power for its axial length. In myopia with accommodation relaxed, light rays from an object at infinity converge too soon and thus focus in front of the retina. Hyperopia, the hyperopic eye, does not possess enough optical power for its axial length. In hyperopia with accommodation relaxed, an object at infinity focuses behind the retina [2, 3].

Different subsets of myopia have been characterized. Juvenile-onset myopia, defined as myopia with an onset between 7 years and 16 years of age, is due primarily to growth in axial length. Risk factors include family history, and intensive near work. In general, the earlier the onset of myopia is, the greater is the degree of progression. Refractive errors stabilize at about age 15 or 16. In those whose errors do not stabilize, progression often continues into the 20s or 30s [4]

Abbreviations: D-Diopter, ARM-Autorefractometer, LASIK-Laser in situ keratomileusis, PRK-Photorefractive Keratoplasty, SPSS-Statistical package for social sciences, VA-Visual acuity.

Classification of myopia:

- mild myopia is less than or equal to minus 3.00D
- moderate myopia is from minus 3.00to minus 6.00D
- Sever myopia when it is more than minus 6.00D [5].

Degrees of Hypermetropia:

- Mild or low Hypermetropia when it is equal or less than +2.50D.
- Moderate when it is from +2.50--+5.00D.
- High Hypermetropia when it is more +5.00D [6].

Astigmatism is that dioptric condition of the eye, in which, with accommodation completely relaxed, incident rays of light from distant object do not form a point focus on the retina but are brought to multiple foci at varying distances from the retina [7].

Regular astigmatism is further classified:-

a. Simple astigmatism: Where one meridian is normal and the other meridian is either hypermetropic or myopic. These are respectively designated simple hypermetropic and simple myopic astigmatism.
b. Compound astigmatism: Here the two meridians are abnormal, hypermetropic or myopic, designated as compound hypermetropic or compound myopic astigmatism.
c. Mixed astigmatism: Here the two meridians are abnormal but one meridian is hypermetropic and the other is myopic [8].

Anisometropic amblyopia, one of the most common types of amblyopia, is caused by a difference in refractive errors that results in a unilateral or asymmetrical image blur. Most patients with Anisometropic amblyopia have straight eyes and appear "normal," so the only way to identify these patients is through vision screening, as little as +1.00 D of hypermetropic Anisometropia and -2.00 D of myopic Anisometropia can be associated with amblyopia [9].

Visual acuity (VA), Is the assessment of central vision, for testing visual acuity, E Snellen chart or Landolt's C-ring chart is used, and the visual acuity is considered normal 6/6 when the patient, at a distance of six meters can read every letter on the chart from the top to the bottom [10].

Methods of correction of refractive errors: Glasses, contact lenses, surgical correction, corneal Incisional surgery, and laser surgery as photorefractive keratectomy (PRK), and Laser in-situ keratomileusis (LASIK) [11]. All the students primarily corrected or already corrected with glasses.

Objectives

Finding out the prevalence and pattern of refractive errors in secondary school students in Sulaimaniya governorate/Kurdistan region/Iraq

SUBJECTS AND METHODS

848 students both male and female are involved equally, aged from (14- 19) years old chosen from secondary schools in Sulaimani city. All of the study population lived in Sulaimani city of different socio-economic status. . Data were collected from October 2007 to February of 2008.

Study design: This is descriptive cross-sectional study

Statistical and data analysis

Using SPSS version 14.0 computer program. Using Chi –Square test, p value less than 0.05 was considered significant, Microsoft excel 2003, Microsoft excel 2007.

Study area

Six secondary schools and Shahid Dr. Aso Teaching Eye Hospital, (Refraction Department) in Sulaimani city Students included in this study were selected from 6 secondary schools in Sulaimani city (these schools selected according to geographical site to include different socio-economic status). From each school about 130 -140 students were collected. Those schools were 3 for male 3 for female. Both eyes of each student were examined for visual acuity test using E Snellen chart from 6 meters distance in their schools: Both eyes were examined separately and recorded. Started with right eye and then left eye and binocular visual acuity was assessed to detect those having visual acuity less than 6/6 and further examination and refraction done for those having visual acuity less than 6/6 in Refraction Department in Shahid Dr. Aso Teaching Eye Hospital in Sulaimani. For those students who were wearing glasses before, the visual acuity test was done with glasses on. Refractive errors were determined by streak self-luminous Retinoscopy, Autorefractometer (ARM), trial set and frame used.

E Snellen chart is used for examining visual acuity of students, Self-luminous Retinoscopy (hand held) and Autorefractometer used to detect and diagnose types of refraction, Trial set and trial frame to confirm refraction, Direct ophthalmoscope and non-contact biconvex +90 degree lens used for examination of media and fundi to exclude any disease in the retina which may lead to decrease vision Slit lamp for anterior segment examination to exclude any disease that may occlude the media of passing light through it (for example cataract, or corneal opacity).

Questionnaire for data collection it included age, gender, visual acuity testing of both eyes alone and with pinhole, objective and subjective refraction, it also included past and present history of ocular disease,

history of glass wearing and lastly include general examination of the eye.

Keratometry done for those suspecting having Keratoconus. Spectacles prescribed for their visual correction to determine full correction or not.

The variables includes, Myopia (simple, moderate and severe myopia), Hypermetropia wherein parallel rays of light from infinity come to a focus behind the retina when accommodation is at rest and corrected by the convex lenses, and Astigmatism. Different types of astigmatism and these variables were measured by objective refraction (Retinoscopy and Autorefractometer then confirmed by subjective methods trial frame and set (different lenses) used, until had got best correction for the students.

Looking for other variables like the presence of amblyopia, Anisometropia, Correction of vision and history of Glass wearer.

Ethical issues: Agreement gained from the school managers and orally from every student.

RESULTS

Out of 848 students who were examined (424 males and 424 females), 737(86.9%) were normal, and 111(13.1%) have defective vision as shown in Figure 1 bellow.

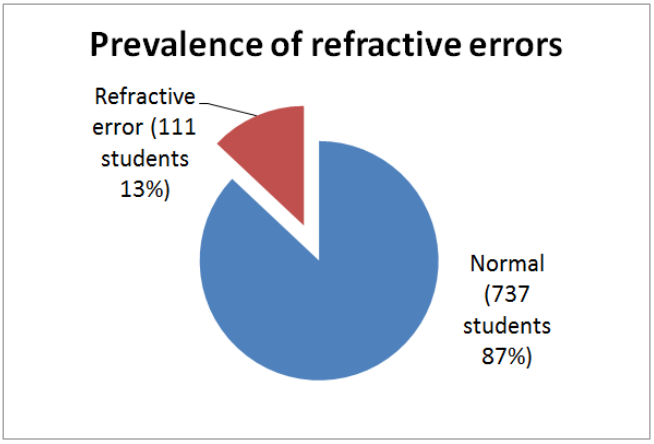

Fig-1: Pie chart showing prevalence of Refractive error among study sample

Regarding demographic characteristics of study group with the laterality pattern of involvement, Table-1 bellow:-

Table-1: Demographic characteristics of the study group

Gender	Normal	with refractive errors	Total number	Percentage
Male	379	45(40.5%)	424	50%
Female	358	66(59.5%)	424	50%
Total	737	111	848	100%
Laterality	Number of students with refractive errors			Percentage
Unilateral		19		17%
Bilateral		92		83%
Total		111		100%

According to the distribution of types of refractive errors among students, Myopia with myopic astigmatism were the commonest types 93 students (41 myopic, 52 students myopic astigmatism) which represents (84% within refractive state of eye). Then comes Hypermetropia with hypermetropic astigmatism in 14 students (12.4% within refractive state of eye), and lastly come irregular astigmatism and mixed astigmatism in two students for each one. As shown in table-2 bellow.

It appears that in pure myopic group 41(37%) students, simple or mild myopia is the commonest type of myopia that occurred in 36(32.4%) students. Then moderate myopia occurs in 3(2.7%) students, While sever myopia was present in two (1.8%) students as shown in Figure-2 bellow.

Table-2: Percentage of Different Types of Refractive errors in affected students.

Type	No. of Students	Percentage %
Pure Myopia	41	36.9
Simple Myopic Astigmatism	22	19.8
Compound Myopic Astigmatism	30	27.0
Pure Hypermetropia	7	6.3
Simple Hypermetropic Astigmatism	2	1.8
Compound Hypermetropic Astigmatism	5	4.5
Irregular Astigmatism	2	1.8
Mixed Astigmatism	2	1.8
Total	111	100.00

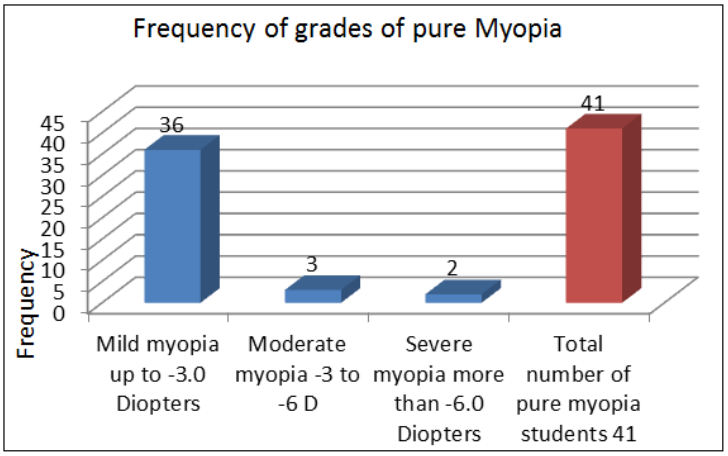

Fig-2: Frequency of mild, moderate and severe pure myopia.

While in astigmatism group of students' compound myopic astigmatism was found in 30(48%) students, simple myopic astigmatism in 22(35%) students, compound hypermetropic astigmatism present in 5(8%) students, while simple hypermetropic astigmatism, mixed astigmatism, and irregular astigmatism are present in 2(3%) students each respectively, as shown in bellow in Figure-3.

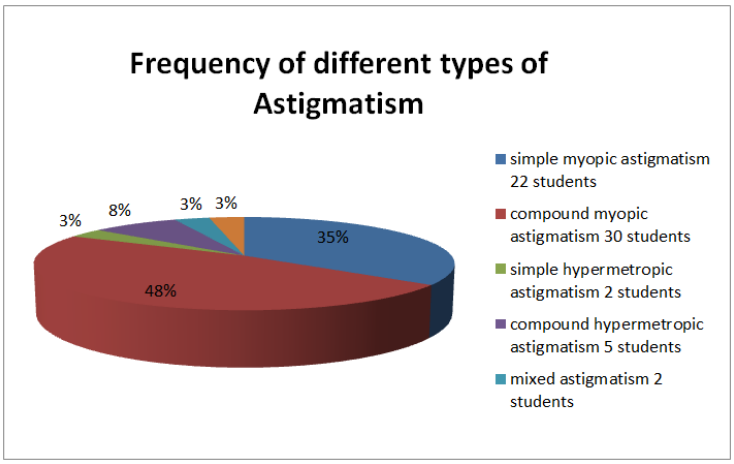

Fig-3: Shows Percentage of different types of Astigmatism.

Mild Hypermetropia which is less than +2.50D was present in 14 students (1.6% of the study sample), pure Hypermetropia in 7 students, 5 students with compound hypermetropic astigmatism and 2 with simple hypermetropic astigmatism

Regarding Anisometropia, 7(6.3%) students had, 4 students having astigmatism, 2 of them with irregular astigmatism and 2 with compound myopic astigmatism, One student with compound hypermetropic astigmatism (P value = 0.02), one with severe myopia and one with myopic astigmatism.

It was found that 11(10%) students have Amblyopia, shown in Figure 4, 10 students with unilateral Amblyopia and one student had bilateral

Amblyopia has severe myopia, while 6 students were compound myopic astigmatism, and one of them from compound hypermetropic astigmatic group. Moreover, 3 of the Amblyopic students were Hypermetropic. P value=0.00

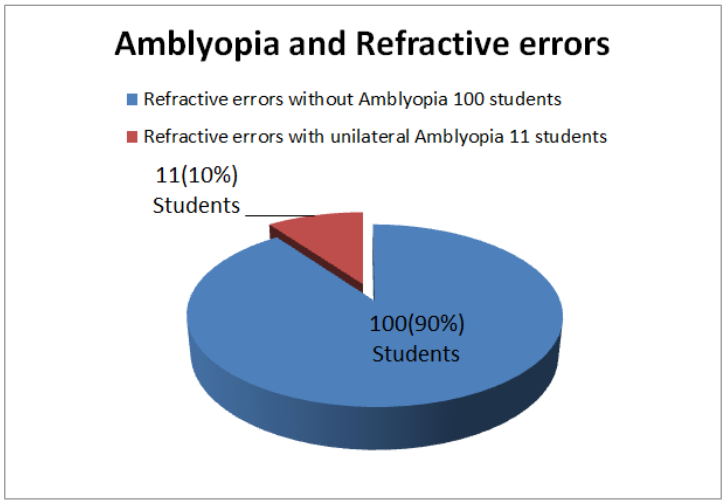

Fig-4: Association of Amblyopia with refractive errors.

Out of 111 student, 81(73%) students got bilateral full correction to 6/6, 6 (4.50%) students have unilateral vision correction to 6/6, 9(8.10%) students their vision correctable to 6/9, and the remaining 15(13.50%) students were correctable to less than 6/12. P value =0.01

Of those 15 students, 10 of them from astigmatic group, 6 of them had compound myopic astigmatism (one of them had corneal opacity), 2 had irregular astigmatism (Keratoconus) one for each compound hypermetropic astigmatism and mixed type. P value =0.01

In sever myopia there were only 2 students, both of them were not correctable or were correctable to less than 6/12. P value =0.01

In hypermetropic, 5 of them had bilateral vision correction to 6/6. One student that had unilateral correction to 6/6, and the other 3 of hypermetropic group were their vision not correctable or were correctable to less than 6/12.

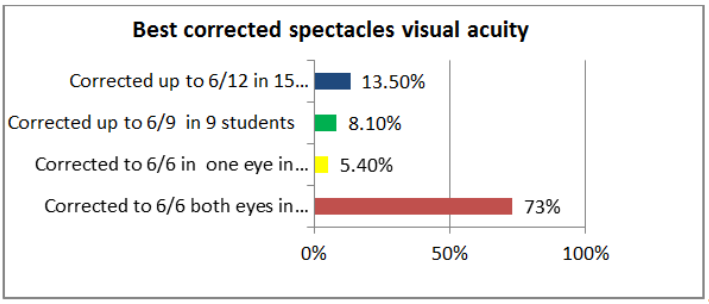

Fig-5: Vision Correction pattern and percentage.

Two students had Keratoconus associated with irregular Astigmatism; one student has compound myopic astigmatism which associated with severe allergy of the conjunctiva with formation of cobble stone and corneal opacity. Allergy was also found in 5 students with myopia, 1 case of hypermetropia and 3 cases of astigmatism.

It was found in that one student has compound hypermetropic astigmatism that associated with squint. P value =0.00

Glasses availability and users : out of 111 students, 35(31.5%) students already had the glasses, 10 have glasses from myopic group, 3 from hypermetropic group, and 18 from astigmatic group, but those had no glasses before were 76(68.5%) students(poverty and neglect are main causes) Figure 6 bellow.

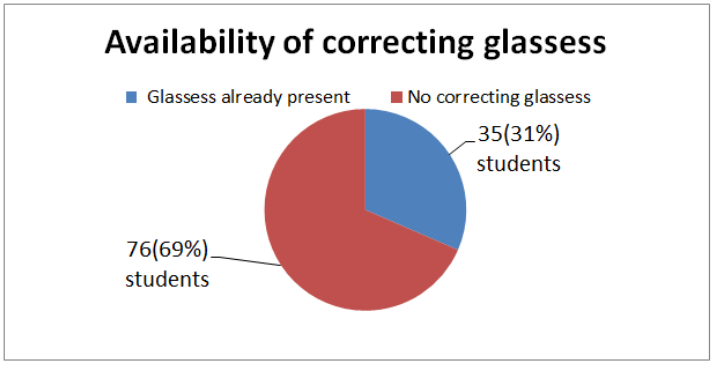

Fig-6: Pie showing Percentage of glass wearer

DISCUSSION

The resultant refractive errors prevalence were found that (13.1%) 111 students out of 848 students, aged (14-19) years, (male and female were equally collected). We have a result similar to that regarding the gender, out of 111 students having refractive errors, males to females, 45, 66 (40.50%, 59.50%) students respectively.

The prevalence of refractive errors in Saudi Arabia study was 9.8%, first detected almost the same prevalence (13.6%) but not all detected cases attends full examination, the prevalence was significantly higher among girls (P<0.033) compared to boys, myopia represents 57.6% of students and they detect 10 students with amblyopia [12].

Myopia in this study represents higher number and percentage of overall refractive errors, 93(84%) students. Amblyopia detected in 11(10%) students, a result close to the results in Saudi Arabia. These values are far lower than the 20.6% prevalence described in an Egyptian community [13]

However, these prevalence values are much greater than those of a similar age group in Tanzania (6.1%) [14]. Ghana (7%) [15], Oman (4.8%) [16], although those studies used a lower cut-off value of 6/12 (20/40) compared to that of Saudi Arabia study, 6/9 (20/30).

While in the prevalence of refractive errors was determined in a sample of high school students from Aligoudarz, Western Iran. More than half of the students in this study had at least one type of refractive error. This finding indicates the importance of refractive errors in this age group [17].

Regarding our results laterality, Bilaterality is the rule with 92(83%) students, while unilaterally in 19(17%) students.

The results here regarding types of refractive errors: it was found that pure myopia and myopic astigmatism is the commonest types of refractive errors with 41, 52 students (37%, 47%) respectively, while Hypermetropia with hypermetropic astigmatism in present in 14 students (12.4%).

In comparison to the study done in Singapore for Prevalence of refractive errors in teenage high school students in Singapore shows, the prevalence of refractive conditions was found to be: myopia (73.9%), hyperopia least (1.5%), astigmatism (58.7%) and Anisometropia (11.2 %.). While the results in this study was less than the Singapore results [18].

The prevalence of myopia it has been reported as high as 70-90% in some Asian countries. 30-40% in Europe and the United States, and 10-20% in Africa [19].

In this study the overall myopia students represents (84%) of refractive errors and it is in between European and Asian countries and is going with the region of Sulaimani (Middle East). The global prevalence of refractive errors has been estimated from 800 million to 2.3 billion [20].

Hypermetropia, pure Hypermetropia observed in 7 students were with low hyperopia which is less than or equal to +2.50 D. Three of them were associated with squint (manifest Hypermetropia is one of the cause of deprivation Amblyopia) there is reflex correlation between accommodation and convergence of the two eyes. Hyperopia is frequent cause of Esotropia and monocular Amblyopia) [21].

Bilateral amblyopia may occur with high refractive errors, typically more than +5D or less than −10D. This is due to form vision deprivation and is more common in Hypermetropia, as Myopes receive some focused retinal images from near stimulation [22].

In this work results, shows 11(10%) students having Amblyopia which is quite high in correlation to high prevalence of refractive errors in this age group In Greece, the prevalence of myopia among 15 to 18 year old students was found to be 36.8% [23].

Anisometropia was found in 7 students (6.3%). It is less than the study done in Singapore for Prevalence of refractive errors in teenage high school students in Singapore. (Anisometropia was 11.2). As a result of corrections, out of 111 student, 81 had full correction to 6/6, 6 of them were with unilateral correction to 6/6, and 9 of them had vision correction to 6/9, and the remaining 15 are not correctable or correctable to less than 6/12, (two of them had Keratoconus, and one of them had corneal opacity) [24].

Anisometropia was detected in 2.58% of schoolchildren in Shiraz/Iran [25]. In this study we found 7(6.3%) students having Anisometropia so it is higher in comparison to the above result.

In this work fortunately most of students gain 6/6 in right and left eyes, 81(73%) students, the other 6, 9 and 15 (5.4%, 8.1% and13.5%) students gaining one eye 6/6, 6/9 and less than 6/12 visual acuity in best eye respectively.

Concerning glasses, 35(4.1% of total the study sample) had glasses before. This indicates severity of students' condition (moderate visual loss) or educational state of the family who were aware of the eye condition of their children. The total of 76 students (9.0% of the total study sample) had no glasses before. They have been either neglecting patient (not wearing glasses) or due to poverty or they are not aware of the condition (that using the better eye). Many poor areas around the world need help by making glasses available freely or low coast [26].

CONCLUSIONS

From this study it was concluded that the prevalence of refractive errors was (13.1%) from the study sample it is Myopia, with myopic astigmatism was the commonest types of refractive errors with the prevalence of 84%.

Simple myopia is the commonest types of myopia correctable to 6/6. Hypermetropia which is less common shows prevalence of 12.4% of total refractive errors, although it is less common but is more associated with Amblyopia and squint. Compound myopic astigmatism is the commonest type of astigmatism.

RECOMMENDATION

- Vision screening must be carried out in primary school children (which this program is performed now in primary health care) school screening is performed in various ways including simple visual acuity testing assessment by paramedical professionals or teachers. Children with visual impairment are referred for an eye examination including refraction, spectacles are prescribed if needed.
- A second vision screening must be carried out in first classes of secondary schools to follow those who are escaping from the first vision screening or not aware of the conditions of their eyes (because as mentioned in the results, 76 students had no glasses before, and as reported, that physiological myopia appeared in adolescence).
- Health awareness to inform the population about the refractive errors and importance of it is correction which reduces much vision impairment in the community as simple lectures given to students.
- Encouraging the students to wear glasses especially females because most of them must wear glasses constantly.
- Forming an organization or an institute which is sponsored by the ministry of health to make free glasses for students especially for the poor ones, managed and supervised by paramedical professionals.
- We should insist that the students must use good lighting while reading, taking frequent eye rest breaks during long study periods, and encouraging them to be physically active.
- If the child wears glasses for myopia, it would be good for him/her to take them off for reading (most, but not all, children would benefit from this).
- Decrease visually stressed environment like watching TV's, computers, Game Boxes, I pads, mobile… etc.
- Good nutrition that rich in vitamins and minerals will help the child to decrease progression of refractive errors.

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Conflict of interest: None

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