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Evaluation Of Refractive Error And Vision Related Problems Among Children In Rural Area

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ABSTRACT

Background: Refractive error is a common eye condition that occurs when eye shape prevents light from focusing directly on the back of eye, resulting in blurry vision. It is one of the leading cause for visual impairment in children. Convergence insufficiency and excess accommodation insufficiency and excess, colour vision deficiency, extraocular muscle weakness, squint, visual field defect can cause severe impact in children vision.

Objective: To evaluate the refractive status of eye and vision related problems like accommodation excess, accommodation insufficiency and convergence insufficiency using RAF (Royal Air Force Rule) and colour vision deficiency, EOM weakness, corneal reflex, and visual field defect in children in rural area.

Methods: In the period between February 2023 to April 2023 all the study participants underwent vision screening in rural area school Chidambaram, India. Visual acuity is measured for both distance and near, NPC and NPA is measured using RAF ruler, corneal reflex is assessed using pen torch, EOM motility tested by broad h test, colour vision is measured using Ishihara plates and visual field is assessed using amsler grid chart test and confrontation field test.

Result: This study includes 500 participants between the age group of 8 -16 years, with a mean age of 12.6 ± 2.02 years;278(55.6%) were male children and 222(44.4%) were female children. A total of 149 (29.8%) of uncorrected refractive error, 11(2.2%) of colour vision defect, 401(80.2%) of accommodation excess and 7(1.4%) of accommodation insufficiency, 20(4.0%) of convergence insufficiency, 51(10.2%) of exophoria, 42(8.4%) of EOM problems, 9(1.8%) of visual field defect was seen in children.

Conclusion: High prevalence of uncorrected refractive error and vision related problems are present in children.

Keywords: *Children, rural area, refractive error, broad h test, amsler grid chart test, confrontation field test.*

1. INTRODUCTION

One of the most typical eye conditions is refractive error. It happens when the eye's ability to focus outside images clearly is compromised. Refractive errors cause hazy vision, which can occasionally be so bad that it impairs vision. To measure Objective and Subjective Convergence as well as Accommodation in 1 mm increments, the RAF Rule (Royal Air Force Regulation) is used. Normal value of near point of convergence and near point of accommodation is 6 to 10 cm. Congenital colour vision abnormalities are non-progressive, incurable conditions that are screened for to help children realize the consequences of their condition for many aspects of their lives, such as employment between stimuli. Colour vision is assessed by using Ishihara plates [1]. Normal colour vision is denoted by 16/16 plates. An Amsler grid is a printed grid that can be used to find paracentral deficiencies, which are rather common in glaucoma patients, as well as abnormalities in the central field. Confrontation field test is a easy test used to assess peripheral visual field. Ocular motility was evaluated using the broad-H test. The positions of gaze in which misalignment of the patient's eyes was observed or for which the patient reported doubling of the target were determined [2]. Abnormal eye movements were recorded. Ocular alignment can be quickly and easily verified with the Hirschberg test, sometimes referred to as the corneal light reflex test. Vision screening is important in children to rule out refractive error and other ocular problems in children [3,4].

2. METHODS

The cross-sectional study was conducted in rural area schools of Chidambaram, Tamil nadu, India, from february 2023 to April 2023. Written informed consent was obtained from each participant before the commencement of the study. The study was approved by the Institutional Ethical Committee (No.747/2023/IEC/ACSMCH).

Inclusion criteria: Children with age 8 to 16 years were included.

Exclusion criteria: Children with above 16 years were excluded.

Study procedure: This study included 500 participants. After collecting demographic data vision screening is started.

Distance Visual Acuity Testing:

For testing distant visual acuity, the patient is seated at a distance of 6m from the Snellen's chart, so that the rays of light are practically parallel and the patient exerts minimal accommodation. The chart should be properly illuminated (not less than 20ft candles). The patient is asked to read the chart with each eye separately and the visual acuity is recorded as a fraction, the numerator being the distance of the patient from the letters, and the denominator being the smallest letters accurately read.

When the patient is able to read up to 6m line, visual acuity is recorded as 6/6, which is normal.

Similarly, depending upon the smallest line which the patient can read from the distance of 6m, his vision is recorded as 6/9, 6/12, 6/18, 6/24, 6/36 and 6/60, respectively. If he cannot see the top line from 6m, he is asked walk towards the chart till he can read the top line. Depending upon the distance at which he can read the top line, his vision is recorded as 5/60, 4/60, 3/60, 2/60 and 1/60, respectively.

If the patient is unable to read the top line even from 1m, he is asked to count fingers (CF) of the examiner. His vision is recorded as cf-3', cf-2', cf-1' or cf close to face, depending upon the distance at which the patient is able to count fingers when patient is fail to count fingers, the examiner moves is hand close to the patient face. If he can appreciate the hand moments, the visual acuity is recorded as HM+ve. when the patient can't distinguish the hand movement, the examiner notes whether the patient can perceive light or not. If yes, vision is recorded as PL+ve and if not, it is recorded as PL-ve [5,6].

Near Visual Acuity Testing:

Following the evaluation of each child's distant visual acuity, their monocular near visual acuity was assessed using the Near ETDRS modified Snellen charts (Lighthouse Inc.) at a test distance of 40 cm and a brightness of at least 24 cd/m2. The left eye was examined first, then the right. The testing process and scoring were the same as those for distant visual acuity testing [7].

Near Point of Accommodation:

The NPA was calculated using the most effective correction available. The near Snellen E chart was moved towards the participants as they maintained a monocular focus on the letter "E" one line above their near visual acuity threshold until they reported that the letters were fuzzy and they could no longer maintain a clear image. The target's distance from the spectacle plane was measured in centimeters at this location of persistent blur. Three measurements of the NPA were taken, and the average of those measurements was noted. For each eye, the AA was computed monocularly [8].

Near Point of Convergence:

NPC was performed with best corrected vision using RAF ruler. RAF ruler has movable target and a rod marked with centimeters and diopter. A dotted line is given as a target and patient is instructed to inform if single image is seen as double.

Raf ruler is moved gradually towards the participant eyes from 40 cm distance. Examiner note the ocular divergence as objective NPC and participants answer is recorded as subjective NPC. To get accuracy NPC is repeated for 3 times and average NPC is noted as final [9].

Amsler Grid Test:

Test each eye separately while making any necessary near refractive corrections. Ask patients to focus on the centre of the grid by holding the chart at a comfortable reading distance from their uncovered eye. As they point out any locations where the grid is deformed or missing, ask them to name them. While distortion is more typical with macular problems, missing patches may indicate paracentral glaucomatous visual field loss.

Confrontation Test:

Make a fist with your right hand and place it in the patient's left hemi-field at eye level, to the right of your face, to check their left hemi-field. Raise one to four fingers and inquire as to how many fingers are visible while making sure the patient is still retaining your attention. Move your hand up and to the right, then down and to the right, repeating the test at different times to assess the top and lower quadrants. This straight-forward finger-counting test is only helpful for patients with significant visual field loss owing to glaucoma when the visual field loss is caused by neurological issues (such as strokes).

Repeat the finger-counting test with your left hand, starting immediately to the left of your face and travelling up and left, then down and left, to assess the patient's right hemi-field and upper and lower quadrants[10].

Broad H Test:

Participant is seated straight asked to remove the spectacles. Examiner holds a light source as target and moves to 9 positions of the gaze. Participant is instructed to report any diplopia or pain during the test.

Hirschberg Corneal Reflex:

Pen torch is used as a light source and participant is instructed to focus on the light source. From a distance of 2 feet light source is shine equally into participants eye at midline. Reflection of cornea present near the center of pupil in each eye is observed. Pen point white light present in center of pupil is considered as orthophoria. Abnormal light reflex represents strabismus based on the direction of reflex strabismus classified [11].

Colour Vision:

Participants is seated comfortably and asked to cover one eye and instructed to identify the letters present in ishihara plate. Examiner holds the card at 35 cm and flip the pages. Number of cards identified by participant is recorded. 16/16 is considered as normal colour vision[12,13].

STATISTICAL ANALYSIS: This is a descriptive study in which results are mentioned in terms of mean and standard deviation

3. RESULT

A total of 500 children were included and screened for eye and vision problems. The majority of students screened were between the age group of 8 to 16 years with a mean age of 12.6 ± 2.02 years, 278(58.6%) were male children and 222(44.4%) were female children (Table.1). Refractive error in both eyes for distance seen in 147(29.4%) children (Table 2) and near 2(0.4%). Colour vision defect is present in 11(2.25%) children (Table 2). On measuring near point of accommodation, 29(5.8%) of accommodation insufficiency and 173(34.6%) (Table 3) of accommodation excess is seen in right eye and 25(5%) (Table 3) of accommodation insufficiency, 233 (46.6%) (Table 3) of accommodation excess is seen in left eye and 7(1.4%) of accommodation insufficiency and 401(80.2%) (Table 3) of accommodation excess is seen in both eyes. In NPC total of 20 .9(4%) (Table 4) of convergence insufficiency is seen in children measured by RAF rule. In corneal reflex 448(89.6%) (Table 4) of orthophoria is present and 51(10.2%) (Table 4) of exophoria is seen. 42(8.4%) (Table 4) of extraocular muscle weakness is present. About 9(1.8%) (Table 4) children was identified by visual field defects.

Table 1: Classification as PER Gender

Gender	Number of children	Percentage (%)
Male	278	55.6
female	222	44.4
Total	500	100

Table 2: Visual acuity for distance, near and colour vision

Condition		Number of children	Percentage (%)
Distance visual acuity	normal	353	70.6
	abnormal	147	29.4
Near visual acuity	normal	498	99.6
	abnoramal	2	0.4
Colour vision	noramal	489	97.8
	abnormal	11	2.2

Table 3: Near point of accommodation (NPA)

NPC	OD		OS		OU	
	No of Children	Percentage	No of Children	Percentage	No of Children	Percentage
Normal	298	59.6	242	48.4	92	18.4
Accommodation insufficiency	29	5.8	25	5	7	1.4
Accommodation Excess	170	34.6	233	46.6	401	80.2

Table 4: Near Point of Convergence (NPC), Corneal reflex, Broad H, Amsler Grid, Confrontation

		No of Children	Percentage
Near point of Convergence (NPC)	Normal	480	96
	Convergence Insufficiency	20	4
Corneal Reflex	Normal	448	89.6
	Abnormal	51	10.2
Broad H	Normal	458	91.6
	Abnormal	42	8.4
Amsler Grid	Normal	497	99.4
	Abnormal	3	0.6
Confrontation	Normal	494	98.8
	Abnormal	6	1.2

4. DISCUSSION

Vision screening in school children is necessary to overcome early blindness in children. The majority of the children in the study were between the age 8 and 16 years [14].

In this study children were included and screened for refractive error and other vision related problems. About 12.04 % have uncorrected refractive error and squinting was seen in 0.26% children according to **Prachi N Bakare et al.**

About 29.4% of children have refractive error in our study. About 2% of children having color vision problem. Corneal reflex is normal in 89.6% children, 10.2% having esophoria and 0.2% having exophoria. About 8.4% having abnormal

extraocular muscles weakening.

91.6% having normal extraocular muscle movement has been confirmed by “broad H test”. Convergence insufficiency is present in 3.8% of children.

About 0.6% of central field defect is present in children tested by amsler grid chart test and 1.2% of peripheral field defect is found in children by confrontation test.

Near point of accommodation measurement 59.6% (RE), 48.4% (LE), 18.4% (OU) are normal in children. In RE: (AE) 34.8%, (AI) 5.6%, LE: (AE) 46.8%, (AI) 4.8%, and OU: (AE) 80.4%, (AI) 1.2% are noted respectively[15].

High prevalence of uncorrected refractive error and other vision related like accommodation excess and colour vision defect, convergence insufficiency, extraocular muscle weakness, squint, and visual field defects were seen [16,17].

By creating awareness about uncorrected refractive error and ocular problems we can overcome visual impairment in children.

Easy vision therapy like pencil push test can decrease convergence insufficiency.

Early detection of uncorrected refractive error and vision problems can improve the overall performances of children in rural area [18,19].

5. CONCLUSION

In our study, we seen high prevalence or uncorrected refractive error and accommodation excess and other ocular problems. It can be overcome by using spectacles and using vision therapy. Early detection of ocular problems can decrease the visual impairment in children.

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