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

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Abstract
Refractive error is a global health concern affecting a huge number of people and is associated with various ocular morbidities, overall prevalence of refractive errors was found to be 29%. A refractive error study in children (RESC) in India showed, hyperopia present in 7.7% of children &myopia in 7.4%. Correction of significant refractive errors in childhood helps in preventing amblyopia & strabismus. All the patients who attended the ophthalmic OPD at tertiary health care centre with visual defects were included in the study. The study is proposed to be conducted from November 2018 to May 2019. 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.
All patients accepted post cycloplegic autorefractometer values without any complications with good visual acuity and relief in asthenopia symptoms.

Keywords: Noncycloplegic refractive error, cycloplegic refractive error, autorefractometer

Introduction

The differences between cycloplegic and noncycloplegic automated refraction are due to the accommodative response of the individual. In younger persons, accommodation can greatly influence refractive error measurement. Studies in children have found that autorefraction estimates without pharmacologic cycloplegia are more myopic than autorefraction estimates obtained after cycloplegia, particularly among children with hyperopia. Due to the magnitude of these differences, methods of refraction without cycloplegia are often considered inappropriate for measuring refractive error in children. An autorefractometer can predict the accommodative system activation in children and young adults, and it is less time consuming & comfortable to the patients. Latent refractive errors cannot be accurately diagnosed in youngsters due to accommodation. With the advent of handheld AR machines (Retinomax), AR is being considered as screening tool to evaluate refractive error among children. It may be useful in young adults as well.

Refractive error is a global health concern affecting a huge number of people and is associated with various ocular morbidities, overall prevalence of refractive errors was found to be 29%. A refractive error study in children (RESC) in India showed, hyperopia present in 7.7% of children &myopia in 7.4%. Correction of significant refractive errors in childhood helps in preventing amblyopia & strabismus.

Cycloplegic refraction is considered as the gold standard for measuring refractive errors in epidemiologic studies in children and adolescents. It has been well-established that generally myopia could be overestimated and hyperopia be underestimated if refraction was performed without cycloplegia, but to which extent the prevalence of refractive errors are overestimated or underestimated in different populations is different as the prevalence of refractive errors seems to be a major determinant for the difference between cycloplegic and non-cycloplegic refractive error. Purpose of our study is to compare noncycloplegic refractive error with cycloplegic refractive error using autorefractometer among patients between the age group of 5-30 years.

Automated refraction (AR) 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.

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Methodology

All the patients who attended the ophthalmic OPD at tertiary health care centre with visual defects were included in the study. The study is proposed to be conducted from November 2018 to May 2019. All patients in the age group of above 5years and less than 30yrs with visual defects were included in study. Each patient will be subjected to detailed history taking, followed by the distant visual acuity will be assessed unpopularly by using snellen's visual acuity chart at a distance of 6 meters & near visual acuity will be assessed using jaegers chart at a distance of 25cms. Automated refraction will be done using unique-RK auto ref/keratometer before and after instilling tropicamide eye drops three times at an interval of ten minutes. Complete cycloplegia will be confirmed by making the patient to read near vision chart. A decrease in visual acuity corresponding to doubling of visual angle for both distance and near will be ensured. Three readings will be taken for each eye and the average of these values will be calculated. All patients will go through a fundus examination and examination under slit lamp. All patients will be follow up to analyze the outcome of refractive correction given within a period of seven days after they start using spectacles prescribed. Patients with any other co-existing ocular morbidities, previous intra ocular surgery, uncooperative patients are excluded from studies.

Sample size: 62

Results

In our study included 48% of males and 52% female patients, with maximum patients 20 (32.3%) in age group of 16-20years.

Comparision 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= 0.000000246) in right eye and (p-value = <0.0000001) in left eyes, which is significant.

Comparision 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 = 0.6478) and (p-value = 0.3862) 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 1: Gender distribution of sample population

Gender	Frequency	Percent
Male	30	48%
Female	32	52%
Total	62	100%

Table 2: Age distribution of sample population

Age	Number	Percent
5 to 10	8	12.9%
11 to 15	19	30.7%
16 to 20	20	32.3%
21 to 30	15	24.1%
Total	62	100%

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

Values of Diopter	Pre Score	Post Score	Total
0.25-1.25	12	1	13
1.50-2.50	10	13	23
2.75-3.75	1	28	29
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	23	44	67
p-value= <0.0000001			

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

Values of Diopter	Pre Score	Post Score	Total
0.25-1.25	20	2	22
1.50-2.50	3	5	8
2.75-3.75	1	31	32
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	24	40	64
p-value=<0.0000001			

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	5	11	16
1.50-2.50	8	5	13
2.75-3.75	22	1	23
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	36	17	53
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	3	8	11
1.50-2.50	11	6	17
2.75-3.75	2	0	2
4.00-5.00	18	0	18
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	34	14	48
p-value= <0.0000001			

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

Values of Diopter	Pre Score	Post Score	Total
0.25-1.25	47	39	86
1.50-2.50	6	6	12
2.75-3.75	4	2	6
4.00-5.00	0	1	1
Total	57	48	105
p-value=0.6478			

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

Values of Diopter	Pre Score	Post Score	Total
0.25-1.25	45	40	85
1.50-2.50	2	5	7
2.75-3.75	1	2	3
4.00-5.00	0	0	0
Total	48	47	95
p-value=0.3862			

Discussion

In our study included 48% of males and 52% female patients, with maximum patients 20 (32.3%) in age group of 16-20years.

Comparision of pre &post cycloplegic values of Autorefactometer values in 23 right & 24 left eyes of hypermetropia patients, 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 in right eye and 20 to 31 in left eyes respectively, with (p- value= 0.000000246) in right eye and (p-value = < 0.0000001) in left eyes, which is significant.

Comparision of pre & post cycloplegic values of autorefactometer values in 36 right & 34 left eyes of myopic patients, 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 dilatation 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*. reported that noncycloplegic autorefractometer screening has poor accuracy in detecting spherical equivalent, but has high accuracy in detecting cylinder power and axis in young [4].

In a study of more than 5000 school children, Zhao *et al*. observed a mean difference of 1.23 D greater hyperopia or less myopia with cycloplegic refraction [5].

Studies in children have found that autorefraction estimates without pharmacologic cycloplegia are more myopic than autorefraction estimates obtained after cycloplegia, particularly among children with hyperopia [6].

In our study all patients accepted post cycloplegic autorefractometer values without any complications with good visual acuity and relief in asthenopia symptoms.

Conclusion

In our study we found that hypermetropia is under estimated and myopia is over estimated without cycloplegic refraction using auto refractometer, especially in children & young adults, so cycloplegic refraction is more accurate in children and young adults.

In younger persons, accommodation can greatly influence refractive error measurement.

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