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Electromagnetic Biology and Medicine

ISSN: 1536-8378 (Print) 1536-8386 (Online) Journal homepage: www.tandfonline.com/journals/iebm20

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**To cite this article:** Nermin Küçer (2008) Some Ocular Symptoms Experienced by Users of Mobile Phones, Electromagnetic Biology and Medicine, 27:2, 205-209, DOI: 10.1080/15368370802072174

**To link to this article:** https://doi.org/10.1080/15368370802072174

Published online: 07 Jul 2009.

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*Electromagnetic Biology and Medicine*, 27: 205–209, 2008
Copyright © Informa Healthcare USA, Inc.
ISSN 1536-8378 print/1536-8386 online
DOI: 10.1080/15368370802072174

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# Some Ocular Symptoms Experienced by Users of Mobile Phones

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*This survey study was conducted, using a questionnaire, on 229 university students (181 women, 48 men) in Kocaeli, Turkey. Six ocular symptoms experienced during use of mobile phones were studied by means of the chi-square test with Yates correction. The studied symptoms were blurring of vision, redness of the eyes, vision disturbance, secretion of the eyes, inflammation in the eyes, and lachrymation of the eyes. A significant increase in blurring of vision ($p < 0.05$) was reported by users of mobile phone possession >2 years compared to users of mobile phone possession <2 years. In users of mobile phones, women significantly ($p < 0.05$) complained more often of inflammation in the eyes than men.*

**Keywords** Mobile phone; Ocular symptoms; Microwave; Human.

## Introduction

In recent years, the extensive use of mobile phones raises the question of possible health effects of the radiofrequency electromagnetic fields by these phones. Mobile phones operate on wireless technology, with communication typically occurring via a 900–1800 MHz signal that is pulsed at 217 Hz. This signal carries essentially no power when the user is not talking or receiving, but when the user communicates the power of this pulsed electromagnetic field reaches a maximum of 250 mW (Croft et al., 2002). There are many studies in the literature about the effect of using mobile phones, such as cytogenetic (Maes et al., 2001; d'Ambrosio et al., 2002) and the central nervous system (Hossmann and Hermann, 2003).

Eyes are one of the most thermally vulnerable parts of the body because of their low blood supply (Hyland, 2000). Exposure to high-density microwaves can cause detrimental effects in the eye and induce significant biological changes through thermal actions (Nakamura et al., 2003). In this study, it was reported that pulsed microwaves at 2.45 GHz and 10 $mW/cm^2$ are associated with production of corneal endothelial lesions and with disruption of the blood-aqueous barrier in the non

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human primate eye. It was also found that the ocular damage of microwaves at an average specific absorption rate (SAR) of 0.26 W/kg, if administrated after pretreatment with ophthalmic drugs, can produce significant ocular effects in anesthetized monkeys (Kues et al., 1992).

In another study (Dovrat et al., 2005), a novel experimental system was used to investigate the localized effects of microwave radiation on bovine eye lenses in culture for over two weeks. At the macroscopic level, it was demonstrated that exposure to a few mW at 1 GHz for over 36 h affects the optical function of the lens. Most importantly, self recovery occurred if the exposure was interrupted. At the microscopic level, close examination of the lens indicated that the interaction mechanism is completely different from the mechanism-causing cataract via temperature increase. This is contrary to the latter's effect, which is particularly pronounced in the vicinity of the sutures and assumed to be a result of local friction between the edges of the fibers consisting the lens.

A survey study also showed that visual perturbation was experienced by people living in the immediate vicinity of base stations (Santini et al., 2000, 2003). Another survey study, using questionnaires, was conducted among 873 people using mobile phones in the Saudi population (Meo and Al-Dress, 2005). Symptoms of decreased and/or blurred vision were reported.

This present survey study, again using questionnaires, was conducted for 229 university students living in a Turkish city where mobile phones are extensively used. The aim of this study was to detect possible ocular symptoms experienced by users of mobile phones in order to light the way towards further studies.

## Materials and Methods

### *Questionnaire*

A questionnaire was distributed to 229 students at the Kocaeli Vocational School of Health Service. The questionnaire was filled out by subjects and returned to the person responsible for the study.

The questionnaire designed specifically for this study was composed of two sections. In the first section, general questions were asked to individuals to learn about their general health and use of mobile phones. In the second section, questions were asked to directly detect the possible effects of use of mobile phones on each individual's health.

In the survey, questions were asked to investigate the following symptoms: blurring of vision, redness on the eyes, vision disturbance, secretion of the eyes, inflammation in the eyes, and lachrymation of the eyes.

### *Study Population*

The study group consisted of 79% women and 21% men, all owning a mobile phone. In this survey, respondents were grouped according to time of mobile phone possessions. Times of possessions were divided into four sub-groups: one year, two years, three years, and four years and above. Table 1 shows these intervals and that almost 64.6% of women and men have owned their mobile phones for four year and above.

**Table 1**
Percentages of the intervals of mobile phone possessions

| Possessions | Women | Men | Total |
|---|---|---|---|
| One year | 6.1 | 8.3 | 6.6 |
| Two years | 12.2 | 16.7 | 13.1 |
| Three years | 17.1 | 10.4 | 15.7 |
| Four years and above | 64.6 | 64.6 | 64.6 |

### *Data Analysis*

For this survey, chi-square test with Yates correction were used for comparisons of complaint frequencies in relation with sex and time of mobile phone possession at $P < 0.05$.

## Results

### *Influence of Sex and Mobile Phone Time Possession*

*Sex*. Women reported significantly more inflammation in the eyes symptom ($p < 0.05$) than men (Table 2). Complaint frequencies for other ocular symptoms were not significantly different between men and women.

*Mobile Phone Time Possession*. A significant increase in blurring of vision ($p < 0.05$) was reported by users of mobile phone possession >2 years compared to users of mobile phone possession <2 years (Table 3). For other ocular symptoms experienced during communication, no significant difference was observed between users with mobile phone possession >2 years as compared to users with mobile phone possession <2 years.

## Discussion

As a result of the survey, there were no evidence that the use of mobile phone may cause redness on the eyes, vision disturbance, secretion of the eyes, inflammation in

**Table 2**
Influence of sex on the percentages of complaints

| Symptoms | Women (181) | Men (48) |
|---|---|---|
| Blurring of vision | 6.6 | 6.3 |
| Redness on the eyes | 17.1 | 14.6 |
| Vision disturbance | 27.1 | 14.6 |
| Secretion of the eyes | 9.4 | 0 |
| Inflammation in the eyes | 30.4* | 10.4 |
| Lachrymation of the eyes | 33.1 | 22.9 |

In parenthesis: number of subjects. Results of chi-square test: $* = p < 0.05$.

**Table 3**
Influence of mobile phone time possession on the percentages of complaints

| Symptoms | <2 years (45) | >2 years (184) |
|---|---|---|
| Blurring of vision | 8.8 | 27.2* |
| Redness on the eyes | 17.8 | 16.3 |
| Vision disturbance | 31.1 | 22.8 |
| Secretion of the eyes | 11.1 | 6.5 |
| Inflammation in the eyes | 20.0 | 27.7 |
| Lachrymation of the eyes | 31.1 | 30.9 |

In parenthesis: number of subjects. Results of chi-square test: $* = p < 0.05$.

the eyes, and lachrymation of the eyes. These results support Balik et al. (2005) for redness on the eyes and vision disturbance, but contradicts it for lachrymation of the eyes, secretion of the eyes, and inflammation in the eyes.

The use of mobile phone may cause blurring of vision as a result of our data. This result supports Balik et al. (2005) and Meo and Al-Dress (2005) for blurring of vision.

In addition, we observed a significant difference between female and male mobile phone users in complaints about inflammation in the eyes. There is no published data available in the literature concerning cell phones and inflammation in the eyes; there are only a few publications dealing with influence of gender and mobile phone time possession on mobile phone users complaints. Therefore, these symptoms should be further investigated together with experimental studies.

## Conclusion

This study has shown that mobile phone users complained more often of blurring of vision as a function of mobile phone time possession. In addition, for mobile phone users, women complained significantly more often of inflammation in the eyes than men. This gender difference in inflammation in the eyes is not observed between women and men for other ocular symptoms.

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