ORIGINAL ARTICLE

Contrast Sensitivity in people with Dry Eye Disease at Tertiary Eye Care Hospital

Komal Yaseen[1], Hikmat ullah Afridi[2], Sami Uddin[3]

ABSTRACT

Aim: To determine the effect of dry eye disease on contrast sensitivity and correlate contrast sensitivity with severity of dry eye disease.

Study design: Cross-sectional study

Duration and Setting of Study: This study was conducted from August-2019 to January-2020 in the Department of Ophthalmology Hayatabad Medical Complex, Peshawar

Methods: Patients with visual complaints of dry eyes were selected by non-probability convenient sampling technique. All patients underwent evaluations for inclusion and exclusion criteria. Schirmer's test was used to assess the dry eyes. A dry eye measurement of less than 15 mm was considered to be indicative of Dry Eye Disease (DED). After the Schirmer's test contrast sensitivity were measured using a Pelli-Robson contrast sensitivity chart. A Standard Patient Evaluation of Eye Dryness (SPEED) questionnaire was used to ask about dry eye symptoms. Subjects scoring >5 are considered to be symptomatic.

Results: Forty-three participants (86 eyes) were enrolled in this study. Mean age was 35 (SD±14.22) years with 60% of them were male. The mean log contrast sensitivity was 1.67± 0.16. Contrast sensitivity was found more reduced in eyes with mild DED as compared to the other grades. Mean contrast for mild DED was 1.66±0.17 P=0.95(>0.05). Mean log contrast sensitivity in asymptomatic subjects (n=09) was 1.70± 0.18 and in symptomatic subjects (n=34) it was 1.67± 0.16. (P. value = 0.009).

Conclusions: Contrast sensitivity was reduced in people with dry eyes. However there was no statistically significant relation of contrast sensitivity with severity of dryness. A statistically significant relation was seen between reduced contrast sensitivity and symptomatic dry eyes.

Key words: Dry eye disease, Contrast sensitivity, Schirmer's strips, Pell-Robson chart, SPEED Questionnaire.

INTRODUCTION

Dry eye disease is a condition of tear film and ocular surface that causes instability of tear-film along with increased osmolarity of the tears. This instability of tear film leads to the symptoms of visual disturbance.[1] Pathophysiology of dry eye includes instability of tear film, hyperosmolarity of tear, inflammation of the ocular surface and damage to the ocular surface. Clinical features include stinging or burning, grittiness or sandy sensation, excessive watering, transient blurriness of vision, redness, blepharitis, conjunctival redness, tear film containing lipid and mucin debris, tear meniscus height will be thin or absent, cornea may show punctuate epithelial erosion.[2]

The prevalence of dry eye lies between 5% to 50% in different population around the world.[3] A study conducted in Pakistan shows that the prevalence of dry eyes was found 18.7%. The higher prevalence was found individuals with age more than 70 year.[4] Contrast is described as the ratio of the difference in the luminance intensity of the two adjacent areas to the lower or higher of these luminance values. A contrast threshold is the smallest amount of contrast required to able to see a target.[5] Contrast sensitivity is the inverse of contrast threshold. Thus, persons with low thresholds are said to have high sensitivity, and those with high thresholds have low sensitivity.[6-8] Visual information at low contrast level is important in orientation and mobility like in low contrast forms, faint shadows, stairs when walking down seeing in dusk, rain, fog, snow fall and at night and in activities of daily living. In near visual tasks like reading and writing at low contrast as in poor quality paper etc.[9]

The aim of this study is to evaluate the impact of dryness on contrast sensitivity and compare in

Correspondence:
Komal Yaseen
Email: ruakhattak123@gmail.com
PO.Box: 125 GPO Peshawar Pakistan

[1]Lecturer Optometry (Pakistan Institute of Community Ophthalmology, Peshawar)
[2]Optometrist (District Head Quarter Hospital Alpuray, Shangla)
[3]Assistant Professor, Optometry(Pakistan Institute of Community Ophthalmology, Peshawar

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different grades of dry eye. Dry eyes patient often complain of poor vision despite having best corrected visual acuity because tear film instability impairs the visual functions.[10,11]

METHODS

This study was conducted in the Department of Ophthalmology at Hayatabad Medical Complex, Peshawar, Pakistan. Forty-three subjects (86 eyes) were enrolled. Ethical approval was taken from the ethical committee of Pakistan Institute of Community Ophthalmology (PICO). Written consent was taken after explaining the aim and objectives of the study. Participants were first screened for acute pathologies by an ophthalmologist and asked for any history of ocular surgery was refracted in refraction room. Distance visual acuity recorded with Snellen visual acuity chart with best optical correction of ≥ 6/9(0.2 logMar) were included in the study.[12] The exclusion criteria was as follow: acute pathologies which effect contrast sensitivity, spherical equivalent >6Diopter and history of any ocular surgery.

Schirmer's test was performed to evaluate dry eye. Value of ≤ 15mm was labeled as subject with dry eyes without anesthesia. Level of dry eye was further categorized in grades with Mild dryness (9mm-14mm), Moderate (4mm-8mm), and severe (<4mm).[13]

Contrast sensitivity was recorded with Pelli-Robson contrast sensitivity chart for VA ≥ 6/9 the normal contrast was taken 1.80 log contrast. A value less than 1.80 was marked as reduced contrast.[12]

Standard Patient Evaluation of Eye Dryness Questionnaire (SPEED), sensitivity and specificity were 0.90 and 0.80 respectively[14]. Scoring >5 out of 28 were marked as symptomatic subjects for dry eye disease.[15] Continuous and Categorical variables were translated into Statistical Package for Social Science SPSS version 22 database. Mean values and standard deviation were calculated for continuous variables while proportions and percentages were calculated for categorical variables. P-value was generated using Chi- Square test for comparison of categorical variables.

RESULTS

Eighty six eyes were assessed at refraction room of Department of Ophthalmology. Mean age of participants was 35±14.22 years. Among them 60% (n= 26) were male and female were 40% (n= 17). Mean value for dry eye on Schirmer's test was 9.52mm±5.96 and Mean log contrast sensitivity found was 1.67± 0.16. Mean value found on Schirmer's test in female were 10.8mm ± 5.64, and males were 8.63mm± 6.10. Mean log contrast sensitivity in males were 1.70mm± 0.15 and females it were 1.64mm± 0.18. Twelve eyes were without DED on schirmer test (eight of them were having reduce mean contrast sensitivity of 1.59) and 74 eyes were with DED. Among participants, 53 eyes were having reduce mean contrast sensitivity of

1.57(Table 01). Furthermore, contrast sensitivity was found by grading the eyes in mild, moderate and severe form. It was found that participants with mild DED (n=27) were having mean contrast sensitivity of 1.66±0.17. Moderate level of DED (n=40) were having mean contrast sensitivity of 1.67±0.18. Severe DED were having mean contrast sensitivity of 1.71±0.17 (Table 02) P=0.95. Statistically analysis showed that eyes without DED, 08 out of 12 were symptomatic for dry eye, eyes mild DED (n=27) were all symptomatic. For moderate DED(n=40) 27 were symptomatic for dry eye and 06 eyes with severe DED (n=7) were symptomatic for dry eyes (Table 03). The mean log contrast sensitivity of symptomatic subjects (n=34) were 1.67±0.16 and in asymptomatic participants (n=09) were 1.70±0.18.

Table 01: Contrast Sensitivity in eyes without DED and in eyes with DED on Schimer's test.

	Total (n)	Number of eyes with reduce contrast sensitivity	Percentage (%) of eyes with reduce contrast sensitivity	Mean log Contrast Sensitivity
Eye without DED	12	08	66.6	1.59
Eye with DED	74	53	71.6	1.57

DED=Dry Eye Disease, n=number

Table 02: Grading of contrast sensitivity in log.

GRADES of Dry eyes	Total (n)	Mean log Contrast Sensitivity	Mean Drop Contrast Sensitivity
Mild	27	1.66±0.17	0.14
Moderate	40	1.67±0.18	0.13
Severe	07	1.71±0.17	0.09
Total(n)	74		

DED=Dry Eye Disease, n=number

Table 03: Distribution of eyes as symptomatic and asymptomatic.

		Symptomatic	Asymptomatic	Total (n)
Eye without DED		08	04	12
Eye with DED	Mild	27	00	27
	Moderate	27	13	40
	Severe	06	01	07
Total (n)		68	18	86

DED=Dry Eye Disease, n=number

DISCUSSION

This study result demonstrate that dry eye disease impairs the contrast sensitivity. On the Pelli-Robson contrast chart, the mean log contrast sensitivity was determined to be 1.67+ 0.16, while the mean value for dryness was reported as 9.52mm+5.96. According to our study, 66.6% of eyes without DED had decreased contrast sensitivity, compared to 71.6% of eyes with DED. Results of the study reveals that mild DED has more diminished contrast sensitivity. In our study 88.2% eyes with DED and 11.7% eyes without DED had symptoms, respectively. Contrast sensitivity was found more reduced in symptomatic dry eye subjects as compared to asymptomatic subjects.

Puell, et al evaluated the contrast sensitivity and disability glare in patients with dry eye.[16] In their study, the value recorded for dryness on Schirmer's test was 6.9 mm ± 3.0.They found that the contrast sensitivity was significantly worse in dry eye group ($p<0.01$). Akin, at al studied the effects of artificial tear application on contrast sensitivity in dry and normal eyes.[17] They reported the average contrast sensitivity scores in

low spatial frequency before the application of artificial tear drops in dry eye subjects were 8.84±1.00. Average contrast sensitivity scores in high spatial frequency before application of tear drops were 5.84± 1.82. They found that there is a significant increase in contrast sensitivity after application of artificial tears ($p<0.05$).

Ronaldo, et al evaluated low spatial-contrast sensitivity in dry eyes[18] they checked the contrast sensitivity in patients with keratoconjunctivitis sicca and healthy subjects using Vistech Multivision contrast tester 8000. They found that contrast sensitivity was 35-70% lower in patients with keratoconjunctivitis secca than controls. The addition of a tear substitute improved spatial contrast-sensitivity thresholds in all groups.

Tutt, et al studied the optical and visual impact of tear break-up in human eyes.[19] They noted that optical aberrations created by tear break-up contribute to the decline in image quality. They reported that contrast in the low spatial frequency range can drop to between 20% and 40% of initial values after 60 seconds of nonblinking. The decline in image quality that accompanies tear break-up may be a direct cause of the blurry vision complaints commonly encountered in dry-eye patients.

Another study reported the effect of ocular surface regularity on contrast sensitivity and stray light in dry eye.[20] They found that dry eye with superficial punctate keratopathy (SPK) had significant decrease letter contrast sensitivity 14.4±1.9 than dry eyes without SPK 16.7±and normal eye 19.2±2.7($p<0.05$).

Szczotka-Flynn, et al studied the impact of dry eye on visual acuity and contrast sensitivity: Dry Eye Assessment and Management (DREAM) study.[21] They noted that Schirmer's test score were not significantly associated with contrast sensitivity p.value>(0.55). They concluded that worse VA drives vision-related symptoms in dry eye. They also noted greater tear film instability was associated with worse contrast sensitivity.

Puell, et al evaluated contrast sensitivity and disability glare in patients with dry eye.[16] They noted the symptoms of dry eye using McMonnies dry eye Questionnair >14.5. They documented the mean and standard deviation for dry eye symptoms score 19.2± 6.5.

RECOMMENDATIONS

It is strongly suggested that the eye practitioner take a thorough history of the dry eye symptoms and test the patient's contrast sensitivity. It will aid in early diagnosis and condition management. The examination of dry eyes should also take into account eyes with reduced contrast. The Pelli-Robson contrast chart is advised for use in room illumination of 85 cd/m^2.[22]

CONCLUSIONS

In symptomatic dry eyes, contrast sensitivity was considerably reduced. The degree of reduced contrast sensitivity was unaffected by the severity of dryness. Contrast was more diminished in female patients whereas dryness was more prevalent in male individuals. Mild and moderate dryness was observed more frequently.

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