

International Journal of Medical Ophthalmology



E-ISSN: 2663-8274
P-ISSN: 2663-8266
www.ophthalmoljournal.com
IJMO 2021; 3(2): 14-16
Received: 13-05-2021
Accepted: 17-06-2021

Dr. A Pradeep Kumar
Assistant Professor,
Department of
Ophthalmology, Fathima
Institute of Medical Sciences,
Kadapa, Andhra Pradesh,
India

Dr. Pandurangaiah Elluru
Assistant Professor,
Department of
Ophthalmology, Fathima
Institute of Medical Sciences,
Kadapa, Andhra Pradesh,
India

Corresponding Author:
Dr. Pandurangaiah Elluru
Assistant Professor,
Department of
Ophthalmology, Fathima
Institute of Medical Sciences,
Kadapa, Andhra Pradesh,
India

A comparative study of noncycloplegic refractive error values with cycloplegic refractive error values using autorefractometer

Dr. A Pradeep Kumar and Dr. Pandurangaiah Elluru

DOI: <https://doi.org/10.33545/26638266.2021.v3.i2a.78>

Abstract

Background: A blurred image caused by the shape of the eye which does not bend light correctly. It is a major health problem globally affecting a large number of people with many ocular morbidities.

Aim: The aim of the study was to compare the noncycloplegic refractive error with cycloplegic refractive error using autorefractometer.

Materials and methods: This study was conducted in Department of ophthalmology, Nizam Medical College, Hyderabad between August 2018 to August 2019. Total number of patients selected were 70.

Results: Autorefractometer values were comparable between pre and post cycloplegic values which were 23 and 24 right and left eyes of hypermetropia patients. From dioptic 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 dioptic range (-2.75 to -3.75) from 23 to 2 in right eyes. Number of patients decreased in dioptic range (-4.00 to -5.00) from 17 to 0 in left eyes. In myopic astigmatism, there was no significant shift in number of patients pre and post dilation in both eyes.

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

The accommodative individual response leads to the differences between cycloplegic and non-cycloplegic automated refraction^[1]. An active accommodation response was observed in children and in children, noncycloplegic refractions are prone to significant errors. In children with hyperopia, it was observed that auto refraction estimates without pharmacologic cycloplegic are more myopic when compared to auto refraction estimates after cycloplegic. Refraction method without cycloplegic were considered inappropriate for measurement of refractive error in children and also because of the magnitude of these differences. An autorefractometer was used to predict the activation of accommodative system in both children and young adults and these were advantageous as it was less time consuming and comfortable to patients^[2]. Due to accommodation in young adults, latent refractive errors cannot be diagnosed accurately. Automated refraction (AR) is used as a tool to evaluate refractive error among children and young adults with the advent of hand held AR machines i.e. Retinomax^[3]. The overall refractive errors prevalence was found to be 29% and it is a global health problem which is affecting a large number of people and is associated with many other ocular morbidities. Hyperopia was present in 7.7% of children and myopia in 7.4% when refractive error study was conducted in children in India^[4]. In children, significant refractive errors correction aids in preventing amblyopia and strabismus^[5]. A golden standard in measuring refractive errors in children and adolescents is cycloplegic refraction. If refraction was performed without cycloplegic, myopia can be overestimated and hyperopia can be underestimated but to the extent that refractive errors were overestimated or underestimated in different populations is different as refractive errors prevalence was considered a major determinant for difference between cycloplegic and non-cycloplegic refractive error. The aim of the study was to compare the noncycloplegic refractive error with cycloplegic refractive error using autorefractometer.

Materials and Methods

This study was conducted in Department of ophthalmology, Nizam Medical College, Hyderabad between August 2018 to August 2019. At tertiary health care center, all patients who attended the ophthalmic OPD with defects in vision were included in the study. 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. The patients were instilled tropicamide eye drops three times every 10 mins once, and automated refraction was done using unique RK auto keratometer before and after instilling. The patient was made to read near vision chart and complete cycloplegic was assessed. Due to doubling of visual angle, the decrease in visual acuity for both far and near was ensured. For each eye, three readings were taken and average was calculated. All patients underwent fundus examination and under slit lamp examination. Within seven days, follow up was taken from all patients and refractive correction was analyzed after all patients started using spectacles prescribed. Exclusion was considered based on patients with co-existing ocular morbidities, previous intra-ocular surgery, uncooperative patients. Total number of patients selected were 70.

Results

Table 1: Distribution based on gender and age

Gender	Number	Percentage
Male	33	47%
Female	37	53%
Total	70	100%
Age	Number	Percentage
6-11 years	10	14%
12-16 years	20	29%
17-21 years	22	31%
22-31 years	11	16%
32-35 Years	7	10%

Table 1 shows that 47% of males and 53% of females were there in the study and maximum patients were there in the age group of 17-21 years.

Table 2: Comparison of pre and post score of cycloplegic AR values in hypermetropia for right eye

Diopter Values	Pre Score	Post Score
0.25-1.25	11	2
1.50-2.50	9	12
2.75-3.75	2	26
4.00-5.00	0	3
5.25-6.26	1	0
6.50-7.50	0	2
7.75-8.75	0	1
9.00-10.00	0	1
10.25-11.25	0	0
11.50-12.50	0	0
Total	23	47

Table 2 shows that pre-score and post-score cycloplegic values of autorefractometer values in right eye were observed in 23 and 47 respectively. P value obtained was

<0.0000001.

Table 3: Comparison of pre and post score of cycloplegic AR values in hypermetropia for left eye.

Diopter Values	Pre Score	Post Score
0.25-1.25	21	3
1.50-2.50	2	7
2.75-3.75	1	32
4.00-5.00	0	2
5.25-6.26	0	0
6.50-7.50	0	0
7.75-8.75	0	0
9.00-10.00	0	0
10.25-11.25	0	0
11.50-12.50	0	0
Total	24	44

Table 3 shows that pre-score and post-score cycloplegic values of autorefractometer values in left eye were observed in 24 and 44 patients respectively. P value obtained was <0.0000001.

Table 4: Comparison of pre and post score of cycloplegic AR values (minus) in myopia for right eye.

Diopter Values	Pre Score	Post Score
0.25-1.25	6	12
1.50-2.50	9	6
2.75-3.75	23	2
4.00-5.00	0	0
5.25-6.26	0	0
6.50-7.50	0	0
7.75-8.75	0	0
9.00-10.00	0	0
10.25-11.25	0	0
11.50-12.50	0	0
Total	38	20

Table 4 shows that pre-score and post-score cycloplegic values of autorefractometer values in right eye were observed in 38 and 20 patients respectively. P value obtained was <0.0000001.

Table 5: Comparison of pre and post score of cycloplegic AR values (minus) in myopia for left eye.

Diopter Values	Pre Score	Post Score
0.25-1.25	4	9
1.50-2.50	12	7
2.75-3.75	3	0
4.00-5.00	17	0
5.25-6.26	0	0
6.50-7.50	0	0
7.75-8.75	0	0
9.00-10.00	0	0
10.25-11.25	0	0
11.50-12.50	0	0
Total	36	16

Table 5 shows that pre-score and post-score cycloplegic values of autorefractometer values in left eye were observed in 36 and 16 patients respectively. P value obtained was <0.0000001.

Table 6: Comparison of pre and post score of cycloplegic myopia astigmatism for right eye.

Diopter Values	Pre Score	Post Score
0.25-1.25	48	40
1.50-2.50	7	7
2.75-3.75	5	2
4.00-5.00	0	1
Total	60	50

Table 6 shows that pre-score and post-score cycloplegic values of autorefractometer values in right eye were observed in 61 and 50 patients respectively. P value obtained was 0.6551.

Table 7: Comparison of pre and post score of cycloplegic myopia astigmatism for left eye.

Diopter Values	Pre Score	Post Score
0.25-1.25	46	41
1.50-2.50	3	6
2.75-3.75	2	3
4.00-5.00	0	0
Total	51	50

Table 7 shows that pre-score and post-score cycloplegic values of autorefractometer values in left eye were observed in 51 and 50 patients respectively. P value obtained was 0.3698.

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 patients pre and post dilation in both eyes.

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 patients pre and post dilation in both eyes. In Padmaja Sankaridurg *et al.* [6] study, it was concluded that a high error rate for emmetropic and hyperopic RE are resulted from noncycloplegic assessment of RE in children. Dr. Shelly Sharma *et al.* [7], study result were similar to our present study. 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, *et al.* [8] 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. Zhao *et al.* [9] reported that mean difference of 1.23 D greater hyperopia or less myopia with cycloplegic refraction. Hu YY *et al.* [10] concluded that misclassification of refractive error in a significant proportion of children is caused by measures of non-cycloplegic refractive errors. 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.

References

1. Virgil IG, Angi M, Molinari A, Casotto V. Cox regression was used to compare the measurement error of two tests vs. a gold standard. *Journal of Clinical Epidemiology* 2007;60:345-49.
2. Jorge J, Queiros A, Gonzalez-Meijo 111e J, Fernandes P, Almeida JB, Parafita MA. The influence of cycloplegia in objective refraction. *Ophthalmic Physiol Opt* 2005;25(4):340-5.
3. Bailey MD, Twa MD, Itchell GLM, Dhaliwal DK, Jones LA, McMahon TT. Repeatability of auto refraction and axial length measurements after laser in situ keratotomy. *J Cataract Refract Surg* 2005;31(5):1025-34.
4. Krishnacha Rya PS. Study on accommodation by auto refraction and dynamic refraction in children. *J Optom* 2014;7(4):193-202.
5. Choong YF, Chen AH, Goh PP. A comparison of auto refraction and subjective refraction with and without cycloplegia in primary school children. *Am J Ophthalmol* 2006;142:68-74.
6. Padmaja Sankaridurg, Xiangui HE, Thomas Naduvilath Minzhi LV, Arthur Ho, Earl Smith III, Paul Erickson *et al.* Comparison of noncycloplegic and cycloplegic auto refraction in categorizing refractive error data in children; *Acta Ophthalmologica* 2017, e633-e645.
7. Dr. Shelly Sharma, Dr. Jayashree Shah S. A comparative study of noncycloplegic refractive error values with cycloplegic refractive error values using autorefractometer; *International journal of Medical Ophthalmology* 2020;2(1):01-03.
8. Büchner TF, Schnorbus U, Grenzbach UH, Busse H. Examination of preschool children for ametropia: first experiences using a new hand-held autorefractor. *Strabismus* 2004;12(2):111-7.
9. Zhao J, Mao J, Luo R, Li F, Pok Hare GP, Ellwein LB. Accuracy of noncycloplegic auto refraction in school-age children in China. *Optom Vis Sci* 2004;81(1):49-55.
10. Hu YY, Wu JF, LU TL, Wu H, Sun W, Wang XR *et al.* Effect of cycloplegia on the refractive status of children: the shandong children eye study. *PLoS ONE* 2015;10:e0117482.