A COMPARATIVE STUDY OF NONCYCLOPLEGIC REFRACTIVE ERROR VALUES WITH CYCLOPLEGIC REFRACTIVE ERROR VALUES

[1]Dr. Sowmya Chowdary, Associate Professor, Department of Ophthalmology, Dr. VRK women's Medical College, Hyderabad.

Corresponding Author: Dr. Sowmya Chowdary

ABSTRACT

Background: Refractive errors are an important common cause of visual disturbance worldwide. Symptoms related to refractive errors are quite disturbing and may even disrupt the normal lifestyle of individuals. The evaluation of these patients can be occasionally aided by topical agents called cycloplegic drugs. Thus refraction can be broadly divided into cycloplegic and non-cycloplegic refraction. Cycloplegic drugs are often used to evaluate patients for underlying refractive errors. Cycloplegics cause temporary paralysis of ciliary muscles allowing the determination of total refractive errors. Noncycloplegic refraction is performed without any drug administration. It doesn't affect the accommodation and pupil dilatation. The various listed methods of non-cycloplegic refraction are retinoscopy, autorefraction, and objective and subjective refraction.

Materials and methods: This is a prospective and single center study was conducted in Department of ophthalmology, Dr. VRK Women's Medical College, Teaching Hospital & Research Center, Hyderabad over a period of 1 year. Patients who were in the age group of 6 years above and less than 35 years with defects in vision were included in the study. History was collected from all patients and using snellen's chart, distant visual acuity was assessed at a distance of 6 meters & near visual acuity was assessed by using jaegers chart by placing at a distance of 25 cms.

Result: In our study included 48.9% of males and 51.1% female patients, with maximum patients 30 (33.3%) in age group of 16-20years. Comparison of pre & post cycloplegic values of Auto-refractometer values in 23 & 24 right and left eyes of hypermetropia patients respectively, there was a significant increase in number of patient from dioptric range (+0.25 to +1.25) to (+2.75 to +3.75), which was 12 to 28 and 20 to 31 right and left eyes respectively, with (p-value= 0.0001) in right eye and (p-value = <0.001) in left eyes, which is significant. There was no significant shift in number of patients pre and post dilation in both eyes of patients of myopic astigmatism, with (p-value = 0.6484) and (p-value = 0.3868) for right and left eyes respectively, which are not significant.

Conclusion: Measurement of refractive error is influenced by accommodation in younger patients. Hypermetropia is underestimated and myopia is overestimated without cycloplegic refraction using autorefractometer. Post cycloplegic autorefractometer values were accepted by all patients and without any complications with good visual acuity.

Keywords: Autorefractometer, Visual acuity, Cycloplegic, Automated refraction

INTRODUCTION

Refractive errors are an important common cause of visual disturbance worldwide. The prevalence of types and degree of refractive errors may vary from region to region.
[1] Symptoms related to refractive errors are quite disturbing and may even disrupt the normal lifestyle of individuals. [2] Refractive error patients form the majority of outpatient patients visiting an optometrist or ophthalmology clinic. [3] A study by Schiefer et al. found refractive errors accounted for 21.1% of the patients presenting to an ophthalmologist. [4]

The evaluation of these patients can be occasionally aided by topical agents called cycloplegic drugs. [5] Thus refraction can be broadly divided into cycloplegic and non-cycloplegic refraction. Cycloplegic drugs are often used to evaluate patients for underlying refractive errors. [6] Cycloplegics cause temporary paralysis of ciliary muscles allowing the determination of total refractive errors. [7] Cycloplegic retinoscopy is also known as wet retinoscopy. Cycloplegics have been used since the 19 century to assess refractive errors by relaxing the accommodation. [8]

Noncycloplegic refraction is performed without any drug administration. It doesn't affect the accommodation and pupil dilatation. The various listed methods of non-cycloplegic refraction are retinoscopy, autorefraction, and objective and subjective refraction. [9]

Automated refraction (AR), an office procedure is replacing time consuming retinoscopy nowadays. Autorefractometer is a computer controlled machine to provide an objective measurement of a person's refractive status. It is quick, simple, user friendly, and independent of examiner. [10] The disadvantages are the expense of the instrument and the instrument induced myopia. AR basically comprises of an infrared source and a fixation target. It is based on two main principles – optometer principle and schiener principle. [11] Because of the close distance between the subject and the target some accommodation is inevitable. This alters the actual refractive status. [12] A variety of targets have been used for fixation to relax accommodation. Accommodation can be relaxed by incorporating fogging technique and using flickering green light during the test. [13]

MATERIALS AND METHODS

This is a prospective and single center study was conducted in Department of ophthalmology, Dr. VRK Women's Medical College, Teaching Hospital & Research Center, Hyderabad over a period of 1 year.

Patients who were in the age group of 6 years above and less than 35 years with defects in vision were included in the study. History was collected from all patients and using snellen's chart, distant visual acuity was assessed at a distance of 6 meters & near visual acuity was assessed by using jaegers chart by placing at a distance of 25 cms.

All patients underwent the following procedures: UCVA, noncycloplegic autorefraction, axial length measurement, intraocular pressure check, and slit-lamp examination followed by cycloplegia and cycloplegic autorefraction.

Prior to cycloplegia, distance VA (uncorrected and with habitual correction if any) was determined using a mounted and illuminated E chart of the Early Treatment Diabetic Retinopathy study (ETDRS) charts (LCD backlit lamp, 400 cd/m^2) at 4 m using ambient room lighting. The lines on the chart ranged from 6/4.8 to 6/60 in 0.1 log MAR steps with 5 tumbling 'E' letters per line. Vision was recorded in decimal notation.

For cycloplegia, 0.5% proparacaine hydrochloride was first instilled in each eye, and after approximately 15–20 seconds, two drops of 1% cyclopentolate were instilled 5 min apart in each eye. After 25–30 min, eyes were checked for dilation and pupillary response to light. The eye was considered to be cyclopleged if the pupil was dilated to 6 mm or more and had no reaction to light. If needed, a third drop was instilled. Patients were encouraged to keep their eyes closed if possible for the duration of cycloplegia.

Autorefraction was performed using an autorefractor with an average of three consecutive readings used to record the refractive error status for each eye. Axial length was measured using an IOL MASTER with an average of three measurements considered for data analysis. If any two measurements varied by more than 0.50 dioptres with autorefraction or 0.02 mm for axial length, the readings were discarded and the eye remeasured. For a given child, a single examiner conducted both the pre- and postcycloplegic measurements. Subjective refraction and best corrected visual acuity (BCVA) were determined only in children whose UCVA <6/7.5 in either eye, based on the values of the autorefraction as the starting references. For the purpose of this analysis, UCVA data, cycloplegic and noncycloplegic refractive error measurements, axial length and corneal curvature measurements were considered.

RESULTS

In our study included 48.9% of males and 51.1% female patients, with maximum patients 30 (33.3%) in age group of 16-20years.

Table 1: Gender distribution of sample population

Gender	Frequency	Percent
Male	44	48.9%
Female	46	51.1%

Total	90	100%

Table 2: Age distribution of sample population

Age	Number	Percent
5 to 10	11	12.2%
11 to 15	28	31.1%
16 to 20	30	33.3%
21 to 30	21	23.3%
Total	90	100%

Table 3: Comparison of pre and post score of Cycloplegic AR values in hypermetropia for right eye

Values of Diopter	PreScore	Post Score	Total
0.25-1.25	15	1	16
1.50-2.50	15	18	33
2.75-3.75	1	38	39
4.00-5.00	0	2	2
5.25-6.26	0	0	0
6.50-7.50	0	0	0
7.75-8.75	0	0	0
9.00-10.00	0	0	0
10.25-11.25	0	0	0
11.50-12.50	0	0	0
Total	31	59	90
p-value=<0.0000001			

Table 4: Comparison of pre and post score of Cycloplegic AR values in hypermetropia for left eye

Values of Diopter	PreScore	Post Score	Total
0.25-1.25	25	7	32
1.50-2.50	6	8	14
2.75-3.75	1	41	42
4.00-5.00	0	2	2
5.25-6.26	0	0	0
6.50-7.50	0	0	0
7.75-8.75	0	0	0
9.00-10.00	0	0	0
10.25-11.25	0	0	0
11.50-12.50	0	0	0

Total	32	58	90
p-value=<0.0000001			

Comparison of pre & post cycloplegic values of Autorefactrometer values in 23 & 24 right and left eyes of hypermetropia patients respectively, there was a significant increase in number of patient from dioptric range (+0.25 to +1.25) to (+2.75 to +3.75), which was 12 to 28 and 20 to 31 right and left eyes respectively, with (p- value= 0.0001) in right eye and (p-value = <0.001) in left eyes, which is significant.

Comparison of pre & post cycloplegic values of autorefactometer values in 36 & 34 right and left eyes of myopic patients respectively, there was decrease in number of patients in dioptric range (-2.75 to -3.75) from 22 to 1 in right eyes and decrease in number of patients in dioptric range (-4.00 to 5.00) from 18 to 0 after cycloplegia in left eyes, with (p-value for the table= 0.0003140) for the right & (p = 0.0003234) for the left eyes, which is significant.

There was no significant shift in number of patients pre and post dilation in both eyes of patients of myopic astigmatism, with (p-value = 0.6484) and (p-value = 0.3868) for right and left eyes respectively, which are not significant. All patients accepted post cycloplegic autorefractometer values without any complications with good visual acuity and relief in asthenopic symptoms.

Table 5: Comparison of pre and post score of Cycloplegic AR values (minus) in myopia for right eye

Values of Diopter	Pre Score	Post Score	Total
0.25-1.25	10	16	26
1.50-2.50	13	10	23
2.75-3.75	39	1	40
4.00-5.00	1	0	1
5.25-6.26	0	0	0
6.50-7.50	0	0	0
7.75-8.75	0	0	0
9.00-10.00	0	0	0
10.25-11.25	0	0	0
11.50-12.50	0	0	0
Total	63	27	90
p-value=<0.0000001			

Table 6: Comparison of pre and post score of Cycloplegic AR values (minus) in myopia for left eye

Values of Diopter	Pre-Score	Post Score	Total

0.25-1.25	8	13	21
1.50-2.50	20	13	33
2.75-3.75	2	0	2
4.00-5.00	34	0	34
5.25-6.26	0	0	0
6.50-7.50	0	0	0
7.75-8.75	0	0	0
9.00-10.00	0	0	0
10.25-11.25	0	0	0
11.50-12.50	0	0	0
Total	64	26	90
p-value=<0.0000001			

Table 7: Comparison of pre and post score of Cycloplegic myopic astigmatism for right eye

Values of Diopter	PreScore	Post Score	Total
0.25-1.25	40	35	75
1.50-2.50	4	4	08
2.75-3.75	4	2	6
4.00-5.00	0	1	1
Total	48	42	90
p-value=0.6484			

Table 8: Comparison of pre and post score of Cycloplegic myopic astigmatism for left eye

Values of Diopter	PreScore	Post Score	Total
0.25-1.25	42	38	80
1.50-2.50	2	5	7
2.75-3.75	1	2	3
4.00-5.00	0	0	0
Total	45	45	90
p-value=0.3868			

DISCUSSION

In our study, autorefractometer values were comparable between pre and post cycloplegic values which were 23 and 24 right and left eyes of hypermetropia patients. From dioptric range, number of patients increased significantly (+0.25 to +1.25) to (+2.75 to +3.75) which was 11 to 26 and 21 to 32 right and left eyes respectively. P value in right eye and left eye was <0.0000001, which was significant. Autorefractometer values were comparable between pre and post cycloplegic

values which were 38 and 36 right and left eyes of myopic patients. Number of patients decreased in dioptric range (-2.75 to -3.75) from 23 to 2 in right eyes. Number of patients decreased in dioptric range (-4.00 to 5.00) from 17 to 0 in left eyes. In myopic astigmatism, there was no significant shift in number of patient's pre and post dilation in both eyes.

In Padmaja Sankaridurg study, it was concluded that a high error rate for emmetropic and hyperopic RE are resulted from noncycloplegic assessment of RE in children. [14] Shelly Sharma, study result were similar to our present study. [15] There was no significant shift in number of patients pre and post dilation in both eyes of patients of myopic astigmatism, with (p-value = 0.6478) and (p-value = 0.3862) for right and left eyes respectively, which are not significant.

Büchner TF, showed results which was in detecting spherical equivalent, noncycloplegic autorefractometer screening has poor accuracy but has high accuracy in detecting cylinder power and axis in young. [16] Zhao reported that mean difference of 1.23 D greater hyperopia or less myopia with cycloplegic refraction. [17] Hu YY concluded that misclassification of refractive error in a significant proportion of children is caused by measures of noncycloplegic refractive errors. [18-21] By using non-cycloplegic versus cycloplegic refractometry in children, the error committed with mid to dark-brown iris color decreased with older age, and with more myopic cycloplegic refractive error. In our study, post cycloplegic autorefractometer values were accepted by all patients and without any complications with good visual acuity.

CONCLUSION

It is concluded that measurement of refractive error is influenced by accommodation in younger patients. Cycloplegic refraction is more accurate in children and adolescents and hypermetropia is underestimated and myopia is overestimated without cycloplegic refraction using autorefractometer.

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