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Research Article

The New Epidemic Disease of the Digital Age: Are the Computers Enemy to Our Eyes?

Dijital Çağın Yeni Salgın Hastalığı Bilgisayarlar Gözümüze Düşman Mı?

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ABSTRACT

Objective: Many people work, especially due to the recent covid 19 pandemic lockdown, at home. These people are progressively increasingly exposed to digital screen use. This situation may express an explanation for the get a bigger ratio of myopia.

Material and Method: In this prospective study, we evaluated the eye measurements of medical secretaries who use computers for 8 hours a day. Volunteers were followed before/after the work shift. (8am and 4pm) Refraction, intraocular pressure, axial length and lens thickness measurement, measurement of anterior segment parameters (central corneal thickness, horizontal visible iris diameter, corneal volume, anterior chamber depth, anterior chamber volume, anterior chamber angle, pupil diameter) mean were recorded.

Results: 110 eyes of 110 volunteers were included in the study. The mean age of the volunteers was between 25 and 47 and the mean was 35.8 ± 5.8. There were 95 (86%) female and 15 (14%), male volunteers, by gender. Comparing before and after the work shift spherical refraction (pre-shift -0,29±1,46 / post-shfit -0,54±1,57)(p<0,001), lens thickness (pre-shift 3,71±0,35 / post-shift 3.74±0,30) (p=0,006) and pupil diameter (pre-shfit 3,43 ±0,41 / post-shfit 3,23±0,54)(p<0,001) were detected. No significant change was found in other parameters. (p> 0.05)

Conclusion: Considering the one day period, there are some changes in corneal biomechanics in long-term computer users and this situation may explain the development of myopia.

Keywords: Corneal Biomechanical, Computer Cision Syndrome, Corneal Topography, Myopia, Refraction

ÖZET

Amaç: Pek çok insan, özellikle de son zamanlarda ortaya çıkan covid 19 salgını nedeniyle evde çalışıyor. Bu insanlar giderek artan bir şekilde dijital ekran kullanımına maruz kalıyor. Bu durum, toplumda miyopi oranının artmasını açıklayabilir.

Materyal ve Metot: Bu ileriye dönük çalışmada, günde 8 saat bilgisayar kullanan tıbbi sekreterlerin göz ölçümlerini değerlendirdik. Gönüllüler mesaiden önce / sonra takip edildi. (08:00 ve 16.00) Refraksiyon değeri, göz içi basıncı, aksiyel uzunluk ve lens kalınlığı ölçümü, ön segment parametrelerinin ölçümü (merkezi kornea kalınlığı, yatay görünür iris çapı, kornea hacmi, ön kamara derinliği, ön kamara hacmi, ön kamara açısı, pupil çapı) kaydedildi.

Bulgular: 110 gönüllünün 110 gözü çalışmaya dahil edildi. Gönüllülerin ortalama yaşı 25 ile 47 arasında ve ortalama 35.8 ± 5.8 idi. Cinsiyete göre 95 (% 86) kadın ve 15 (% 14) erkek gönüllü vardı. Mesai öncesi ve sonrası sferik kırılma (mesai öncesi -0,29 ± 1,46 / mesai sonrası -0,54 ± 1,57) (p <0,001), lens kalınlığı (mesai öncesi 3,71 ± 0,35 / mesai sonrası 3.74 ± 0,30) (p = 0,006) ve pupil çapı (mesai öncesi 3,43 ± 0,41 / mesai sonrası 3,23 ± 0,54) (p <0,001) olarak tespit edildi. Diğer parametrelerde önemli bir değişiklik bulunamadı. (p> 0.05)

Sonuç: Bir günlük süre düşünüldüğünde, uzun süreli bilgisayar kullanıcılarında kornea biyomekaniğinde bazı değişiklikler olabilir ve bu durum miyopi gelişimini açıklayabilir.

Anahtar kelimeler: Miyopi, Refraksiyon, Korneal Topografi, Bilgisayar Göz Sendromu, Korneal Biomekanik

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INTRODUCTİON

All the world is coming to terms with COVID-19 lockdown and has been bracing for work from home in every feasible area, there is also no denying that we are going to stay at home for longer times and are going to be our works in a virtual environment for some time in the future. However, people devote more time to electronic devices with visual displays that contribute to eye fatigue, such as laptops, computers, tablets, mobile phones, e-readers. However, people devote more time to electronic devices with visual displays that contribute to eye fatigue, such as laptops, computers, tablets, mobile phones, e-readers. Both teenagers and adults are too exposed to digital screens to do their homework, professional work and social communication. Images and words on computer screens are created by a combination of tiny dots of light called pixels, which are brightest in the center and reduce intensity towards the edges, making it difficult for the human eye to focus. Anyone who uses the devices excessively without adequate breaks can manifest themselves with eye strain and musculoskeletal problems as part of the Computer Vision Syndrome (CVS) spectrum. CVS, also known as digital eye fatigue, has been described by the American Society of Optometry as an eye and vision problem in long-term computer, tablet and mobile phone users. (1) The three basic mechanisms that are accused in the CVS can be counted as extraocular, accommodative and ocular surface problems. (2-3) The most frequently reported symptoms are; head, neck and neck pain, reduction in acoustics, blurred or double vision, close-up formation, transient myopia, focusing problems, deterioration in color perception, dry eyes, stinging, burning, redness and itching. (4-6)

The prevalence of symptoms due to CVS has been determined by various researchers from % 25to % 93. (7-9) The time spent on the screenplays an important role in the severity of symptoms, and studies have shown that ocular symptoms are more frequent and serious in people who spend more than 4-6 hours across the screen. (10-11) Though peoples with computer vision syndrome often only have transient vision problems related to significant electronic device use, some may experience increasingly worsening visual symptoms with each repetition. Visual discomfort may also impact our capability to work. In a study on dry eyes in computer users during the day, evaporative dry eye dryness increased as a result of measurements between morning and evening. (12) In other similar studies, there was a relationship between the decreased number of blinking and increased eye dryness. (13-15) It is not understood whether the cause of the vision problem is the dry eye or another reason. However, in the literature, there is no detailed study about the changes in the anterior segment biomechanical parameters of the eyes except computerized eye dryness.

This study aims to contribute to the literature in terms of changes in the anterior segment biomechanic measurements of occupational computer users and to reveal the effects of 8 hours of daily computer work in the eye at the end of the day.

MATERIAL and METHOD

Subjects

The prospective study was conducted according to the principles of the Helsinki Declaration and the approval of the local ethics committee was obtained. (Ethic number: 2018/214) Participants were volunteers at Hospital, who worked as medical secretaries for at least 5 years. The volunteers were informed both verbally and in writing that participation in the study was voluntary, and they were told that they could withdraw from the study at any time. Volunteers with a previous history of eye surgery, cataracts, glaucoma, uveitis, keratitis, conjunctivitis, corneal disease, macular and retinal disease, pregnancy, malignancy history, and systemic diseases that may affect eye measurements were excluded to prevent eye measurement error. Volunteers included in the study were followed for one day and data of all participants was collected in 3 months.(June 01 2020-September 01 2020) To minimize the statistical error rate, we included the right eyes of all patients in the study

Measurement

After the demographic examination, all participants underwent a biomicroscopic eye examination and the refraction measurement was performed with auto refractometer before and after work shift 8 am and 4 pm at 2 different times. Intraocular pressure measurement with I-care tonometer (ICare; Finland Oy), axial length and lens thickness measurement with optical biometer (Lenstar APS, Haag-Streit Koeniz, Switzerland), Scheimpflug-Placido Corneal Topography (Sirius, Costruzione Strumenti Oftalmici, Florence, Italy) measurement of anterior segment parameters (central corneal thickness, corneal diameter, corneal volume, anterior chamber depth, anterior chamber volume, anterior chamber angle, pupil diameter) were performed at the same time. All measurements were made by an experienced physician at the same time of the day.

Statistical Analysis

Statistical analysis was performed using IBM SPSS for Windows version 22.0. Numerical variables were summarized with mean ± standard deviation, and qualitative variables were indicated by frequencies and percentage. The differences between pre and post shifts in terms of continuous variables were analyzed by Paired Sample t-Test. Any p value less than 0,05 is considered as statistically significant.

RESULTS

The mean age of the 110 participants was between 25 and 47 and the mean was 35.8 ± 5.8. There were 95 (86%) female and 15 (14%), male volunteers, by gender.

Spherical refraction was determined as -0,29±1,46 pre-shift. Spherical refraction was determined as -0,54±1,57 post-shift. Cylindric refraction was determined as -0,54± 0,76 pre-shift. Cylindric refraction was determined as -0,59±0,78 post-shift. Lens thickness was determined as 3,71±0,35 pre-shift. Lens thickness was determined as 3,74±0,30 post-shift. According to the results of refraction measurements, a significant increase in spherical myopic refraction was observed after daily 8 hours of computer use at the end of the day ($p < 0,001$). A significant increase in lens thickness was found in the anterior segment biomechanical parameters ($p = 0,006$). Intraocular pressure was determined as 15,13±2,35 pre-shift. Intraocular pressure was determined as 15,06±2,53 post-shift. ($p=0,66$) Axial length was determined as 23,74±1,02 pre-shift. Axial length was determined as 23,74±1,02 post-shift. ($p=0,19$) (table 1)

Central Corneal Thickness was determined as 520,18±29,64 pre-shift. Central Corneal Thickness was determined as 519,98±29,49 post-shift. ($p=0,870$) Anterior chamber depth was determined as 2,97±0,24 pre-shift. Anterior

chamber depth was determined 2,97±0,24 post-shift. (p=0,558) Anterior chamber volume was determined 152,09±19,38 pre-shift. Anterior chamber volume was determined 150,48±23,43 post-shift. (p=0,105) Angel was determined 40,92±4,75 pre-shift. Angel was determined as 3,23±0,54 post-shift. (p=0,249) Horizontal visible ırıs diameter was 11,99±0,56 pre-shift. Horizontal visible iris diameter was 11,97±0,59 post-shift. (p=0,586) Corneal Volume was determined 55,83±3,11 pre-shift. Corneal Volume was determined 55,67±2,86 post-shift. (p=0,361) Pupil Diameter was determined as 3,43 ±0,41 pre-shift. Pupil Diameter was determined 41,23±4,89 post-shift. A significant decrease in pupil diameter was found in the anterior segment biomechanical parameters ($p < 0.001$). No significant change was found in other measurement values.

The results of measurement of central corneal thickness, horizontal visible iris diameter (White to white measurement), corneal volume, anterior chamber depth, anterior chamber volume, anterior chamber angle, pupillary diameter are shown in Table 2 and Table 3.

DISCUSSION

The aim of our study; to investigate whether there was any change in eye anterior segment biomechanical measurements, eye refraction and intraocular pressure, after long-term computer use during the day. Thus, it is to reveal the effects of long term digital screen exposure on eye biomechanics and refraction, such as during the covid 19 lockdown period.

CVS is caused by prolonged viewing of the digital device's screens. The most known symptoms related to CVS are dry eyes, eye strain, blurred vision, headaches and shoulder/neck pain. Patients may also complain of eye irritation and double vision.

Akkaya et al detected that long-term computer use did not alter the Schirmer test outcomes significantly, but there were statistically significant alters in the tear break-up time (TBUT) outcomes of the evaporative type eye dryness. According to the results of the study, the use of long-term computers found that the evaporative type may cause dry eye disease. (12) Another study by Mutti et al. Found that visual disturbances in %75 of the operators using 6-9 hours daily (Neck pain, back pain, shoulder pain, blurred vision, slowness in focus, double vision, presbyopia, burning in eyes, stinging, irritation) has been reported. (16) Today, it is estimated that there is a personal computer with approximately one billion Internet connections around the world. (17) Myopia is the most common eye disorder worldwide. (18) The prevalence of myopia in America has increased from %25 to %44 between 1972 and 2004. (19) Its prevalence in urban communities in Asia has reached around %80. (20-21) Genetic and environmental factors come into prominence in the etiopathogenesis of myopia. A recent study found that working on a computer for 14 hours per week triggered myopia. (22) Muhamedagic et al found that 100 students with -3 diopters and higher refraction had followed up for 1 year and that near work increased the progression of myopia. (23) While the prevalence of myopia is much lower in the underdeveloped regions of the world, this rate is increasing with urbanization. (24) The correlation between close work and myopia is not completely clear. As a result of some epidemiological studies; Extreme close studies, high level of education and less outdoor activity have been shown as risk factors for myopia development. (25-27) Kinge et al followed the university students for 3 years and found that the near work led to the onset of myopia or the progression of the patients with myopia. (28) In contrast to the others, a study was conducted on 386 school-age students in China and no relation was found between close study and myopia progression. (29)

In our study, it was found that the long-term work at the computer was the basis for myopia development and caused a statistically significant increase in myopic refractions. When we look near, there must be accommodation in the eyes to make the image appear clearly on the retina, and there are three components. According to Helmholtz's definition of accommodation, should be pupil myosis, increased lens thickness and koverjenas. The accommodation reflex is the physiological response for focusing on close objects. It is also called close reflex or the accommodation-convergence reflex. (30) The regulation of these three states allows the eye's focus to change from a distant object to a nearby object or vice versa, by altering the refractive power of the eye. In our study, we found a statistically significant reduction in pupil diameter. This may be the result of spasm in ciliary muscles as a result of prolonged light exposure and accommodation. In our study, we found an increase in myopic refraction. This may be due to the increase in the thickness of the lens due to long-term near work. The increase in lens thickness may be temporary. But this increase in the thickness of the lens may become permanent as the near working time increases, and this may lead to myopic refraction disease in long-term computer users. Therefore, we think that computer users should be careful. We think it may be useful to look at long distances at frequent intervals to prevent ciliary muscle spasm, which is the result of prolonged accommodation and we should warn such patients to apply the 20-20-20 rule (Looking away from 20 feet for 20 seconds every 20 minutes).

In our study, we could not detect a statistically significant change in the anterior segment measurements except for pupil diameter and lens thickness. This suggests that the computer did not significantly affect the anterior segment biomechanical of the eye except for pupil diameter and lens thickness.

It can be said that the number of participants is relatively low in terms of the limitations of our study and the long-term follow-up has not been made. Therefore, we do not know whether the changes in eye measurements are permanent or temporary. We have study anterior segment measurements of the detailed eye for a long day and at the end of the study have found an increase in myopia refraction. Our study is important in terms of revealing the reasons for this increase. As a result, our study may contribute to the literature because long-term computer users are aware of this situation and show that the computer can be effective in the etiopathogenesis of myopia, which is becoming increasingly prevalent today. Further studies are needed in the future with more patients and longer computer use.

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