Research Article
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Assessment of types of phorias in myopic patients before and after refractive correction

Abstract

Purpose: To assess the types of phorias in different degrees of myopic patients and different age groups before and after refractive correction.

Study design: Descriptive cross-sectional study.

Material and methods: This was a comparative cross-sectional study that included 100 patients. Types of phorias in myopic patients were assessed before and after refractive correction. Patients involved are 15-35 years of age groups. Data was collected from the University of Lahore Teaching Hospital.

Results: A total of 100 subjects were participated out of which 52% were males and 48% were females. 38% were 15-20 years, 42% were 21-25 years, 9% were 26-30 years, and 11% of participants were31-35 years of age. Visual acuity before the correction of refractive error was also recorded 42% of participants were observed with 6/6-6/12 visual acuity, 6/18-6/36 visual acuity was reported in 42% subjects and 16% subjects had <6/60 visual acuity. After the correction of myopic error 87% subjects had 6/6-6/12 and 13% subjects had 6/18-6/36 best corrected visual acuity. Degree of myopia was recorded mild in 42% participants, moderate in 42% subjects and severe in 16% subjects. Before the correction of myopia 21% participants were observed with esophoria, 54% had exophoria and 25% subjects were orthophoric. After refractive correction 13% participants were esophoric, 28% were exophoric and 59% were orthophoric while measuring horizontal phoria at distance. In vertical phoria before correction 14% participants were hyperphoria, 1% were hypophoria and 85% were orthophoric. After best correction 5% participants were recorded as hyperphoria, 1% were hypophoria and 94% were orthophoric.

Conclusion: Horizontal and vertical phorias were evaluated at distance with Maddox rod. It is concluded that after correction the frequency of horizontal phorias is high than vertical phorias. In horizontal phorias exophoric pattern has significant frequency. Exophoria can also result due to weak fusional reserves. Fusional convergence eliminates the disparity of retinal images and maintain exophoria in myopic patients. So, convergence weakness and excess of divergence leads to exophoria in myopic patients. Mostly exophoric participants are reported from age range of 15 to 20 years. After refraction if patient still have asthenopia symptoms proper evaluation and management should be made for latent squint. By treating and managing the latent squint the chances of phorias to convert in manifest squint will be minimize.

Keywords: heterophoria, myopia, esophoria, exophoria, hyperphoria, hypophoria, maddox rod

Volume 11 Issue 2 - 2021

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Received: September 30, 2021 | **Published:** October 14, 2021

Introduction

Myopia is that the commonest ophthalmic condition. Myopia may be a sort of refractive error. The term myopia is employed to explain distant blurred vision. In myopia when accommodation is relaxed, collateral beams of light or rays of light from infinities fall ahead of retina, instead of on retina. The term myopia is additionally known as near-sightedness.[1]

Myopia can be classified based on degree of refractive error. According to the amount up to -1.00D myopia is classified as low myopia. From -1.00D to -3.00D myopia fall in low myopia category. From -3.00D to -6.00D myopia is termed as moderate myopia. High myopia ranges from -6.00D to -10.00D. If the degree of myopia is above -10.00D, it termed as very high myopia.[2]

Squint is a condition in which one eye deviate away from the fixation point means both eyes are misdirected. In Squint visual axes of each eye do not meet at point of the regard. As a result, fusion of both images from both eyes is replaced either by diplopia or suppression of one image this ultimately causes the loss of binocular single vision.[3]

When fusion is broken or made impossible, inclination for the deviation of the eyes is present that led to latent form of squint. Thus, the eyes can regain its normal alignment with fusion. The latent squint is also known as heterophoria. Fusional vergence compensate heterophoria. An optomotor reflex called fusional vergence that generates restorative movements of eyes to beat disparity of retinal image. Uncorrected high refractive errors, accommodation–vergence anomalies and anatomical factors, as well as increased near-work demand may cause phoria.[4]

Research was conduct by Out-patient department of Services Institute of Medical Sciences (SIMS) /Services Hospital Lahore, Pakistan on Students of SIMS. 40% of the participants had latent squint. 43.3% of the themes with latent squint had the symptoms of headache and tiredness in the eyes. 33.3% of the participants with

phoria had problems with accommodation. Intermittent diplopia and reading work avoidance response was present in 26.6% of the participants with phoria. 16% of those with phoria had symptoms of blur vision due to fatigue. 23.3% of those with phoria had complaint that the words become small words during reading. 76.6% of the participants with phoria had problem of sleepiness during study session.[5]

In Iran, the prevalence of phoria, and its variants are found in the use of combined and differentiated cover trials to detect phoria by 6 m and 40 cm respectively. Esotropia prevalence was highest in adults of 24 years of age or more. The overall frequency of phoria, exophoria, and esophoria was 12.9%, 11.7% and 1.2% respectively. One in 10 students had phoria; however, as a result of close work, the students become more prone to asthenopia symptoms, early visual fatigue, and decreased productivity.[6]

In December 2017 research was conducted by Bahauddin Zakariya University on a topic "correlates of myopia in students of Bahauddin Zakariya University, Multan". A study was conducted on myopia and the effects of variant specification on it among university students in Punjab.

General prevalence of myopia was about 24.19%. Prevalence of myopia in males were recorded high 28.81% than in females 20%. The prevalence of myopia was found highest in age group tween teen and lowest in age group eighteen. Myopia prevalence was unquestionably distinguished in different age groups. In conclusion, the results of the study expressed that many factors possibly mutually to cause myopia. It was suggested that myopia is partly inherited and less environmental. Parents who had myopia their children had a greater chance of developing myopia.[7]

In research conducted by Noor Ophthalmology Research Center and Arak University of Medical Sciences in 2015 on the topic of "the strabismus prevalence in 7 years old children in Iran" and the chief purpose is to evaluate the frequency of tropia and phoria in children in Iran with associated factors. I was a cross sectional population- based study in which measurement of corrected along with uncorrected visual acuity, cycloplegic refraction and cover test is performed on the participants. The near cover test was performed at 40cm whereas the distant cover test was performed at 6m along with the best correction of visual acuity. In this test phorias and tropias are also measured but independently along with the correlated tests. In this test a total 4157 participant students were taken out of which only 3675 participant students participated.

According to that research the frequency of strabismus was 1.68%, whereas in girls the frequency was 1.27% and in boys it was 2.17%. However, 1.27% had exotropia and 0.44% had esotropia. The chief of our concern was phoria and the frequency of phorias in children that participated in this research was 32.98%. The frequency of strabismus in participants with residual vision was 23.77% whereas in non-strabismic participants the percentage of residual amblyopia was 1.43%. Therefore, the frequency of strabismus in higher in hyperopic children as well as children with astigmatism.

The conclusion of this research manifested the frequency of phoria and tropia in Iran. In this research it was concluded that exotropia was the most significant type of tropia, and intermittent squint was the most common form of strabismus. Hyperopia is also very significant in children. Thus, it is indicated in this research that in patients with phorias and tropias screening and treatment was very important and full attention should be directed towards the good treatment as well as careful screening to prevent amblyopia and strabismus in such children.[8]

Material and methods

This was a comparative cross-sectional study which included 100 patients. Types of phorias in myopic patients were assessed before and after refractive correction. Patients involved are 15-35 years of age groups. Data was collected from University of Lahore Teaching Hospital. Phoria in selected subjects was detected with the help of following equipment/tests including Maddox rod in front of the right eye after obtaining best corrected visual acuity (BCVA). Performa and a pencil to record the data.

Results

Total 100 subjects were participated out of which 52% were males and 48% were females. 38% were 15-20 years, 42% were 21-25 years, 9% were 26-30 years and 11% participants were31-35 years of age. Visual acuity before the correction of refractive error was also recorded 42% participants were observed with 6/6-6/12 visual acuity, 6/18-6/36 visual acuity was reported in 42% subjects and 16% subjects had <6/60 visual acuity. After the correction of myopic error 87% subjects had 6/6-6/12 and 13% subjects had 6/18-6/36 best corrected visual acuity. Degree of myopia was recorded mild in 42% participants, moderate in 42% subjects and severe in 16% subjects. Before the correction of myopia 21% participants were observed with esophoria, 54% had exophoria and 25% subjects were orthophoric. After refractive correction 13% participants were esophoric, 28% were exophoric and 59% were orthophoric while measuring horizontal phoria at distance. In vertical phoria before correction 14% participants were hyperphoria, 1% were hypophoria and 85% were orthophoric. After best correction 5% participants were recorded as hyperphoria, 1% were hypophoria and 94% were orthophoric.

Table 1 depicts that 42% participants (7 esophoric and 18 exophoric) had mild myopia, 42% participants (8 esophoric and 27 exophoric) had moderate myopia and 16% participants (6 esophoric and 9 exophoric) had severe myopia before the correction of refractive error.

Table 1 Types of horizontal phorias according to degree of myopia

Before correction

		Types of horizontal phoria in participants before correction		Total
		Esophoria	Exophoria	Orthophoria	
Degree of myopia in the participant	Mild	7	18	17	42
	Moderate	8	27	7	42
	Severe	6	9	1	16
Total		21	54	25	100

Citation: Maqbool J, Amir A, Iftikhar A, et al. Assessment of types of phorias in myopic patients before and after refractive correction. *Adv Ophthalmol Vis Syst.* 2021;11(2):37–42. DOI: 10.15406/aovs.2021.11.00406

After correction

		Types of horizontal phoria in participants after correction		Total	
		Esophoria	Exophoria	Orthophoria	
Degree of myopia in the participant	Mild	4	6	32	42
	Moderate	6	15	21	42
	Severe	3	7	6	16
Total		13	28	59	100

Table 2 shows that after correction mild degree of myopia was observed in 4% esophoric, 6% exophoric and 32% orthophoric participants. Moderate degree of myopia was recorded in 6% esophoric, 15% exophoric and 21% orthophoric participants. Severe myopia was recorded in 3% esophoric, 7% exophoric and 59% orthophoric participants.

Table 2 Types of vertical phorias according to degree of myopia

Before correction

		Types of vertical phoria in participants before correction		Total	
		Hyperphoria	Hypophoria	Orthophoria	
Degree of myopia in the participant	Mild	2	0	40	42
	Moderate	8	1	33	42
	Severe	4	0	12	16
Total		14	1	85	100

After correction

		Types of vertical phoria in participants after correction		Total	
		Hyperphoria	Hypophoria	Orthophoria	
Degree of myopia in the participant	Mild	0	0	42	42
	Moderate	4	1	37	42
	Severe	1	0	15	16
Total		5	1	94	100

Table 3 depicts that before the correction of refractive error mild degree of myopia was observed in 2% hyperphoria and 40% orthophoric participants. Moderate myopia was reported in 8% hyperphoria, 1% hypophoria and 33% orthophoric participants. Severe degree of myopia was observed in 4% hyperphoria and 12% orthophoric subjects.

Table 3 Types of horizontal phoria in participants according to age group

Before correction

		Types of horizontal phoria in participants before correction		Total	
		Esophoria	Exophoria	Orthophoria	
Age of the participant	15-20	6	21	11	38
	21-25	13	18	11	42
	26-30	0	9	0	9
	31-35	2	6	3	11
Total		21	54	25	100

Citation: Maqbool J, Amir A, Iftikhar A, et al. Assessment of types of phorias in myopic patients before and after refractive correction. *Adv Ophthalmol Vis Syst.* 2021;11(2):37–42. DOI: 10.15406/aovs.2021.11.00406

After correction

		Types of horizontal phoria in participants before correction		Total	
		Esophoria	Exophoria	Orthophoria	
Age of the participant	15-20	6	15	17	38
	21-25	5	6	31	42
	26-30	0	4	5	9
	31-35	2	3	6	11
Total		13	28	59	100

Table 4 illustrates that after the correction of refractive error moderate myopia was observed in 4% hyperphoria subjects and 1% hypophoria subjects. Mild degree of myopia was reported in 42% orthophoric participants. Severe form of myopia was recorded in 1% hyperphoria and 15% orthophoric participants.

Table 4 Types of vertical phorias in participants according to age group

Before correction

		Types of vertical phoria in participants before correction		Total	
		Hyperphoria	Hypophoria	Orthophoria	
Age of the participant	15-20	7	0	31	38
	21-25	4	0	38	42
	26-30	0	1	8	9
	31-35	3	0	8	11
Total		14	1	85	100

After correction

		Types of vertical phoria in participants after correction		Total	
		Hyperphoria	Hypophoria	Orthophoria	
Age of the participant	15-20	3	0	35	38
	21-25	0	0	42	42
	26-30	0	1	8	9
	31-35	2	0	9	11
Total		5	1	94	100

Table 5 Types of horizontal phorias according to visual acuity

Before correction

		Types of horizontal phoria in participants before correction		Total	
		Esophoria	Exophoria	Orthophoria	
Visual acuity before correction	6/6-6/12	7	18	17	42
	6/18-6/36	8	27	7	42
	≤6/60	6	9	1	16
Total		21	54	25	100

Citation: Maqbool J, Amir A, Iftikhar A, et al. Assessment of types of phorias in myopic patients before and after refractive correction. *Adv Ophthalmol Vis Syst.* 2021;11(2):37–42. DOI: 10.15406/aovs.2021.11.00406

After correction

		Types of horizontal phoria in participants after correction		Total	
		Esophoria	Exophoria	Orthophoria	
Visual acuity before correction	6/6-6/12	4	6	32	42
	6/18-6/36	6	15	21	42
	≤6/60	3	7	6	16
Total		13	28	59	100

Table 6 Types of vertical phorias according to visual acuity

Before correction

		Types of vertical phoria in participants before correction		Total	
		Hyperphoria	Hypophoria	Orthophoria	
Visual acuity before correction	6/6-6/12	2	0	40	42
	6/18-6/36	8	1	33	42
	≤6/60	4	0	12	16
Total		14	1	85	100

After correction

		Types of vertical phoria in participants after correction		Total	
		Hyperphoria	Hypophoria	Orthophoria	
Visual acuity before correction	6/6-6/12	0	0	42	42
	6/18-6/36	4	1	37	42
	≤6/60	1	0	15	16
Total		5	1	94	100

Discussion

In study conducted by Malaysia in 2004 they concluded that exophoria were most common in emmetropes and myopes, but they suggested that if the viewing distance increases the heterophoria decreased towards the orthophoric location. They keep their results consistent with the fixation disparity at distinct viewing distances. In a study conducted by Jaschinski, he relays his emphasis on exo-shift with respect to fixation disparity within the limit from 30cm to 60cm of fixation target at distance. Whereas in the study conducted by Malaysia they reported the exo-shift for viewing distant object in most of the subjects only few reported eso-shift for near objects.

Whereas exophoria and hyperopia have been described as buffers of emmetropization, where the absorption of hyperopia and exophoria could be an early sign of stress-induced vision disparity or myopic progression. More studies comparing heterophoria changes and visual distances between patients with signs and symptoms may be helpful. There is a distinct pattern of heterophoria changes with visual acuity between patients with signs or symptoms because the subject with asthenopia signs or symptoms have been reported to act differently in tonic alteration[9] and in transient myopic shift presentation.[10] In advance information on the evolving pattern of heterophoria with visual acuity might be practically useful in the diagnosis and management of non-involving strabismic disparity and binocular anomelies[11] such as convergence (insufficiency), divergence excess and much more.

Many modern theories of myopia causes include that living and reuniting are important element in the evolution of myopia. In school going children many doctors find that bifocal control myopia progression. In near esophoria that happened in childhood get cure by using bifocal lenses suggested by many doctors. But same thing is not happened with exophoria and non-phoria (orthophoria). Then it is proved that patients have esophoric are more prone to get myopic. Two more studies are in favor of this. Before getting myopic, esophoric pattern are more seen in myopic patients than emmetropic person.[12]

However, in research it showed that there is closed relation between esophoria and myopia progression. In many studies, esophoric patients are less in numbers, but there is no any study present that clarify relation between esophoria present at near and other refractive errors. If in esophoric group progression myopia rate in higher, then there is increase in absolute myopia amount. All these previous studies showed that in esophoric group myopia amount is higher.

A study leaded by Malaysia National University, in esophoric group myopia is more common. In more than six diopter exophoria, myopia is lesser. In orthophoric to 6 PD exo group myopia happened least. This study is proposed by Goss. He finds that in esophoric group rate of myopia is higher. Which is least find in exophoric group about

PD (prism diopter) or less or no happened in exophoric group from orthophoria to six PD (prism diopters).

Goss suggested through finding of his study that, myopia found in esophoric group more than exophoric group that lie from orthophoric group to six PD (prism diopter). This study also stated that other than two phoria group myopia more found in esophoric group. There is big difference between both studies, Goss study talked about continuity while other research is showed up all the errors of refraction.

Goss included use of bifocals in myopia progression in his study. Other than two groups, esophoric patients more found in higher myopia group in children group age range from 9 to 24. In early years of school time esophoria is happened mostly in myopic patients than emmetropic patients.

When he considered group age range from 25 to 39 he found no remarkable change in other euphoria groups. This study is more concise that included limited number of groups. This study sticks with result. It showed that if there is possible control of phoria, then development of myopia is controlled also.[12,13]

In all previous research we concluded that ultimately phoria associated with refraction of eye and muscle imbalance. Whole eye examination including phoria assessment is necessary for onset of myopia. Past studies showed that phoria has indirect relation with myopia or sometime onset of myopia begin after phoria. In this research we will study the association of phoria in myopic patients. All the previous research studied the pattern of phoria at near distance and compared with myopic condition of the patient but in our study, we worked on the phorias present at distance in myopic patient. Our whole concern was to evaluate the phorias at distance in myopic patient and we ignored the phorias at near targets. All subjects were corrected by both spectacles and contact lenses after refractive correction. There was not any specific differences in results of contact lenses and spectacles users in this research because our main concern is to assess the type of phoria in myopic patients before and after refractive correction.

Secondly it is proved in many research that strabismus is higher in hyperopes, patients with high astigmatism and patients with anisometropia. So, we excluded such patients from our research only patients with 1D of astigmatism is included. Because 1D of astigmatism is very much evident in majority of myopic patients. So, our chief concern is to evaluate the frequency of phoria in myopic patients with 1D of astigmatism or no astigmatism. We do not include strabismic and anisometropic patients because that's another debate with multiple other factors. Our foremost priority will be the diagnosis of the types of phorias in myopic patients and to prove any possibility that myopic patients will have phoria and their ultimate risk factors that will affect the vision in the long-term basis. Patients who came in outdoors with asthenopia symptoms and did not cure after refraction. For this, phoria assessments will be performed in myopic patients to prevent strains and asthenopia symptoms after refraction.

Conclusion

Horizontal and vertical phorias were evaluated at distance with Maddox rod. It is concluded that after correction the frequency of horizontal phorias is high than vertical phorias. In horizontal phorias exophoric pattern has significant frequency. Exophoria can also result due to weak fusional reserves. Fusional convergence eliminates the disparity of retinal images and maintain exophoria in myopic patients. So, convergence weakness and excess of divergence leads to exophoria in myopic patients. Mostly exophoric participants are reported from age range of 15 to 20 years. After refraction if patient still have asthenopia symptoms proper evaluation and management should be made for latent squint. By treating and managing the latent squint the chances of phorias to convert in manifest squint will be minimize.

Acknowledgments

None.

Conflicts of interest

There are no financial conflicts of interest.

Funding

None.

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