UNIVERSITI TEKNOLOGI MARA

INVESTIGATIONS ON THE COMPARISON BETWEEN ELECTRONIC AND NON-ELECTRONIC NEAR WORK ON SYMPTOMATIC HEALTH CONCERNS AND OCULAR CHANGES

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ABSTRACT

Background: Over the years, technology has revolutionised our world and impacted our lifestyles. Extended technology exposure has been linked to both physical and mental health concerns. Extant literature on electronic health risks has primarily focused on office workers or schoolchildren. Although young people commonly use electronic devices, there is a dearth of information regarding daily usage patterns between the weekends and weekdays. Yet, very little attention has been paid to its effects on visual functions and changes in ocular structure in young adults. This thesis intends to compare the near work-related symptomatic health concerns, visual function, and micro-ocular structure changes between electronic and non-electronic near work among young adults. **Methods**: This study adhered to the Declaration of Helsinki. Three main research questions were examined using a survey and 2 experimental studies. The cross-sectional quantitative method approach was employed. The survey studied weekend-weekday electronic related activities profile in young adults. Seven questions were used to inspect lifestyles regarding indoor-outdoor activities and near-work usage patterns. The symptomatology enquiry consisted of questions on general ocular, visual, ocular surface, and body sensation. The first experimental study inspected the effect of electronic near-work on visual function. The accommodation accuracy (accommodation lag) and accommodation stability (accommodation microfluctuations) were compared before and after the electronic and non-electronic near-work task using infrared open field binocular autorefractor Grand Seiko. The 2D Colour Analyser measured the luminance of near task and room illumination and illuminance spectrophotometer, respectively. The second experimental study focused on the microstructural changes after 20-minutes of the near task. Changes in the microstructure in choroidal thickness were assessed by 3D optical coherence tomography (OCT). The microstructural changes were observed between the baseline and after electronic and non-electronic tasks. **Results:** *Lifestyle and Symptomatology Survey*: The analysis was performed on 220 respondents (age range=20.3±2.9 years old). Overall, young adults reported a preference for spending most of their hours each day on electronic near work than non-electronic near work. Young adults were found to have spent more time with electronics on the weekends than on the weekdays. The symptomatology patterns comprised 45% body, 43% ocular surface, 38% general ocular, and 32% visual sensation. Lower back pain (70%) was found to be the highest reported symptom, followed by shoulder (68%), and upper back/neck pain/tired eye (67% each). *Vision Function Experiment*: There was no significant change in the accommodation lag after 20 minutes near work on electronic and non-electronic. Similarly, there was no significant change in the accommodation microfluctuations after 20 minutes near work on electronic and non-electronic. *Microstructure Experiment*: There was a significant thinning of choroidal thickness after 20-min reading. Approximately 31.17 μm choroidal thinning after electronic and 28.00 μm choroidal thinning was observed after non-electronic reading. Although the microstructural change in choroidal thickness was noted to be slightly higher for the electronic than the non-electronic reading, but not statistically significant. **Conclusion:** This thesis provides more insight into the visual adaptation behaviour in dealing with vision stress between electronic and non-electronic near-work. The lifestyle of young adults inclined towards the indoor trend, pre-eminent electronic engagement with notable reported health symptoms. The baffling predisposition lingered over the weekends. The robust accommodation system responding to electronic and non-electronic near work was expected because young people are shielded with sufficient accommodation, so they automatically accommodate to keep things clear. This might imply an efficient readjustment mechanism of the accommodation system in young adults. However, this efficacy was not translated into micro-ocular structures reaction. Choroidal thinning was more evident in electronics than non-electronic near work. This unique discovery stipulates further investigation. Future studies on the longitudinal effects of excessive electronic exposure might warrant the added value of understanding electronic vision stress.

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CHAPTER 1

INTRODUCTION

1.1 Electronic Technology Enhanced Lifestyle

The human lifestyle has evolved over time. Human lifestyle evolved from nomad to native, from hunting and farming to manufacturing, and migrated from rural to urban regions. Such transitions of their lifestyle have been attributed to the natural desire to improve their well-being. Two notable aspects show evidence of changes in human lifestyle; the economic shift resulting from the industrial revolution and the shift in education. The changes therein are broader consequences of urbanisation involved in the Industrial Evolution. This physical transition resulted in an increase in the urban population and the size of urban areas, which led to gradual changes in the human lifestyle (Vaidya et al., 2018). Since the onset of IR 3.0, there has been a significant shift in the pattern of human mobility, affecting human behaviour and well-being on the micro level and societal structure on the macro level (Wu et al., 2016). There is an increasing concern of chronic diseases due to the transformations in human lifestyles. With increased residential density, lowered mobility and the introduction of sedentary habits, human exposure to chronic diseases has also risen. Simultaneously, compulsory education enforced by most countries has introduced the near-work problem.

There is an uprising trend in the amount of exposure time for engagements with electronic technology because electronic technology supplemented the human lifestyle, altering every facet of it (Bandura, 2002). Exposure to electronic devices is certainly not a recent phenomenon. With the invention of the computer around 1970, human history changed significantly. The first successful demonstration on television took place in 1927, designed by Philo Taylor Farnsworth, who projected a simple line image with a beam of electrons. During this time, it introduced a ground-breaking idea – those images can be displayed virtually. Display inventions fuelled innovations for the evolution of computers in the 1970s. A decade later, computer technology shifted from monochrome to colour video displays. This was followed by the computer being accompanied by separated keyboards, computer processor units (CPU) and displays in bulky designs. Around the 1990s, the knowledge of wireless communications led to the