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Original Research Paper

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USE OF DIGITAL GADGETS AND ASSOCIATED CHIEF MUSCULOSKELETAL AND VISUAL COMPLAINS AMONG MEDICAL UNDERGRADUATES IN A COLLEGE OF DELHI

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ABSTRACT

BACKGROUND: Digitalisation is now indispensable. Medical undergraduates, thought of not being much involved with technology like hard core technical streams, are rampantly using these devices, hence assessing the implications of these devices on them is necessary.

AIMS AND OBJECTIVES: To assess the association of Digital devices (computers/laptops and cell-phones) on the physical health of the users, against self-reported duration of the devices.

MATERIAL AND METHODS: A cross sectional study was carried among medical undergraduates. Sample size was calculated to be 781. All students aged 18 years and above, were included. A pretested anonymous semi structured proforma with validated tools (Standardized Nordic Questionnaire for Musculoskeletal Symptoms, semi-structured visual questionnaire) was used. Schirmer's I test was done. Duration was considered in terms of average daily use (≤ 6 hours/day or > 6 hours/day) and past years spent using these devices (≤ 5 years or > 5 years). Statistical analysis was done using SPSS version 17.

RESULTS: Final analysis could be done on 800 participants. Musculoskeletal discomfort (MSDs) of neck (55.19%), lower back (49.55%), and upper back (31.16%) was more among frequent users, unlike shoulder (31.10%) and knee (12.53%) MSDs, reported more among those with lesser daily use. MSDs could not be attributed to past years of use. Retro-orbital pain (48.32%) was more among frequent users, while watering (59.50%) and double vision (16.74%) were frequent in those with lesser use. Tired eyes (80.28%) was more among past users, contrary, blurred vision (54.16%) was more among recent users. Duration of daily use was significantly attributing to the presence of dry eyes (47/51) while visual acuity showed no such association.

CONCLUSION: Benefit of these devices could be severely undermined if abuse and overuse are not kept in check. Physical symptoms, often determined by the ergonomic conditions, but screen time may add the personal risk.

KEYWORDS : Digital device, Physical Health, Musculoskeletal disorder, Computer Vision Syndrome.

Introduction:

Digital devices are very much a part of our daily life to the extent that even it's hard to recall when we started using them or how and when we are using those gadgets. The digital devices are the device/systems that generates and uses digital timing signals operating at greater than 9000 cycles per second (9 KHz). [1] The current study focuses precisely on the computers, laptops and cell-phones. Health sector is not uninfluenced by these Digital gadgets and these are becoming quite inevitable. Hence it's necessary and urgent to recognize the implications of these devices on the upcoming medical fraternity, medical undergraduates and a dire need of implementing the promotive and preventive measures to tackle this.

The physical discomforts most commonly reported with the use of digital devices are musculoskeletal disorders (MSD) [2-4] and visual [5,6] disorders. The long periods of working at a computer can cause musculoskeletal problems and eyestrain. Intensive computer work puts stress and strain on muscles, as well as joints, because of continuous and repetitive nature of movements. Individual factors, prolonged awkward postures, poor workstation design and psycho-social environment can lead to development of symptoms of musculoskeletal disorders (MSD). If these symptoms are ignored and no preventive measures are taken, cumulative trauma disorders like myalgia, myofascial syndromes, nerve entrapment syndromes, tendonitis, epicondylitis and tenosynovitis can develop.

Visual display Terminals (VDTs) cause symptoms such as eyestrain, visual discomfort, and visual fatigue. Recently, there has been reports of transient smartphone blindness. [7]

The human eye basically prefers to look at the objects greater than 6 m away. Work done on computer demands a close-up view which strains eye muscles and thereby leads to eye fatigue. Computer vision syndrome is related to the unique aspects of the task. Working at a computer is more visually demanding than doing other standard corresponding work such as reading printed documents. Aspects of the design of the computer video display such as screen resolution and contrast, image refresh rates and flicker, and screen glare, as well as working distances and angles all may contribute to worker symptoms. On traditional LCD screens, images are represented in pixels, which are darker in the centre and become less defined on the outside. Any time one have that pixilated effect, eyes have trouble locking on and constantly re-focus. The constant straining to find focus can cause eye fatigue and poor posture, leading to tight shoulders and a sore back. [8] Hence presence of visual and MSDs symptoms are interrelated and need to be assessed together.

Under normal circumstances, humans blink about 18 times a minute. When using cell phones and computers, we blink nearly three times less. Focusing too much while looking at the computer screen causes less blinking, this can cause uneven distribution of tear film over eye causing dry eye. Looking down while reading a book negates the reduced blinking rate but that is not the case while using the computer since the eyes must be wide open during the computer use. This can also cause the tear film to evaporate more. All these leads to complain of Dry Eye. [9]

Aim:

With this background the present study aimed to estimate the prevalence of the MSDs and visual discomforts among the study population and to find out the association, if any, between the duration of use of these devices, and the presence of these physical symptoms in the study population.

Materials & Methods:
It was a **cross-sectional analytical study,** carried out for a duration of 12 months i.e. from January to December, 2014. The study population was medical undergraduate students of the Maulana Azad Medical College located in Central Delhi. Final year students being the examinee batch were not included. All the students aged 18 years and above, who could be contacted and who gave the written informed consent to participate in the study, were included. No exclusion criteria was set up. Being the part of another study where we assessed the impact of these devises on psychosocial health of the users as well, the lowest prevalence of all the computer related health problems, included under the objectives of the study, was for mental stress 35%.[10] With relative error of 10%, the sample size came to be 710 at 95% level of confidence. Including the nonresponse rate to be 10% the final sample size was 781. However, no sampling was done, in study all the students in the four admission batches were included, which was 1000. Final analysis could be done for 800 students.

Study Tools:
A pretested validated anonymous semi structured proforma, part of which was self-administered, was used for data collection. It had 3 parts.

Part 1: Demographic information. This section assessed age, gender (male or female) and semester at the time of inclusion in the study.

Part 2: Questionnaire, designed by the researcher, inquiring about the pattern of use of the devices and other relevant information. The most applicable option have to be selected amongst the given choices.

Part 3:A. Standardized Nordic Questionnaire for analysis of Musculoskeletal Symptoms (NMQ): [11] Participants were surveyed to record whether they had musculoskeletal problems (e.g., ache, pain or discomfort) for the nine regions mentioned in NMQ in the past 12 months. A participant would not meet eligibility criteria if he/she indicated that musculoskeletal symptoms resulted from a non-work related accident/trauma.

B. Visual questionnaire [12] - It was a semi structured questionnaire, includes two sections concerning the intensity of ocular symptoms and intensity of visual symptoms. Symptoms were rated based on intensity ranging from 0 that is no complain to 5 which stands for very intense symptoms.

Part 4: Ocular examination:
Visual acuity – Monocular visual acuity was measured without spectacles and recorded with Snellen's chart printed in English, at distance of 6 m under normal lighting condition.

Dry eye test – Schirmer's I test was performed to measure basal and reflexive tear production in a non-anesthetized eye. Reading of ≥15 mm wetting of the paper after 5 minutes was considered as normal. Wetting of strip less than this was considered as dry eye.

Statistical Analysis:
The data collected was entered through Excel spreadsheet and was analysed using SPSS version 17. The results obtained were described by univariate tables. Means and proportions, along with confidence intervals were calculated for the outcome variables. Analytical tables were made for bivariate analysis for finding the association between the individual risk factors and each of the individual outcome variables. Data was tested for normality of distribution. Association between health conditions and device use was tested for significance by statistical tests for difference between means by Mann-Whitney U test or student t test after analysing for the distribution of the data, Chi Square test or Fisher's exact test, was applied for difference in proportions, as relevant. P value less than 0.05 was considered statistically significant.

Results:
The four admission batches included in the study were contacted in the period of one year (January 2014 to December 2014), results included in Table 1. shows the graduation year of the participant at the time of enrolment in the study.

Difference in MSDs' presence against the daily duration of device use (Table 2) shows statistically significant variation for symptoms of neck, shoulder, upper and lower back and knees, with more participants responding positive to the symptoms among those using the device for > 6 hours per day (neck 55.19%; lower back 49.55%; upper back 31.16%) except shoulder and knee discomfort where majority of the positive responders were using the device for ≤ 6 hours a day (shoulder 31.10%; knees 12.53%). Differences in the proportions for other MSDs were not statistically significant.

Comparing the presence of MSDs between the users with ≤ 5 years of use to those using it for more than five years, majority of the participants who had reported the presence of symptoms were using the device for > 5 years but no statistical significance ($p > 0.05$) could be attributed to this, for the presence of MSDs.

BMI, being an important confounding factor for the presence of MSD, was also analysed against symptoms of MSD, but was not found to be statistically significant ($p > 0.05$).

Table 3 shows analysis of vision related symptoms against average duration of device use per day and past years spent on device. Significant difference was observed in the reporting of symptoms of watering, retro-orbital pain and double vision against duration of daily use, while tiredness of vision and blurred vision had significant association with past years spent facing the device.

Watering of eyes (59.50%; $p<0.05$) and double vision (16.74%; $p<0.01$) were more frequently seen in users with ≤ 6 hours of daily use while, retro-orbital pain (48.32%; $p<0.05$) was seen more among users with >6 hours of daily use. Symptoms of tired eyes (80.28%; $p<0.01$) were reported more among users with more than 5 years use of devices. On the contrary blurred vision (54.16%; $p<0.01$) was reported more among recent users (≤5 years of device use).

Association of visual acuity with the average daily duration of device use and duration of using screen in years presented in Table 4, showed no significant ($p>0.05$) association between the duration of use of device and visual acuity. Among those using screen for > 6 hours a day, about 10% of the participants had visual acuity <6/60. Almost all (74/75) of those with low visual acuity were using the screen for > past 5 years but no statistical significance could be attributed to this for presence of low visual acuity.

When analysed for the presence of dry eyes by Schirmer's test, against the daily duration of device use, statistically significant difference ($p <0.001$) was present between those using it for > 6 hours against those using it ≤ 6 hours per day. Dry eyes were present in majority (47/51) among the users who were facing the screen for > 6 hours a day. Comparison against the period one has faced screen in the past years (> 5 years or ≤ 5 years) showed no statistical significance ($p > 0.05$) between the users in the two groups.

Discussion:
The duration of device use had a significant impact on the frequency of neck and back (upper and lower) symptoms in students using the devices for > 6 hours/day in the present study. Corroborating to the findings, Shan et al in their research on more than 3000 students, also found increased duration of device use (computer and mobile phones) to be associated with increased prevalence of neck and low back pain among the users. [13] Finding from Klussmann also supports our results for neck symptoms. [14] Talwar, also had similar findings regarding MSDs with increase in reporting of symptoms as the duration of work on computer increased. [8]

Although self-reporting of dry eye symptoms did not have a

significant association with the daily duration of screen use, but as evident on Schirmir's dry eye test results, dry eyes were present in majority (92.16%) among the users who were facing the screen for > 6 hours a day. Findings are similar to those of Kawashima and Moon who found markedly high frequency of dry eye disease (Schirmir's test) in VDT or smartphone users with longer screen time in different population.[15,16]

Shantakumari et al also found complains of dry/tired/sore eyes to be more in students working for longer duration on computer. [17] Logaraj et al also found significant correlation between increased hours of computer use and the symptoms of redness, burning sensation, blurred vision and dry eyes. [18] The symptoms often not appreciated by the users but may cause loss of productivity among the users. [19]

As suggested by Bansal et al accommodation and convergence responses to electronic screens appear to be similar to those found when viewing printed material, whereas prevalence of dry eye symptoms is greater during computer use. This is probably due to dynamics of the computer screen and decrease in blink rate due to constant viewing of the monitor positioned in primary gaze leading to increased corneal exposure and hence the multitude of ocular problems.[20] In addition to this, we found retro-orbital pain (48.32%) to be more frequent among users with > 6 hours of daily use. Talwar had reported a gradual increase in visual complaints as the number of hours spent for working on computers daily, increased.[8] Agarwal also found occurrence of eye strain (53.8%), itching (47.6%) and burning (66.7%) in subjects using computer for > 6 hours.[5] Hence this symptom can also be attributed to increased duration of device use.

Our findings are in conflict with others[5,8] in context of watering of eyes (59.50%) and double vision (16.74%), as these symptoms are more frequent in users with lesser screen time but being a cross sectional study the temporal sequence is hard to establish.

Digital devices (computer/laptops and cell phones) present both opportunities and challenges. The benefit could be severely undermined if abuse and overuse are not kept in check. Impact like physical discomfort may be more obvious measure of technology`s influence on our health, but screen time may add the personal risk. Hence inbuilt constant reminders of time spent on screen or later age of introduction of these devices, as much as possible, are some of the measures which may be worthwhile for coping with these symptoms and increasing the productivity of the users.

Conclusion:

It is apparent from the findings that a large percentage of the undergraduate students in medical college in our setting do suffer from physical symptoms due to overuse of these devices, and that these cannot and should not be ignored. Age at the earliest use of the devices and duration of use are identified to be important determinants of the health implications of these digital devices. These modifiable factors should be targeted for intervention.

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