

Comparison of Contrast Sensitivity in Subjects Wearing Spectacles and Contact Lenses

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ABSTRACT

Aim: The purpose of this study was to compare the contrast sensitivity level in people wearing soft contact lenses and spectacles.

Study design: Cross sectional

Duration and Setting of Study: Six months, Ophthalmology Department, Hayatabad Medical Complex, Peshawar.

Methods: Data were taken from participants having myopic refractive error only, wearing soft contact lenses and spectacles for correction of their myopia. All the participants underwent comprehensive eye examination. Contrast Sensitivity (CS) were measured with Lea contrast sensitivity chart for each eye separately at three meters, two meters and one meter distances with spectacles first and then with soft contact lenses. After complete assessment, mean change in CS in contact lenses and spectacles were compared with paired t-test using SPSS 17.0.

Results: A total of 48 eyes were tested. The mean age of subjects was 22 ± 1.45 . Contrast sensitivity Mean in spectacle was 78 at 3m, 127 at 2m, and 160 at 1m. CS Mean in contact lens is 65 at 3m, 117 at 2m, and 156 at 1m. Paired T test (two tailed) for means and alpha 0.05 was applied and showed the results were insignificant at 3m with $p=0.095$, at 2m $p=0.185$ and at 1m $p=0.327$. The higher mean change in CS was observed in the age group of 23 years and moderate myopia.

Conclusions: There was no statistically significant difference in CS between spectacle and soft contact lens wearing at three, two and one meter. According to our results there is no preference for contact lenses and spectacles regarding contrast.

Keywords: contrast, contrast sensitivity, myopia, soft contact lens, spectacles

INTRODUCTION

Contrast is defined as the difference in luminance or color that makes an object distinguishable. It is the degree of blackness to whiteness of a target. The human visual system is more sensitive to contrast than absolute luminance.¹ Contrast is expressed as a percentage from 0% to 100%.²

The increasing use of contact lenses (CL) has created a new patient group whose visual quality is affected independently of visual acuity.³ Visual acuity measurement is not an adequate assessment of visual functions in these patients, which increases the need for contrast sensitivity. Contact lens users complain that their vision with CL is not as sharp as with glasses. Vision loss in soft contact lens wearers may be the result of subtle corneal edema.⁴

Contrast Sensitivity (CS) function is affected by optical abrasions, diffraction and scattering which degrade retinal image. Contact lenses induced spherical abrasions are more significant than spectacles which may affect contrast in contact lenses.⁵ The reports about soft CL and spectacles CS are conflicting and opposite results have been observed. Some studies suggest that contact lenses has higher contrast sensitivity.⁶ while some studies says that the spectacles group has a higher contrast sensitivity function (CSF) for all mid and high frequencies than either contact lens group.⁷

It is observed that with best corrected visual acuity myopes experienced reduction in contrast sensitivity in comparison to emmetropes. With increasing in degree of myopia, it is observed that contrast sensitivity reduces.⁸ Contrast sensitivity examination is better predictor of the visual quality and visual performance of a person than assessment of visual acuity. In patients with visual impairment, contrast sensitivity testing is recommended. It helps in diagnosis and evaluation of subtle ocular diseases.⁹

The aim of this study was to compare the contrast sensitivity level in subjects wearing soft contact lenses and spectacles.

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METHODS

This comparative cross-sectional study was conducted at low vision clinic, ophthalmology department, Hayatabad medical complex Peshawar for a period of 6 months. This study followed the tenets of declaration of Helsinki and was approved by ethical Research committee, verbal consent was taken. 48 eyes were checked of participants aged between 15-30 years. Patients were recruited through non-probability convenient sampling technique. Visual acuity was recorded with Snellen acuity chart at distance of 6m. Retinoscopy was done and myopic refractive error was checked, subjects were divided into four groups on basis of refractive error i.e. mild, moderate, severe and very severe myopia. Subjects with astigmatism of more than -0.5 and hyperopia were excluded. Those subjects having corrected vision acuity of 6/9 or better in each eye with both spectacles and contact lens and free from any ocular or systemic pathology were taken. After that patient's prescription was placed in spectacle trial lens frame and CS was measured by Lea contrast sensitivity chart at three meters, two meters and one meter respectively, with each eye separately. Letter by letter method was used where value of each symbol read was one. Test was stopped when subject failed to read three or more symbol in next line and CS of previous line was noted as subject's final CS. The final value is then converted into contrast sensitivity given on lea chart. Then soft spherical contact lens was cleaned with enzyme disinfecting solution and lenses were inserted in the eye. Slit lamp

examination of the soft contact lens wearer were carried out to check contact lens fitting and deposits on the contact lens. Only soft spherical monofocal CL was used. After confirmation of contact lens fitting and free deposit lenses, visual acuity were taken both monocular and binocularly. Then contrast sensitivity was measured after one hour after insertion of contact lenses. After complete assessment, change in contrast sensitivity in contact lens and spectacle were compared. Analysis was done using SPSS 17.0. Mean, standard deviation was calculated for categorical and continuous variables. Two tailed Paired t-test was applied to generate p value for comparison of mean and alpha 0.05 was used. Data was also presented in tables form.

RESULTS

A total of 48 eyes of 24 subjects were checked including 02 (8%) males and 22 (92%) females. Mean age was found to be 22 ± 1.45 years. Contrast sensitivity for all the subjects were calculated using spectacles and contact lenses. In this study 8(17%) eyes had mild myopia, 32(66%) were having moderate myopia, 8(17%) eyes had high myopia. The mean contrast sensitivity for 3m group using spectacles was 78 ± 32.34 and 65 ± 18.17 for contact lenses. Mean Contrast sensitivity at 2m was 127 ± 48.95 for spectacles and 117 ± 51.71 contact lenses. Similarly mean contrast sensitivity for 1m was 160 ± 48.46 with

spectacles and 156 ± 49.15 with contact lenses. The difference in Mean was 13 at 3m, 10 at 2m and 4 mean difference was found at 1m. It is also observed that mean contrast sensitivity was better with spectacles than with contact lens correction.

By using paired sample t test, no significant ($p=0.095$) difference between spectacles and contact lenses for 3m and ($p=0.185$) for 2m were observed. Similarly, highly insignificant ($p=0.327$) difference was found at 1m between spectacles and contact lenses.

Table 01: Refractive error wise distribution of data

Refractive error	Frequency	%
Mild Myopia 0 D to -1.50D	8	17%
Moderate myopia -1.75D to -6.0D	32	66%
High myopia <-6.0D	8	17%
Total	48	100%

D=Diopter, <=Less than, %= Percentage

Table 02: Contrast sensitivity at different distances

Distance	Contrast sensitivity	Frequency		P-value
		Spectacles (%)	Contact lenses (%)	
At 3m	Severe loss 11-40	3 (25%)	4 (55%)	0.095
	Mild loss 41-80	25 (67%)	30 (45%)	
	Normal 81-200	20 (8%)	14 (0%)	
	total	48 (100%)	48 (100%)	
	Mean $\pm$SD	78 $\pm$32.34	65 $\pm$18.17	
At 2m	Severe loss 11-40	0 (0%)	02 (04%)	0.185
	Mild loss 41-80	20 (42%)	32 (67%)	
	Normal 81-200	28 (58%)	14 (29%)	
	total	48 (100%)	48 (100%)	
	Mean $\pm$SD	127 $\pm$48.95	117 $\pm$51.71	
	Severe loss 11-40	0 (0%)	0 (0%)	0.327
	Mild loss 41-80	0 (0%)	0 (0%)	
	Normal 81-200	48 (100%)	48 (100%)	
	total	48 (100%)	48 (100%)	
	Mean $\pm$SD	160 $\pm$48.46	156 $\pm$49.15	

SD=Standard Deviation, %= Percentage

DISCUSSION

A total of 48 eyes were checked in this study. All the 24 subjects were in range from 19-24 years. Mean age was 22 ± 1.45 . In previous research their subject's age range was 14 to 49 years.⁷ In Previous literature refractive correction was ranged from 0 DS to -3.75DS.⁷ In this study myopic refractive error ranged from 0 D to >6D, in which 8 eyes had mild myopia (17%), 32 were having moderate myopia (66%), 8 eyes had high myopia (17%).

In our study no significant change in contrast sensitivity was observed in contact lens than spectacles. Some other studies contradict our results. A study suggested that changes in corneal physiology due to CL wear may reduce the CSF.⁸ Another study observed that CL with higher thicknesses and low oxygen transmissibility may reduce the CSF by inducing corneal edema.⁹ Another study with six-sample size concluded that the CSF initially decreases with soft CL wear but it rapidly recovers to a normal state within few hours.¹⁰ In another study, found a reduction in the CSF with soft CL after few hours of wear when compared to the initial CSF with no correction.

Another study observed, in 2020, that contrast sensitivity was significantly decreased in spectacles as compared to contact lenses.¹¹ However in our study contrast sensitivity was checked after one hour of lens wear while in the study above, CS was assessed after three months which could be the factor for difference in results. Another study also observed an increase in CS with contact lenses.¹² Aberrations of spectacles are high as compared to contact lenses which could affect the contrast sensitivity.¹³

Another study supported our results, no change was

Another study supported our results, no change was found between contact lenses and spectacles contrast sensitivity. A study published by University of Texas Arlington, they don't found any differences between soft CL and spectacles over 18 hours period of testing¹⁴

In previous studies soft contact lens were wore for 18 hours continuously, but due to time limitation, in our research subject wore soft contact lenses for 1 hour.¹⁵

In previous study none of their subject has worn soft contact lens before but in this research, subjects were mostly daily wear contact lens users.

Another study neither found systemic difference between soft contact lenses and spectacles nor any systematic change. This result stand in favor with our present research.¹⁶

Mean in spectacle was 78 at 3m, 127 at 2m, and 160 at 1m. CS Mean in contact lens is 65 at 3m, 117 at 2m, and 156 at 1m. The difference in Mean was 13 at 3m, 10 at 2m and 4 mean change was found at 1m. In another previous research, CS was measured by sinusoidal pattern for distance and Arden plate for near and no change in CS was found. While for distance, it showed decrease in CS in Contact lens which contradicted our results.¹⁷

Lea contrast chart carries 10M size for each threshold; therefore further research should be done using different size and spatial frequencies to check validity. So far, according to our results there is no preference for contact lenses and spectacles regarding contrast.

CONCLUSIONS

There was no statistically significant difference in CS between spectacle and soft contact lens at three, two and one meter. The greater mean change in CS was reported in moderate myopic eyes.

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