



Original Article

Comparison of Objective Refraction in Darkness Using Autorefractor to Cycloplegic Refraction Using A Retinoscope

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Purpose: To compare objective refraction in darkness using autorefractor with cycloplegic refraction using a retinoscope.

Method: This comparative cross-sectional study was conducted in the College of Ophthalmology and Allied Vision sciences/ KEMU in the Lahore population. A total of 45 patients of ages 5-15 years were selected. A proforma was filled related to their refractive status and the objective refraction in darkness was compared with cycloplegic refraction and subjective refraction. The data were entered and analyzed by SPSS version 20. Frequencies, mean and standard deviation, were calculated.

Results: There was a significant difference in spherical values among the three procedures i.e. autorefraction in darkness, cycloplegic refraction, and subjective refraction. Cylindrical values were statistically insignificant in the left eye. The mean difference in spherical values was 0.3 in all children and teenagers.

Keywords: Cycloplegia, Autorefraction, Retinoscopy

Introduction:

Two methods are mainly used for evaluation of refractive errors; one is subjective and the other is automated.¹ Objective techniques are suitable to use in children and adults which are not cooperative. On the other hand, subjective techniques include direct interaction with the patient to evaluate their refractive status although it is a time taking procedure in uncooperative patients.² Accurate correction of errors of refraction is demanding in very young children with high hypermetropia, strabismus, and amblyopia.³

The effect of both lens and cornea to focus the light rays is called the refracting power of the eye and by changing the lens curvature passage of light change that's called the force of accommodation. By inhibiting the ciliary muscle action cycloplegia retards the accommodative power of the eye so that objective refractive error of the eye can be determined and it is done by paralysis of ciliary body by using cycloplegic drugs Or anticholinergics as they hinder the muscarinic effect of acetylcholine. This action comprises mydriasis (Pupillary dilatation) and cycloplegia (paralysis of ciliary body).⁴ It is mainly used to evaluate full hypermetropia in those with accommodative esotropia and to avoid overcorrection in case of myopia and also helpful in correcting errors in uncooperative in case of amblyopia and subjective refraction of individuals who face excessive accommodation.⁵

One of the commonly used methods of assessing refractive error objectively is retinoscopy and it is mainly suitable in those who are infants, non-verbal and younger. It is a mean of objective refraction used to detect potentially amblyogenic error especially if a substantial grade of anisometropia is existing because, unless corrected, the patient may develop amblyopia.⁶

Even by expert optometrists, manual retinoscopy is a slow, hectic and difficult task.⁷ These things can be avoided with an autorefractor that does not require a skilled person.

Subjective Refraction and cycloplegic refraction has become the gold standard for determining visual status. In younger's cycloplegia is controlled by the time required to obtain full cycloplegia, its relationship with patient, inconvenience or discomfort. Nowadays, auto refractors instead of cycloplegia have become broadly used to access the objective refraction of children in clinical practice, visual evaluation or for research purposes i.e. clinical trials, and epidemiologic surveys.⁸

Those who wear high minus glasses induce an excessive effort of accommodation.⁹ For this reason we do not overcorrect myopia that becomes problematic. Mostly autorefractors have built-in fogging techniques to prevent accommodation. Some evidence shows that auto refraction without cycloplegia has suitable repeatability and effectivity

as compared to subjective refraction and cycloplegic retinoscopy but, while using such instruments, accommodation may not be fully neutralized therefore in decreased accuracy especially overcorrection of myopia in those who have more accommodative reserves.¹⁰ Children with over corrected myopia have higher accommodative effort which may lead to progression in myopia.¹¹

Materials and Methods:

A specially designed performa was prepared for the evaluation of refractive error with auto refraction, cycloplegic and subjective refraction. *45 people had been included in the measurement of the refractive errors and findings were entered on a pre-designed study Performa.* Spherical and cylindrical values among all three types of methods were compared. All the data was entered and analyzed using Statistical Package for Social Science (SPSS Version 20.0).

Results:

A self-reported performa based study was conducted in which 45 participants (35% females and 65% males) of ages 5-15 including all types of refractive errors visiting the Eye OPD of Mayo Hospital Lahore and students of College of Ophthalmology and Allied Vision Sciences. There was a significant difference in spherical values among the three procedures i.e. autorefraction in darkness cycloplegic refraction and subjective refraction. Cylindrical values were statistically insignificant in the left eye. The mean difference in spherical values was 0.3 in all children and teenagers.

Table 1: One way Anova

Table 1 shows the distribution of spherical, cylindrical and its axis values with autorefraction, cycloplegic refraction and with a retinoscopic method. Spherical values showed statistically significant difference ($p < 0.05$). Cylindrical values were statistically insignificant $p > 0.05$. Axes of both right and left eye showed insignificant values $p > 0.05$. So there was a significant difference among spherical values in all three techniques.

Discussion:

The study was conducted on the comparison of objective refraction in darkness to cycloplegic refraction and retinoscopy. A sample size of the study was 45 out of which 65% were females and 35% were males. This sample size was concluded by a specially designed formula. This study included persons with no associated ocular pathology.

Some studies suggested that cycloplegic Retinoscopy and cycloplegic autorefraction could be beneficial screening instrument for an error of refraction in teenagers, but could not discover any study indicating consistency of autorefraction under cyclopentolate. In that

		Sum of Squares	df	Mean Square	F	Sig.
Rt autosphere	Between Groups	47.686	3	15.895	21.017	.000
	Within Groups	31.008	41	.756		
	Total	78.694	44			
Rt autocylinder	Between Groups	.870	3	.290	1.064	.375
	Within Groups	11.180	41	.273		
	Total	12.050	44			
Rtautoaxis	Between Groups	616.705	3	205.568	.063	.979
	Within Groups	134029.740	41	3269.018		
	Total	134646.444	44			
Ltautosphere	Between Groups	11.991	3	3.997	3.490	.024
	Within Groups	46.962	41	1.145		
	Total	58.953	44			
Ltautocylinder	Between Groups	.203	3	.068	.333	.802
	Within Groups	8.347	41	.204		
	Total	8.550	44			
Lt autoaxis	Between Groups	5063.963	3	1687.988	.547	.653
	Within Groups	126607.014	41	3087.976		
	Total	131670.978	44			
RtRetinosphere	Between Groups	36.621	3	12.207	20.189	.000
	Within Groups	24.790	41	.605		
	Total	61.411	44			
Rt Retinocylinder	Between Groups	.925	3	.308	1.264	.299
	Within Groups	10.000	41	.244		
	Total	10.925	44			
RtRetinoaxis	Between Groups	1449.405	3	483.135	.151	.929
	Within Groups	131491.706	41	3207.115		
	Total	132941.111	44			
Lretinosphere	Between Groups	6.027	3	2.009	2.019	.126
	Within Groups	40.798	41	.995		
	Total	46.825	44			
Lretinocylinder	Between Groups	.178	3	.059	.341	.796
	Within Groups	7.133	41	.174		
	Total	7.311	44			
Lretinoaxis	Between Groups	1461.935	3	487.312	.150	.929
	Within Groups	133545.843	41	3257.216		
	Total	135007.778	44			
Rtsubjectivesphere	Between Groups	26.215	3	8.738	17.950	.000
	Within Groups	19.960	41	.487		
	Total	46.175	44			
Rtsubjectivecylinder	Between Groups	.778	3	.259	1.107	.357
	Within Groups	9.597	41	.234		
	Total	10.375	44			
Rtsubjectiveaxis	Between Groups	4278.571	3	1426.190	.452	.717
	Within Groups	129351.429	41	3154.913		
	Total	133630.000	44			
Lsubjectivesphere	Between Groups	3.201	3	1.067	1.438	.246
	Within Groups	30.424	41	.742		
	Total	33.625	44			
Lsubjectivecylinder	Between Groups	.167	3	.056	.340	.796
	Within Groups	6.702	41	.163		
	Total	6.869	44			
Lsubjectiveaxis	Between Groups	1461.935	3	487.312	.150	.929
	Within Groups	133545.843	41	3257.216		
	Total	135007.778	44			

study, auto refraction with cycloplegia showed good agreement with cycloplegic retinoscopy in identifying the type of refractive error.² In our study autorefraction in darkness and cycloplegic refraction showed no significant difference in spherical values, but cylindrical values showed insignificant values in the left eye. Auto refraction, cycloplegic refraction and subjective performed the same day.

When retinoscopic and automated refraction results are compared, the values are changed into the spherical equivalent for investigation and individually these statements of a sphere and cylindrical and their axis are changed in a single point to get eccentricity for each dimension in diopter units that simultaneously relate the spherical, cylindrical and its axis of the dimensions.¹²

Smith¹³ studies revealed that the SD of the uncertainty in the Calculation of error of refraction is near 0.3. Mostly extended SD of uncertainty, which gives a ninety-five percent self-reliance would then be 0.6 diopters in Calculations of error of refraction. Errors of refraction calculated with the difference of 0.25 diopters, appropriated more than 0.50 diopter variation in spherical and cylindrical values as a clinically major change.

Studies showed that clinically major alterations were higher in kids under the age of 6 years. This was because of a higher level of accommodation and a lower level of collaboration of youngsters while doing automated refraction. This improves in grown up kids. In teen-agers having mixed astigmatism, it should be verified with hand-held automated refractor and retinoscopy. In this study, spherical values showed variations among the three procedures. Refraction made by autorefractor gives well myopic refraction as compared to subjective refraction. However, there was no significant association with cycloplegia.¹³

A recent study including screening of children with refractive error with and without cycloplegia by using Retinomax K-plus 2 and plus opti X S08, and compare it to cycloplegic retinoscopy, exposed that sensitivity was advanced with cycloplegia, as an accommodative element was excluded in youngsters.¹⁴ This study was done in children and comparison of objective refraction in darkness to cycloplegic and subjective refraction. The results showed no significant difference among all three types of techniques, spherical values were significant, cylindrical values showed variation among all types of procedures.

In a recent study, it was found that quantities of spherical equivalent and spherical power without cycloplegia by Plusoptix A09 were likened with cycloplegic refraction. Though, the application of cycloplegic drug indicates an Enlarged spherical equivalent, cylindrical power and spherical power calculated by Plusoptix A09. Moreover, the cylindrical power calculated by Plusoptix A09 with and without

cycloplegic is greater.¹⁵

Conclusion:

Spherical values in all three techniques showed statistically significant values. Cylindrical values showed statistically insignificant values in the left eye. Auto refraction showed more myopic refraction as compared to subjective refraction.

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