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Original Article

Comparison of Cycloplegic Refraction Versus Dynamic Retinoscopy in Children from 5 to 12 Years of Age

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ABSTRACT

Refractive errors are a noteworthy cause of visual disruption worldwide. **Objective:** To compare the results of dynamic and cycloplegic retinoscopy in children. **Methods:** A descriptive-type cross-sectional study was conducted at the university of Lahore teaching hospital on 50 patients from 5 to 12 years of age. Approval was taken from the ethical board of the institution and informed consent from patients parents. Patients who had any other ocular pathology other than refractive errors were excluded. To study the refraction results in children, first in a dark room, retinoscopy without cycloplegic was performed then 1% cyclopentolate eye drops were used. After that retinoscopy was done under cycloplegic effect results were compared after being converted into spherical equivalent. Paired sample t-test was applied to compare means. $P < .05$ was taken as significant. **Results:** There were 25 males and 25 females. The mean age in years was 7.66 ±there were 12 myopic patients, 22 hypermetropic and 16 astigmatic patients. The mean logMar of visual acuity uncorrected was 0.5 ± 0.23 and the best corrected visual acuity was 0.1± 0.01. The mean S.E of right eye dynamic retinoscopy was 1.78±2.60, cycloplegic retinoscopy 1.52± 2.54 and of left eye was 1.72±49 and1.47± 2.34 respectively. It can be deduced that on average 0.26D more by dynamic retinoscopy. A significant correlation with ***r*** 0.96 and ***r*** 0.94 in left eye existed. **Conclusion:** There is a significant difference between cycloplegic retinoscopy and near retinoscopy. It was deduced that near retinoscopy showed more hypermetropic readings than cycloplegic retinoscopy.

INTRODUCTION

Refractive errors are a noteworthy cause of visual disruption throughout the globe. People of every age, ethnicity, and socioeconomic status are affected by refractive errors. World Health Organization (WHO) estimated 285 million people are visually impaired out of which 39 million were blind.80% of visual impairment, including blindness can be cured or prevented. Visually impaired people living in developing countries are about 90% [1, 2]. Foremost causes of visual impairment are 43% uncorrected refractive errors (myopia, hyperopia, astigmatism alone), 33% includes cataract and 2% comprises glaucoma [3]/ When a ray of light fails to focus on the retinal plane, refractive error arises. As a result, the image perceived by the individual is blurred and refractive correction becomes evident. Refractive errors can be classified as Myopia (near-sightedness), which is a disorder in which a patient is unable to perceive far objects clearly [4]. Hyperopia (far-sightedness) and astigmatism. Refractive errors can be corrected with aid of glasses, contact lenses, and refractive surgery. Retinoscopy is a dark room procedure in which a patient is asked to look at a distant target to relax accommodation and a beam of light is thrown into the patient's eye and red reflex is noted. Refractive error is determined according to the kind of reflex observed. In contrary to dry retinoscopy patient is asked to look at the beam of the retinoscope in cycloplegic retinoscopy [5]. To determine accurate refractive errors adequate amount of cycloplegia has immense

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significance. For epidemiological studies in children and adolescents, cycloplegic refraction is the gold standard method. Cycloplegic refraction is an efficient technique to control accommodation by using cycloplegic agents [6]. Cycloplegic drugs paralyze the ciliary bodies and induce accommodation relaxation. As the ciliary body relaxes, the anterior zonular fibers stretch, and the posterior zonular fibers lose tension, resulting in a thinning of the vitreous. This allows the eyes to be relaxed and thus helps to focus on the distance. In the eye, the acetylcholine receptors are located in the iris sphincter, and the ciliary activity of these receptors causes the iris and ciliary body to contract. Cycloplegics temporarily inhibit this action, causing ciliary paralysis and pupil dilation [1]**.** There are three most commonly used cycloplegic drugs, namely atropine, cyclopentolate, and tropicamide. The drug that is considered the gold standard for its cycloplegic effects is atropine but has a slow onset and a 15-20 day recovery period. Therefore, in adults, it is not routinely used as a diagnostic agent [7]. Cyclopentolate is a commonly used drug in children. It is a synthetic antimuscarinic paralytic agent. In patients with dark iris, cyclopentolate has a rapid onset of action (30-45 minutes), a relatively short duration of action (24-48 hours), few side effects, and is contraindicated in closed-angle glaucoma [8-10]. Another numbing agent is tropicamide, a synthetic analog of tropic acid. In addition, compared to cyclopentolate, it is known as safe and fast-acting and it is more suitable for patients because of the onset of action (20-30 minutes) and recovery time (6-7 hours). Near Retinoscopy is a technique for determining refractive errors described by Mohindra in 1975. Near retinoscopy is used as a substitute for cycloplegic refraction and this technique was described by Mohindra. This technique is used to measure the accommodative response of the children [11]. One of the studies shows that cycloplegic drugs have some drawbacks; especially in younger patients' discomfort is the most important drawback during the instillation of drops. The child may become upset or uncooperative and some parents do not allow the administration of any kind of drugs so an alternative is needed [12]. This is a monocular technique; one eye will remain un-occluded eye at a distance of 50cm. It is a dark room procedure. It utilizes the patient's accommodative ability. Along the visual axis, the subject will fixate on the light of the retinoscope. From retinoscope light, an adjustment in lens power for both working distance and tonus of accommodation is estimated at 1.25 diopters. The final non-cycloplegic value is obtained by subtracting 1.25 diopters from the gross retinoscopy values. Examiner asses the retinoscopic reflex by asking the patient to read the accommodative target [13]. The purpose of this study is to investigate whether Mohindra's technique is a useful substitute for the near retinoscopic technique. Cycloplegic refraction is not a friendly procedure for children due to the Stinging effect of drugs. It is also more time-consuming for the examiner as well as the patient.

METHODS

A descriptive type crossectional study was conducted at the University of Lahore Teaching hospital. 50 patients (100 eyes) from ages 5 to 12 years were examined. An equal number of patients of both male and female children per examined in this study because there is an equal no of chances of having refractive errors in both male and female children. First, near retinoscopy or Mohindra's technique was used to rule out the refractive errors of kids. The lights of the examination room were switched off to make it a completely dark room. Then retinoscopy was performed in that dark environment at 50cm. After jotting down results on a paper sheet, the cycloplegic drug mostly used to attain the purpose of cycloplegia, namely Cyclopentolate was instilled in both eyes of the child. One drop in each eye was instilled. After waiting 30-45 minutes same procedure of retinoscopy was repeated and the working distance this time was 1 meter or 2/3 of a meter. A working distance of 1.5D according to the working distance of 2/3 of a meter was deducted from the retinoscopic values of the patient's refractive error. In addition, the tonus allowance of cyclopentolate drug which is about 0.5D also deducted. Whereas in Mohindra's technique of retinoscopy, the readings obtained by retinoscopy were formulated without subtracting 1.5D of working distance. Data were analyzed by using SPSS 25.

RESULTS

Table 1 shows the Mean age of the children was 7.66 ± 2.5. There were 12 myopic patients, 22 hypermetropic and 16 astigmatic patients. There were 25 male and 25 female patients. The mean logMar of visual acuity uncorrected was 0.5 ± 0.23and best corrected visual acuity was 0.1± 0.01.

	Total	Male	Female
NO.	50	25	25
Mean Age in years	7.66± 2.5	7.64± 2.3	7.4± 2.6
Myopia	12	5	7
Hypermetropia	22	9	13
Astigmatism	16	7	9

Table 1: Descriptive statistics

Table 2 shows the mean S.E of right eye dynamic retinoscopy was 1.78±2.60 compared to 1.52± 2.54. The mean S.E of left eye dynamic retinoscopy was 1.72±49 compared to 1.47± 2.34. It can be deduced that on average 0.26D more by dynamic retinoscopy. A significant correlation with r 0.96 existed and r 0.94 in left eye.

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	Dynamic retinoscopy	Cycloplegic retinoscopy	P value	Co-relation
Right Eye	1.78±2.60	1.52± 2.54	0.03	0.96
Left Eye	1.72±49	1.47± 2.34	0.04	0.94

Table 2: Comparison of near retinoscopy with cycloplegic retinoscopy

Figure 1. shows that there was a difference between spherical equivalents obtained by two techniques in the right eye. 6 patients had a 0.25D difference, and 27 patients had 0.5D. 14 patients showed a 0.75D difference and 2 patients has a 1D difference and 1 patient had no difference.

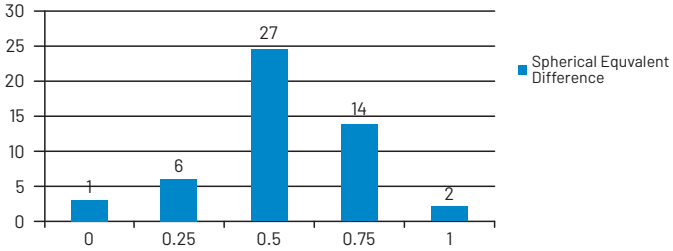

Figure 1: Right eye spherical equivalent difference

Figure 2 showed that there was a difference between spherical equivalents obtained by two techniques in the left eye. 6 patients had a 0.25D difference, and 25 patients had 0.5D. 14 patients showed a 0.75D difference, 2 patients have a 1D difference and 3 patients had no difference.

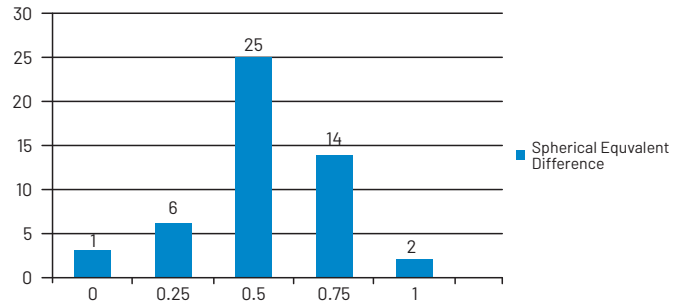

Figure 2: Left eye spherical equivalent difference

DISCUSSION

In this study, near retinoscopy results of refraction were compared with the Cycloplegic Technique of retinoscopy. For this purpose, children between the ages of 5 years to 12 years were examined. Multiple studies showed that non-cycloplegic refraction is not the standard gold method for measuring refractive errors it can lead to the overestimation of myopia [14]. Dynamic or near retinoscopy technique showed less hypermetropic values than the cycloplegic one. Then, differences between the spherical equivalents of the retinoscopic readings obtained from both techniques were analyzed. It was concluded retinoscopy done in a completely dark room is as effective as cycloplegic retinoscopy, if there is an adjustment factor. cycloplegic retinoscopy through an effective method of ruling out refractive errors in children less than 11 years old, also has some drawbacks like drug reaction time, the unfriendly nature of cycloplegics towards children, and most importantly possible side effects of these drugs. Keeping these factors in mind a study was conducted by Ali mirzajani and his colleagues. They introduced a technique known as Mirza tele lens retinoscopy in which they placed a trial lens 22.2 cm far from the spectacle plane and compared its results with cycloplegic retinoscopy they found a significant difference between the two techniques and concluded that mirza tele lens retinoscopy can be performed in uncooperative individuals [15].A comparative study was conducted to evaluate the precision of cycloplegic and non-cycloplegic autorefrectometers and retinoscopy. It was deduced that results obtained by auto refractometer were almost similar to retinoscopy [16]. A study was conducted in which 47 patients were enrolled from 3 to 11 years of age. They were assessed by cycloplegic, dynamic retinoscopy, and auto refractometer and it was concluded that dynamic retinoscopy can be considered as an alternative to cycloplegic retinoscopy [17]. Dynamic retinoscopy is also a suitable technique to measure the amplitude of accommodation [18]. A study on 387 children was conducted in Beijing, the purpose of the study was to determine the difference between cycloplegic and non-cycloplegic autorefrectometers. The difference between non-cycloplegic spherical equivalents was increased in that study with the increase of hyperopic correction [19]. A similar study was carried out by Farnaz Kaousar et all they assesses regression co-relation and agreement between the mohindras retinoscopy technique and results of post-cycloplegic refraction. They included 101 children from 1 to 12 years of age and performed near retinoscopy on them. Afterward instilled cyclopentolate and performed cycloplegic refraction. They again examined patients after 72 hours and deduced the final prescription. They concluded that Mahindra's retinoscopy overestimates hypermetropia and underestimates myopia but there is particular point refraction where alike results by both techniques are deduced.so it can be considered an option [20]. Children which undergo cycloplegic refraction get scared of the examiner and avoid the next possible visit of an optometrist. They also become highly uncooperative and hostile towards the examiner to avoid the instillation of cycloplegic eye drops. So keeping all these facts in view, an optometrist may go for Mohindra's retinoscopy technique in their daily examination practice.

CONCLUSIONS

It was deduced that near retinoscopy showed more hypermetropic readings than cycloplegic retinoscopy. As there is difference of 0.26D that is clinically unimportant so it produces the almost same result as cycloplegic

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retinoscopy. Furthermore, this technique reduces the waste of time considerably by subtracting the wait for the dilation of the pupil and accommodation paralysis. Near retinoscopy is also friendly for children because they do not suffer from any stinging or scorching effect in their eyes. In our study we took spherical equivalents to make the calculations easy. Cylindrical factors should be considered in future. We did not include patients with strabismus ,aphkia anisometropia, and amblyopic children. They should also be considered for further studies.

Conflicts of Interest

The authors declare no conflict of interest

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