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Accuracy of Concave Sleeve in Comparison with Plano Sleeve While Doing Retinoscopy

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KEYWORDS

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DECLARATIONS

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ABSTRACT

Background: One of the main reasons for a reduction in visual acuity is refractive error. It can either be determined by using different devices or by placing corrective lenses in front of the eye and asking questions. **Objective:** To evaluate the accuracy of the concave sleeve in comparison with the plano sleeve while performing retinoscopy. **Methodology:** This was a cross-sectional comparative study in which 43 patients visiting Mayo Hospital for ocular examination were recruited. Patients above 15 years of either sex were included. Patients with any other external ocular disease were excluded from the study. Data was collected by using a self-designed proforma which included information about patient profile, previous ocular history, type of refractive error, and concave sleeve reading and plano sleeve reading of retinoscopy. College of Ophthalmology and Allied Vision Sciences, Lahore. The study was conducted from September to December 2021. All the data was entered and analysed by using the statistical package for the social sciences (SPSS version 25.00). Descriptive statistics were used for quantitative data, such as standard deviation and mean. Interclass correlation was applied to compare both groups. Paired sample T-test was applied for the mean value. Retinoscopy with plano and concave sleeves was performed in each individual. Results of both techniques were analysed by the interclass correlation method. Plano sleeve retinoscopy was performed first in a dark room, and a distance target was given to the patient. After performing plano sleeve retinoscopy, concave sleeve retinoscopy was performed. The final prescription was adjusted by subtracting the working distance of 1.5D. **Results:** Results were taken from a self-designed proforma using the Interclass Correlation method. Interclass correlation value of spherical equivalent of concave and plano sleeve was strong and positive (ICC = 0.863). Concave and Plano sleeve of retinoscopy were performed in each individual. There was no significant difference between the accuracy of the two sleeves. (p-value=0.26). **Conclusion:** Concave sleeve and plano sleeve have the same accuracy in measuring refractive error with retinoscopy, and there is no significant difference between the accuracy of both sleeves.

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INTRODUCTION

One of the main reasons for a reduction in visual acuity is refractive error. It can either be determined by using different devices or by placing corrective lenses in front of the eye and asking questions. In 1997, the WHO set an ambitious goal to remove avoidable blindness in the world by 2020.[1] Refractive error is recognised as the main cause of correctable visual impairment. Glasses, contact lenses, or refractive surgery are used for the detection and treatment of refractive error. However, worldwide, there are up to 43 % of cases of visual defect because of uncorrected refractive error.[2] Addressing refractive error can reduce and prevent a high proportion of individuals from undergoing unnecessary vision loss.[3]

The subjective method involves the use of VA charts, and it involves patient participation. The objective method can be determined fast and easily with instruments such as an autorefractometer and a retinoscope, and there is no patient involvement.[4] Retinoscope and autorefractometry are both genuine methods for refractive error assessment. Accommodation status is one of the most important points in refraction. In fact, to obtain an exact measurement of refractive error, accommodation should be in a relaxed condition.[5] Autorefractors overestimate myopia and underestimate hypermetropia. An accurate and effective method for objective refraction is retinoscopy.[6] Retinoscopy can measure normal, pathological, and surgically induced refractive states of the eye.

Retinoscopy is a gold standard technique for resolving the refractive status of the eye in many conditions, such as in children and KC.[7] During retinoscopy, based on the direction of the retinal reflex, the examiner puts different lenses in front of the eye of the patient. Retinoscope uses the technique of neutralisation of the light reflex. It has two sleeves, sleeve down and sleeve up. When the streak is in the proper position, the light of the streak will be divergent.[8] In retinoscopy, the eye level of the examiner and patient should be at the same level. Retinoscopy is performed in a dark room. While right eye retinoscopy is performed, the patient is given a distance target at a distance of 6 meters and is asked to look with the left eye and then with the right eye. There is a light source in the streak retinoscope that produces light. By moving the slide knob, the sleeve light is changed. By moving the sleeve up, the rays of light are convergent. In the sleeve down position, rays of light are divergent.[9] Normally, sleeve down is used. For assessment, a retinoscope, a semi-dark room, and a trial lens box are used.

During static retinoscopy, the examiner should ensure that the person is watching a fixation object at a distance of six meters. At this distance, accommodation is relaxed, and this can reduce variability of the results. Two main types of retinoscopy are the spot retinoscope and the streak retinoscope. The streak retinoscope is more accurate in determining the high axis of the cylinder.[9] Light can be made convergent or divergent by moving the sleeve up or down. The reflex is neutralised with plus and minus lenses. Movement is neutralised by plus lenses. Minus lenses neutralise an 'against' movement.

The sleeve up of the retinoscope produces concave or convergent rays of light, while the down sleeve produces plane or divergent rays of light. The concave effect converges rays usually at 35cm in front of the retinoscope; from there, rays cross or diverge. A plane mirror diverges rays that do not come to the point of focus.[10] Neutralising the meridian by retinoscopy can be confirmed by moving the sleeve all the way up, creating a concave mirror effect, and a reflex should appear neutralised. Placing an extra sphere of +0.25 will give opposite movement.[11] The current study aimed to evaluate the accuracy of the concave sleeve in comparison with the Plano sleeve while performing retinoscopy.

METHODOLOGY

This was a cross-sectional comparative study in which 43 patients visiting Mayo Hospital for ocular examination were recruited.[12] Patients above 15 years of either sex were included. Patients with any other external ocular disease were excluded from the study. Data was collected by using a self-designed proforma which included information about patient profile, previous ocular history, type of refractive error, and concave sleeve reading and plano sleeve reading of retinoscopy. College of Ophthalmology and Allied Vision Sciences, Lahore. The study was conducted from September to December 2021.

All the data was entered and analysed by using the statistical package for the social sciences (SPSS version 25.00). Descriptive statistics were used for quantitative data, such as standard deviation and mean. Interclass correlation was applied to compare both groups. Paired sample T-test was applied for the mean value. Retinoscopy with Plano and concave sleeves was performed in each individual. Results of both techniques were analysed by the Interclass correlation method. Plano sleeve retinoscopy was performed first in a dark room, and a distance target was given to the patient. After performing Plano sleeve retinoscopy, concave sleeve retinoscopy was performed. The final prescription was adjusted by subtracting the working distance of 1.5D.

RESULTS

Results were taken from a self-designed performa. Interclass correlation value of spherical equivalent (SE) of concave and plano sleeve was strong and positive (ICC = 0.863). P-value for SE of concave and Plano sleeve was 0.264 (Paired Sample T-test), which showed that the results of both sleeves had no significant difference. Mean value taken out from the Paired sample T-test showed that the mean value for the SE of the concave sleeve was -2.554, and the mean value for the SE of the Plano

Table 1: Interclass correlation of spherical equivalent of concave and plano sleeve

Control variables			Concave Sleeve	Plano Sleeve
Spherical Equivalent	Concave Sleeve	Correlation	1	0.863
		p-value	-	0.000
		df	86	86
	Plano Sleeve	Correlation	0.863	1
		p-value	0.000	-
		df	86	86

Table 2: Correlation of the sphere of the concave and plano sleeve with subjective refraction in right eye

Control variables			Concave Sleeve Sphere	Plano Sleeve Sphere
Subjective Refraction Sphere	Concave Sleeve Sphere	Correlation	1.000	0.946
		p-value	-	0.000
		df	0	38
	Plano Sleeve Sphere	Correlation	0.946	1.000
		p-value	0.000	-
		df	38	0

Table 3: Correlation of cylinder of concave and plano sleeve with subjective refraction in right eye

Control variables			Concave Sleeve Cylinder	Plano Sleeve Cylinder
Subjective Refraction Sphere	Concave Sleeve Cylinder	Correlation	1.000	0.628
		p-value	-	0.022
		df	0	11
	Plano Sleeve Cylinder	Correlation	0.628	1.000
		p-value	0.022	-
		df	11	0

Table 4: Correlation of axis of concave and plano sleeve with subjective refraction in right eye

Control variables			Concave Sleeve Axis	Plano Sleeve Axis
Subjective Refraction Sphere	Concave Sleeve Axis	Correlation	1.000	1.000
		p-value	-	0.000
		df	0	11
	Plano Sleeve Axis	Correlation	1.000	1.000
		p-value	0.000	-
		df	11	0

Table 5: Correlation of sphere of concave and plano sleeve with subjective refraction in left eye

Control variables			Concave Sleeve Sphere	Plano Sleeve Sphere
Subjective Refraction Sphere	Concave Sleeve Sphere	Correlation	1.000	0.399
		p-value	-	0.011
		df	0	38
	Plano Sleeve Sphere	Correlation	0.399	1.000
		p-value	0.011	-
		df	38	0

Table 6: Correlation of cylinder of concave and plano sleeve with subjective refraction in left eye

Control variables			Concave Sleeve Cylinder	Plano Sleeve Cylinder
Subjective Refraction Sphere	Concave Sleeve Cylinder	Correlation	1.000	0.931
		p-value	-	0.000
		df	0	11
	Plano Sleeve Cylinder	Correlation	0.931	1.000
		p-value	0.000	-
		df	11	0

Table 7: Correlation of axis of concave and plano sleeve with subjective refraction in left eye

Control variables			Concave Sleeve Cylinder	Plano Sleeve Cylinder
Subjective Refraction Sphere	Concave Sleeve Cylinder	Correlation	1.000	1.000
		p-value	-	0.000
		df	0	11
	Plano Sleeve Cylinder	Correlation	1.000	1.000
		p-value	.000	.
		df	11	0

Correlation for SE of the concave sleeve was 1, and for the plano sleeve was 0.863. Both have a strong and positive correlation.

DISCUSSION

Refractive errors are a type of vision problem that makes it hard to see clearly. They happen when the shape of your eye keeps light from focusing correctly on your retina. The most common symptom is blurry vision. One of the main reasons for a reduction in visual acuity is refractive error. Refractive errors can be caused by Eyeball length (when the eyeball grows too long or too short). After cataract, the second leading cause of blindness is refractive error, and the WHO has identified this, and addressing this is a priority for WHO Vision 2020.

Ametropia can be determined by asking questions to the patient, that is, subjective refraction, or by using different instruments, that is, objective refraction. Reduction in visual acuity also leads to a reduction in visual comfort.[13] Refractive error is divided into myopia, astigmatism, and hyperopia. The myopia prevalence has risen over the past 60 years, with significant variations in myopia prevalence regionally across the world.[14] Refractive error is one of the main causes of visual defects. Refractive development is determined by both genetics and environmental factors.[15]

Refractive error can be corrected by using glasses, contact lenses, and LASIK surgery. The subjective and the objective are two methods for determining ametropia. The objective method can be determined fast and easily with instruments such as an autorefractometer, retinoscope, and there is no patient involvement. Retinoscopy and autorefractometry are both genuine methods for refractive error assessment.[16] Autorefractors overestimate myopia and underestimate hypermetropia. An accurate and effective method for objective refraction is retinoscopy.[17]

Retinoscopy is an excellent method for determining refractive error.[18] Based on the direction of the retinal reflex, the examiner puts different lenses in front of the eye of the patient.[19] Retinoscopy uses the technique of neutralisation of the light reflex. Optically, the direction of light is reversed in a concave mirror because the position of incoming light is reversed.[20] The test can be quick, easy, and reliable, and requires minimal cooperation from the patient.

One of the main reasons for a reduction in visual acuity is refractive error. Ametropia can be determined by asking questions to the patient, which is subjective refraction, or by using different instruments, which are objective refraction. Reduction in visual acuity also leads to a reduction in visual comfort.[1] Retinoscopy is an excellent method for determining refractive error.[21] Optically, the direction of light is reversed in a concave mirror because the position of the incoming light is reversed. Retinoscopes have different sleeve positions and are made by different manufacturers. Sleeve down or sleeve up position. Mostly, the use of the sleeve of retinoscopy produces a divergent light.[22]

One of the uses of a concave sleeve is to sharpen the reflex while determining the axis of astigmatism. It is used to confirm the neutral point and, in high myopia, to see the reflex. Both techniques were performed on each person. Concave sleeve retinoscopy was performed first. The patient was asked to fixate on the distance target at a distance of 6 meters. Retinoscopy was performed in a dark room. A working distance of 66cm was maintained. The right eye was tested first. Refractive error was neutralised with the help of trial lenses. Final prescription was adjusted by subtracting the value of working distance, i.e., 1.5D. Following concave sleeve retinoscopy, Plano sleeve retinoscopy was performed by moving the sleeve upward. The right eye was tested first. The distance target was given to the patient. Retinoscopy was done in a dull, illuminated room. Refractive error was neutralised with the help of trial lenses. Working distance of 1.5D was subtracted from the final prescription.

CONCLUSION

Refractive errors are among the leading causes of reduced visual acuity and blindness worldwide, second only to cataract. Accurate diagnosis through both subjective and objective methods is essential, with retinoscopy proving to be a reliable and effective tool for assessment. It minimizes patient cooperation requirements and provides precise results compared to autorefractors. Proper detection and correction using glasses, contact lenses, or surgical options can significantly improve vision and comfort, reducing the global burden of visual impairment. Concave sleeve and Plano sleeve have the same accuracy in measuring refractive error with retinoscopy, and there is no significant difference between the accuracy of both sleeves.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.
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