ORIGINAL ARTICLE

Medical Journal of Western Black Sea
Batı Karadeniz Tıp Dergisi

Med J West Black Sea 2023;7(2): 241-246
DOI: 10.29058/mjwbs.1300076

Myopia in the COVID-19 Pandemic Period in Young Adults: The Sample of Turkey-Zonguldak

Genç Yetişkinlerde COVID-19 Pandemisi Dönemi Miyopi: Türkiye-Zonguldak İli Örneği

Pınar KAYA[1], Cemile ÜÇGÜL ATILGAN[2]

[1]Etlik City Hospital, Department of Ophthalmology, Ankara, Turkey
[2]University of Health Sciences, Ulucanlar Eye Training and Research Hospital, Department of Ophthalmology, Ankara, Turkey

ORCID ID: Pınar Kaya 0000-0001-9243-6124, Cemile Üçgül Atılgan 0000-0002-8875-1567

Cite this article as: Kaya P and Üçgül Atilgan C. Myopia in the COVID-19 pandemic period in young adults: the sample of turkey-zonguldak. Med J West Black Sea. 2023;7(2):241-246.

Corresponding Author
Pınar Kaya

E-mail
drpnrcck@gmail.com

Received
21.05.2023

Revision
15.08.2023

Accepted
22.08.2023

ABSTRACT

Aim: Investigating the relationship between the development and progression of myopia and digital screen time in young adults during the COVID-19 pandemic.

Material and Methods: This single-centered, retrospective study included 106 young adults aged 18-25 years, followed up in January-March 2019, 2020, and 2021. The patients were divided into two groups: emmetrope and myopia according to their baseline refractive values. The association between spherical equivalent refraction (SER) values and digital screen time before and during the pandemic was evaluated.

Results: The mean age of 59 patients' (69.5% female) in the emmetrope group was 20.7±2.0, and 20.6±2.3 years of 47 patients (68.1% female) in the myopia group (p=0.422, p=0.877, respectively). The patients were reported to spend more time on digital devices in both groups (p<0.001). Before the pandemic, the SER value did not differ between 2019 and 2020, but the average annual change in SER was -0.19±0.34 D in the pandemic between 2020-2021 for the emmetrope group (p<0.001).The mean annual change of SER was -0.08±0.19 D between 2019-2020 and -0.21±0.26 D in the myopia group during the pandemic (p=0.015). The annual change of SER was under 0.50 D for both, and a significant correlation was not detected between the increase in digital screen time and the change in SER in the emmetropic and myopic groups.

Conclusion: The increased usage of digital devices during the pandemic is not associated with a myopic shift in young adults. Although no correlation was found, a shift to myopia was detected in both groups during the pandemic.

Keywords: Adult myopia, COVID-19 pandemic, digital screen, myopia, progression of myopia

ÖZ

Amaç: Genç erişkinlerde pandemi döneminde dijital ekran kullanım süresi ile miyopi gelişimi ve miyopi progresyonu arasındaki ilişkiyi araştırmak.

Gereç ve Yöntemler: Retrospektif, tek merkezli çalışmamıza Ocak-Mart 2019, 2020 ve 2021 yıllarında takip edilen 18-25 yaş arası 106 genç yetişkin dahil edildi. Başvurudaki sferik eşdeğer refraksiyon (SER) değerlerine göre hastalar emetrop ve miyop olmak üzere iki gruba ayrıldı. Pandemi öncesinde ve pandemi döneminde SER değişiklikleri ile dijital ekran kullanım süresi arasındaki ilişki değerlendirildi.

Bulgular: Emetrop gruptaki 59 hastanın (%69.5'i kadın) yaş ortalaması 20.7±2.0, miyop grubundaki 47 hastanın (%68.1'i kadın) yaş ortalaması 20.6±2.3 idi (sırasıyla; p=0.422, p=0.877). Her iki grupta da hastaların dijital cihazlarda daha fazla zaman geçirdikleri saptandı (p<0.001). Emetrop grupta pandemi öncesi SER değeri 2019-2020 yılları arasında farklılık göstermezken, 2020-2021 pandemi

yılları arasında SER'deki ortalama yıllık değişim -0.19±0.34 D idi (p<0.001). Miyop grupta SER'deki ortalama yıllık değişim 2019-2020 yılları arasında -0.08±0.19 D ve pandemi dönemimde -0.21±0.26 D idi (p=0.015). Yıllık SER değişimi iki grupta da 0.50 D'nin altındaydı ve iki grupta da dijital ekran süresindeki artış ile SER değişimi arasında anlamlı bir korelasyon saptanmadı.

Sonuç: Pandemi döneminde dijital cihazların artan kullanımı, genç erişkinlerde miyopi gelişimi ve artışıyla korele değildir. Korelasyon saptanmamış olsa da her iki grupta da pandemi döneminde miyopiye kayma saptanmıştır.

Anahtar Sözcükler: Erişkin miyopisi, COVİD-19 pandemisi, dijital ekran, miyopi, miyopi progresyonu

INTRODUCTION

Myopia is one the most common cause of vision loss and has become a public health issue (1). The worldwide prevalence of myopia (the spheric equivalent of -0.50 D or less) and high myopia (the spheric equivalent of -5.00 D or less) is estimated to be 52% (almost 5 billion people) and 10% (almost 1 billion people), respectively, by 2050 (2). Close and intensive work has been suggested as the essential reason for developing myopia. This theory was first put forward in the 16th century and has been studied ever since (3). In recent studies, decreased time spent outdoors, intensive near work and use of digital devices have been found to be risk factors for developing and progression of myopia (4-6).

The novel coronavirus disease 2019 (COVID-19) was first seen in December 2019 in China and has emerged as a global health threat due to its accelerated geographic spread since then. After it was defined as a pandemic by the World Health Organization (WHO), various precautions were taken to manage the coronavirus disease 2019 (COVID-19) in the world. The Turkish Government initiated the nationwide school closure and shifted to online courses to prevent the spread of the infection on 16 March 2020. On 3 April 2020, the complete lockdown on people under the age of 20 was applied in Turkey (7). Home office working was recommended for the working population. The significant increase in the time spent on the digital screen and the noticeable decrease in the time spent outdoors strengthen the concerns that the incidence of myopia would increase (8,9). Recent studies have demonstrated the increased frequency of myopia in children during the COVID-19 pandemic (10).

Although myopia progression has been described extensively in children in the pandemic, this issue has not been evaluated in young adults. Our study aimed to investigate the relationship between myopia development and increasing time spent on the digital screen in young adults.

MATERIAL and METHODS

This single-centered, retrospective study was conducted in accordance with the Declaration of Helsinki with a permission from the Bülent Ecevit University ethics committee. Comprehensive, detailed, and standardized ophthalmic examinations were performed for 106 patients aged 18-25 years in January-March 2019 and 2020 in the ophthalmology clinic at Devrek State Hospital, which is a primer-level care located in an urban area in Zonguldak, which is a city in the Western Black Sea Region of Turkey. In the first year of the pandemic, these patients were examined again, and data were collected in January-March 2021. All the patients had these inclusion criteria: the best-corrected visual acuity of all participants was 1.0 with Snellen chart in both eyes, emmetropia, or myopia under the degree of -6 Diopter (D). The exclusion criteria were the refractive status of ≥ +0.50 or ≤ -6.0 D, a history of ocular disease, ocular injury, or systemic disease, and the history of drug usage which may affect the eye. The refractive values of all the patients before, at the begining, and in the first year of the pandemic, the used digital device information, the time spent on digital screen, and the follow-up time were recorded.

The individuals were divided into two groups emmetropic (refractive status <+0.50 D and >-0.50 D), and myopic (refractive status ≤ -0.50 D and >-6.00 D), as defined by the the World Health Organization according to their non-cycloplegic spherical equivalence refraction (SER) status at admission (1). There was no patient with one eye emmetropic and one myopic. SER was calculated according to the formula of the algebraic sum of the diopter powers of the sphere and half of the cylinder (sphere + 0.5 x cylinder). The changes in refraction values in 2019, 2020, and 2021 were examined to compare 2019 with 2020 and 2020 with 2021. How many hours a day all participants spent in front of a digital screen, and which digital device they used before and during the COVID-19 pandemic was learned through a questionnaire. The digital devices were classified as mobile phones, tablets, and computers individually or at least two at once. We evaluated whether the increase in the time the patients spent with close working devices such as cell phones, tablets, and computers affected the onset or progression of myopia.

Statistical Analysis

IBM SPSS Statistics 22 was performed for the descriptive and statistical analyzes. Demographic characteristics and clinical data were expressed as mean, standard deviation, frequency, or percentage. Since the data were unsuitable for normal distribution, Mann Whitney U and Wilcoxon tests

were used. The chi-square test was used for categorical data. The Spearman correlation test was evaluated for correlation between data. P value of 0.05 or less was considered as statistical significance.

RESULTS

106 young adults were included in the present study. In the emmetropic group, the mean age of 59 patients was 20.7±2.0 (range:18-25) with 41 (69.5%) females, and in the myopic group, the mean age of 47 patients was 20.6±2.3 (range:18-25) with 32 (68.1%) females. There was no significant difference between the groups regarding age and gender (p=0.422 and p=0.877, respectively). Follow-up time was 12.3±1.6 months in the emmetropic and 12.8±4.8 months in the myopic group before the pandemic (p=0.846). It was 12.2±0.3 months in the emmetropic and 12.3±1.5 months in the myopic group during the pandemic (p=0.158) (Table 1).

Evaluating the emmetropic group, all (100%) of the patients used digital devices before the coronavirus pandemic, and mobile phone was the most-used digital device (100%). 13 (22%) of the individuals used at least two of the digital devices. The use of at least two digital devices increased to 23 (39%) of patients in the pandemic (Table 2). During the pandemic, the mean time that participants spent on the digital screens increased from 4.07±2.12 hours to 6.27±2.79 hours/day (p<0.001) (Table 1). In the same group, the average SER value was +0.002±0.08 D (range: -0.375 and 0.375 D) in 2019 and 2020, and during the pandemic, it decreased to -0.198±0.35 D (range: -0.27 and 0.25 D) in 2021 (Table 3). Before the pandemic, the SER value did not differ between the years 2019 and 2020, but the average annual change in SER was -0.19±0.34 D in the COVID-19 pandemic period between the years 2020 and 2021 for the emmetropic group. Annual SER changes were significantly increased (p<0.001).

Table 1: Descriptive characteristics, follow up period, time spent on digital devices (n=106).

Characteristics	Emmetropic Group (n=59)	Myopic Group (n=47)	p
Age (year±SD)	20.71±2.01	20.58±2.34	0.422
Female, n(%)	41 (69.5)	32 (68.1)	0.877
Follow up time (month±SD)			
Before the pandemic	12.3±1.6	12.8±4.8	0.846
During the pandemic	12.2±0.3	12.3±1.5	0.158
Time spent on digital devices (hours a day±SD)			
Before the pandemic	4.07±2.12	4.22±2.61	0.637
During the pandemic	6.27±2.79	6.96±2.83	0.356

Mann Whitney U test was used for statistical analyses.Results indicate mean±standard deviation.

Table 2: Differences in digital material usage between groups.

Time Spent on Digital Devices	Emmetropic Group (*n*=59)		Myopic Group (*n*=47)	
	Before the pandemic	During the pandemic	Before the pandemic	During the pandemic
Not using, n (%)	0 (0.0)	0 (0.0)	2 (4.3)	0 (0)
Cell phone only, n (%)	46 (78.0)	34 (57.6)	29 (61.7)	17 (36.0)
Tablet only, n (%)	0 (0)	0 (0.0)	0 (0)	0 (0)
Computer only, n (%)	0 (0.0)	2 (3.4)	0 (0)	0 (0)
At least two of devices, n (%)	13 (22.0)	23 (39.0)	16 (34.0)	28 (59.6)

Table 3: Spherical equivalent refractive (SER) values of cases (n=106).

SER value (Diopter)	Emmetropic Group (n=59)		Myopic Group (n=47)		p
2019 year	+0.002±0.08 D	Range: -0.375 and 0.375 D	-1.876±1.19 D	Range: -5.00 and -0.5 D	**<0.001**
2020 year	+0.002±0.08 D	Range: -0.375 and 0.375 D	-2.01±1.25 D	Range: -5.00 and -0.5 D	**<0.001**
2021 year	-0.198±0.35 D	Range: -0.27 and 0.25 D	-2.25±1.29 D	Range: -5.00 and -0.5 D	**<0.001**

Mann Whitney U test was used for statistical analyses. Results indicate mean±standard deviation. **Range:** minimum and maximum

Evaluating the myopic group, 45 (95.7%) of the patients used digital devices before the pandemic, and mobile phones were the most-used digital device with 45 (95.7%) patients. 16 (34%) of the individuals used at least two digital devices. During the pandemic, at least two digital device usage increased to 28 (59.6%) patients (Table 2). The mean time that participants spent on the digital screen increased from 4.22±2.61 hours to 6.96±2.83 hours/day in the coronavirus pandemic (p<.001) (Table 1). In the same group, the mean SER value was -1.876±1.19 (range: -5.0 and -0.50 D) in 2019 and it increased in 2020 from -2.01±1.25 D (range: -5.0 and -0.50 D) to -2.25±1.29 D (range: -5.0 and -0.50 D) in 2021 year during the pandemic (Table 3). The mean annual change of SER value was -0.08±0.19 D between 2019 and 2020 and -0.21±0.26 D during the pandemic. The annual SER changes was significantly increased (p=0.015).

The correlation between the increase in the duration of digital device usage and the change in SER values of patients during the pandemic period was examined. Although daily digital screen usage and myopia progression increased in both groups, there was no significant correlation in both groups according to the Spearman correlation analysis (p=.282 in the emmetropic group, and p=.721 in the myopic group).

DISCUSSION

The power of our study is being the first to evaluate the myopic shift in young adults during the COVID-19 pandemic in the Western Black Sea Region of Turkey. Our study's results indicate that increased digital device usage during this pandemic did not lead a myopic shift in young adults. The present study is particularly significant because it investigates the progression of myopia in young adults and its correlation with the use of digital devices. Online courses, and work from home through the internet have been applied to prevent the coronavirus spread since March 2020 in Turkey. University students and the working population had to use digital devices to access education and jobs. Additionally, young adults were engaged in digital devices for entertainment because of the lockdown. Therefore, their outdoor activities decreased significantly during the coronavirus pandemic. Concerns about the greater increase in myopia have been increased because previous publications in the literature demonstrated that decreased time spent outdoors, and intense close work might accelerate myopia progression (4,8,9). At the onset of the pandemic, Pellegrini et al. named it as "quarantine myopia," and drew attention to this topic as it is one of the most important causes of visual loss (10). Subsequently, many studies on this subject have shown that myopia has increased during the pandemic among children. Since studies on young adults are scarce in the literature, we focused on this topic among students and the working population aged 18 to 25. We compared data on changes in SER between the baseline period (2019 and 2020 years, pre-COVID) and the first year of the pandemic (2021), and we detected the correlation between the time spent on digital devices and myopia progression. We also compared the emmetropic and myopic groups within themselves and each other.

Stabilization of myopia was defined as a change of less than 0.5 D by the Correction of Myopia Evaluation Trial (COMET) reported in approximately 15 years (11). But it was recommended in the Report of the Joint WHO to conduct studies on myopia up to the age of 25 (1). In the current study, we found a significant increase in the time spent on digital devices among young adults (p<.001). We also detected a statistically significant myopic shift in emmetropic patients (SER change -0.19±0.34 D/year in 2020-2021, p<0.001) and in myopic patients (SER change -0.08±0.19 D/year in 2019-2020; -0.21±0.26 D/year in 2020-2021, p=0.015). However, the patients' refractions were assumed as stable because this increase was less than 0.5 D in this study. A shift to myopia was detected even if the value was less than 0.5 D, which may exceed 0.5 D in studies with longer follow-up periods. Although no correlation was found between the increase in time spent on digital devices and a shift to myopia, these findings of our study are remarkable for demonstrating the effect of home confinement on young adults in the coronavirus pandemic period.

In these years, many studies have been conducted about myopia progression during the pandemic. In a comprehensive, prospective cross-sectional study, the prevalence of myopia was found to be significantly greater in children aged 6-8 years (12). In another study conducted in China, an association was found between the increased time of digital devices and the rapid progression of myopia in 7-12 years old children (13). Aslan and Sahinoglu-Keskek designed a study on the same topic in Turkey, and they found a significantly higher progression in myopia than in the previous years in 8-17-year-old students. However, as in our study, they did not find a correlation between the duration of digital device usage and myopia progression (14). More studies about myopia progression in adults need to be conducted. Regardless of the pandemic, 8–year-long follow-up results of the patients aged 20 at baseline were published in a study by Lee S.S et al. They indicated a continuation in myopia progression in one-third of adults during the third decade of life. They also stated that myopia was more common in women than in our study (15). There was not any statistical difference between the emmetropic and myopic groups in terms of gender in our study.

According to various studies, increased screen time and prolonged near work are some of the critical risk factors for myopia (4,16,17). However, there are still contradictions in the relationship between digital devices and myo-

pia. McCrann et al designed a study involving 418 children, and they used objective data through device-recorded cellphones. Their study revealed that smartphone usage was found to lead independent increase in myopia (OR 1.08, 95% CI, 1.03-1.14) (18). A systematic review of 15 studies on 49.789 children found no definite relationship between digital display and myopia (19). The present study did not support the theory that using digital devices increases myopia. However, there is a need for detailed studies on this subject in young adults as well.

A study conducted in Turkey in May 2020 stated that screen usage increased to 71%, and the meantime of using screens reached 6.42±3.07 hours/day during the COVID-19 pandemic (7). In our present study, we observed that the rates and the duration of using digital devices increased significantly in patients during the pandemic. We believe this continuous use of digital devices may lead to a progression of myopia in both emmetropic and myopic groups in the following years.

A great number of studies have reported that sufficient time spent outdoor is associated with a lower incidence of myopia. People reduced the frequency with which they went out almost to none, due to the concerns over encountering coronavirus and the lockdown throughout the COVID-19 pandemic. Brighter light has been considered to stimulate the release of dopamine from the retina and inhibits axial elongation in animal models (20,21). The World Health Organization emphasized that spending more than 2 hours a day outside prevents myopia progression regardless of the activity (1). Time spent outdoors was stated as protective against myopia also in young adulthood (22). Awareness should be strengthened in the population, and outdoor activities should be encouraged.

Being single-centered and the small size of patients was one of the limitations of our study. Data on digital device usage and the time spent of them were collected subjectively, which may cause bias. Besides, our study is a citywide population study, and may not reflect the whole country, mainly due to the difference in the prevelance of myopia between rural and urban regions. Also, we were not able to quantify the illumination.

CONCLUSION

More data on young adults measured with cycloplegia and longer follow-up terms with a comprehensive population were required for better observations of the effect of the pandemic on myopia progression. However, there was no significant increase in myopia in the present study; behavioral changes like the tendency to engage in technological devices and indoor occupations caused by the pandemic may lead to an onset and progression of myopia not only in children but also in adults. Our study highlighted the need to raise awareness of myopia management strategies in the whole society during the pandemic.

Acknowledgment

None.

Author Contributions

Pınar Kaya, and **Cemile Üçgül Atilgan;** desing of the work, interpretatiton of data. All authors read and approved the final manuscript.

Conflicts of Interest

The authors have no conflict of interests to declare. Consent for publication: All participants gave written informed consent for their data to be published.

Financial Support

No specific grant for this research was received from any funding agency in the public, commercial or not-for-profit sectors.

Ethical Approval and Consent for Publication

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Institutional Review Board/Ethics Committee of Bülent Ecevit University, Zonguldak, Turkey. All participants gave written informed consent for participation in the study. Availability of data and material: All data will be available upon request.

Review Process

Extremely peer-reviewed and accepted.

REFERENCES

1. Holden BA, Mariotti SP, Kocur I, Resnikoff S, Mingguang H, Naidoo K, Jong M. The impact of myopia and high myopia. Report of the Joint World Health Organization–Brien Holden Vision Institute Global Scientific Meeting on Myopia. World Healt h Organization, Geneva, Switzerland. 2015.
2. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, Wong TY, Naduvilath TJ, Resnikoff S. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. Ophthalmology 2016;123:1036-1042.
3. de Jong P. Myopia: its historical contexts. Br J Ophthalmol 2018;102:1021-1027.
4. Saxena R, Vashist P, Tandon R, Pandey RM, Bhardawaj A, Gupta V, Menon V.. Incidence and progression of myopia and associated factors in urban school children in Delhi: The North India Myopia Study (NIM Study). PloS one 2017;12:e0189774.
5. Wen L, Cao Y, Cheng Q, Li X, Pan L, Li L, Zhu H, Lan W, Yang Z. Objectively measured near work, outdoor exposure and myopia in children. Br J Ophthalmol 2020;104:1542-1547.
6. He M, Xiang F, Zeng Y, Mai J, Chen Q, Zhang J, Smith W, Rose K, Morgan IG. Effect of Time Spent Outdoors at School on the Development of Myopia Among Children in China: A Randomized Clinical Trial. Jama 2015;314:1142-1148.

7. Ozturk Eyimaya A, Yalçin Irmak A. Relationship between parenting practices and children's screen time during the COVID-19 pandemic in Turkey. J Pediatr Nurs 2021;56:24-29.
8. Sumitha M, Sanjay S, Kemmanu V, Bhanumathi MR, Shetty R. Will COVID-19 pandemic-associated lockdown increase myopia in Indian children? Indian J Ophthalmol 2020;68:1496.
9. Wong CW, Tsai A, Jonas JB, Ohno-Matsui K, Chen J, Ang M, Ting DSW. Digital Screen Time During the COVID-19 Pandemic: Risk for a Further Myopia Boom? Am J Ophthalmol 2020;223:333-337.
10. Pellegrini M, Bernabei F, Scorcia V, Giannaccare G. May home confinement during the COVID-19 outbreak worsen the global burden of myopia? Graefes Arch Clin Exp Ophthalmol 2020;258:2069-2070.
11. COMET Group. Myopia stabilization and associated factors among participants in the Correction of Myopia Evaluation Trial (COMET). Invest Ophthalmol Vis Sci 2013;54(13):7871-7884.
12. Wang J, Li Y, Musch DC, Wei N, Qi X, Ding G, Li X, Li J, Song L, Zhang Y, Ning Y, Zeng X, Hua N, Li S, Qian X. Progression of Myopia in School-Aged Children After COVID-19 Home Confinement. JAMA Ophthalmol 2021;139:293-300.
13. Ma M, Xiong S, Zhao S, Zheng Z, Sun T, Li C. COVID-19 Home Quarantine Accelerated the Progression of Myopia in Children Aged 7 to 12 Years in China. Invest Ophthalmol Vis Sci 2021;62:37.
14. Aslan F, Sahinoglu-Keskek N. The effect of home education on myopia progression in children during the COVID-19 pandemic. Eye (Lond) 2021;1-6.
15. Lee SS, Lingham G, Sanfilippo PG, Hammond CJ, Saw SM, Guggenheim JA, Yazar S, Mackey DA. Incidence and Progression of Myopia in Early Adulthood. JAMA Ophthalmol 2022;140:162-169.
16. Grzybowski A, Kanclerz P, Tsubota K, Lanca C, Saw SM. A review on the epidemiology of myopia in school children worldwide. BMC Ophthalmol 2020;20:27.
17. Enthoven CA, Tideman JWL, Polling JR, Yang-Huang J, Raat H, Klaver CCW. The impact of computer use on myopia development in childhood: The Generation R study. Preventive Medicine 2020;132:105988.
18. Mccrann S, Loughman J, Butler JS, Paudel N, Flitcroft DI. Smartphone use as a possible risk factor for myopia. Clin Exp Optom 2021;104:35-41.
19. Lanca C, Saw SM. The association between digital screen time and myopia: A systematic review. Ophthalmic Physiol Opt 2020;40:216-229.
20. Smith EL, 3rd, Hung LF, Huang J. Protective effects of high ambient lighting on the development of form-deprivation myopia in rhesus monkeys. Invest Ophthalmol Vis Sci 2012;53:421-428.
21. Ashby RS, Schaeffel F. The effect of bright light on lens compensation in chicks. Invest Ophthalmol Vis Sci 2010;51:5247-5253.
22. Morgan IG, French AN, Ashby RS, Guo X, Ding X, He M, Rose KA. The epidemics of myopia: Aetiology and prevention. Prog Retin Eye Res 2018;62:134-149.