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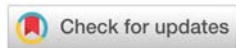
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Research Article

Effect of smartphone addiction on reaction time in geriatric population

Abstract

Context: Mobile phones have entered our lives through technological developments, becoming the most commonly used technological device, there advances have had a huge impact on many walks of life. Technology gives human beings good effects such as convenient everyday life. There has been a progressive increase in both the number and proportion of the aged in India over time and as age advances there is decline in motor and cognitive functioning. As the age increases, the reaction time also seems to increase. Older adults can benefit from the use of smartphones in a number of ways.

Aims: The aim of this study was to observe the Effect of Smartphone Addiction on Reaction time (RT) in Elderly Population.

Setting and design: This was an experimental study.

Subjects and methods: Ninety elderly subjects were enrolled for the study by random sampling in and around from Ludhiana. They all used a Smartphone for several hours per day. The subjects were divided into 3 groups A, B and C of 30 each both male and female according to the scores on Mobile Phone Addiction Scale (MPAS). Simple reaction time was estimated by Ruler Drop Method (RDM). The RT (in seconds) of each participant was calculated with the standard conversion equation.

Statistical analysis used: The data was analysed using mean, standard deviation (SD), and Pearson's correlation.

Results: The comparison of Ruler Drop Method between group A, B and C. The Mean+SD value of Group A is 0.27+0.040, the Mean+SD value of Group B is comparatively low 0.23+0.027 and the Mean+SD value of group C is low than group A and B 0.20+0.032. The value of Pearson correlation between MPAS and Ruler drop method is -0.656 which is statistically significant.

Conclusion: The study concludes that the group with high MPAS score has low RT compared to low and moderate groups.

Introduction

Smartphones are the new generation of mobile phones, they have emerged over the last few years [1]. Mobile phones have entered our lives through technological developments, becoming the most commonly used technological device [2]. Smartphones are equipped with the capabilities to display photos, play games, play videos, navigation etc [3]. These advances have had a huge impact on many walks of life [4]. Adoption of new technology has always been challenging for the elderly. However, with an increase in the graying population, the elderly are also found moving toward more digitally connected lives [5]. Smartphone ownership among seniors varies substantially by age. Around 59% of 65–69 year-old own smartphones, 49% among 70–74-year-old. This drops off considerably in the mid-70s and beyond [6]. From early adulthood, there are declines in mental domains such as processing speed, reasoning, memory and executive functions [7]. Smart phone addiction has become severe

these days [8]. Older adults can benefit from the use of smart phones in a number of ways. Mobile services available on smart phones may help older adults enhance communication with their families and friends, enrich their personal interests, and check various healthcare related information [9]. Use of computers and Internet present many advantages for seniors. It has a positive effect on their autonomy and cognition-related issues, preventing people from cognitive decline and improving autonomy and everyday functioning [10]. Better cognitive abilities are found in the elderly who appropriately used Internet to simplify some of the everyday tasks and used technology in a balanced way [11].

Reaction speed is the ability to give a quick motor response to a definitive stimulus [12]. Reaction time (RT) has been used as a test of cognitive functioning for over a century. Two of the most common RT tests are simple and choice RT (SRT and CRT, respectively) [13]. Simple reaction time shortens from infancy into the late 20s, then increases slowly until the 50s and 60s,

and then lengthens faster as the person gets into his 70s and beyond. In other words, adolescents will probably have slower reaction times than adults [14].

Age associated Cognitive decline is among the greatest challenges to improve the wellbeing of older patients. Older group are treated as a burden to the society. No research has been done which deals with the Effect on Reaction Time which tends to decline as one ages. It is a known fact that elder age group show less interest and excitement in conventional treatment. With use of smart phone we can also enhance the quality of the exercises. The patients will enjoy their therapy time as it seen in the Paediatric Population. The aim of this study is to see the Effect of Smartphone Addiction on Reaction time in Elderly Population so that conclusion of study could signify their role in physiotherapy treatment.

Repeatedly practice one activity such as a sequence of movements or a mathematical problem, neuronal circuits are being formed, leading to better ability to perform the practiced task with less waste of energy. Once we stop practicing a certain activity, the brain will redirect these neuronal circuits by a much known 'use it or lose it' principle hence the repeated activity will results in new connections of brain [15].

Methodology

This study is of cross-sectional design. 90 subjects both male and female with age group of 60-70 years were selected by Random sampling. Subjects were taken from in and around Ludhiana who were able to communicate well, used Smartphone for several hours per day (3-8 hours per day) with the Education should be at least 12th class or more. Smartphone owners interact with their phones an average of 85 times a day, approximately 3 hours minimum to 8 hours maximum, including immediately upon waking up, just before going to sleep, and even in the middle of the night. 59 males had participated in the study with 31 females. 45% of the population was under 60-65 years whereas 55% was under 65-70 age group.

The subjects who had any auditory, visual or perceptual deficits, sensory loss and with any kind of neurological conditions were excluded from this study as this population was unable to perform the test effectively.

Null Hypothesis of the study was there will be no significant effect of Smartphone Addiction on RT in Geriatric Population and Alternate Hypothesis was that there will be significant effect of Smartphone Addiction on Reaction Time in Geriatric Population.

Procedure

Informed consents were obtained from all the subjects. They all used a Smartphone for several hours per day. Mobile Phone Addiction Scale (MPAS), a self-report measure designed to assess the incidence of behavioral and cognitive symptoms of problematic cell phone usage. Participants were asked to rate their agreement with each item on the MPAS using a 5-point Likert scale, ranging from 1 "Not at all", to

5 "Always". Reliability for the scale was demonstrated by a Cronbach's alpha of .90. Scores on the MPAS ranged from the lowest possible score of 17 to a high score of 77 (out of a possible 85), and were categorized into groups as follows: low = scores ranging from 17 to 38, moderate = 39 to 47, and high = 48 to 77 as mentioned [16]. The subjects were divided into 3 groups A, B and C of 30 each both male and female according to their scores on MPAS. Group A 30 subjects within the range of low score, Group B 30 subjects within the range of moderate score, and Group C subjects within the range of high score. The experiment described in this paper involves a simple testing of Reaction Time by Ruler Drop Method (RDM) because the RDM was easy to perform, Simple reaction time was estimated by asking the participants to catch a falling ruler. RDM for reaction time have good intrarater reliability (0.81) and moderate-to-good degree of validity (0.54) [17]. The subjects were invited to sit on a chair with their dominant hand kept in the mid-prone position, elbow flexed to 90°, and forearm supported on a table. The assessor held the ruler vertically, with its lower end between the participant's thumb and index finger (i.e., web space). He or she was then instructed to catch the ruler using a pinch grasp as quickly as possible when the assessor released it at an unannounced time. The reaction time (in seconds) of each participant was calculated with the following equation. $t = \sqrt{2d/a}$ Distance (d) was calculated by the difference between the initial (0cm) and final grasping height of the ruler, and $a = 980 \text{ (cm/s}^2\text{)}$ represents the gravity constant. A familiarize trial was carried out before the actual test. Best of 5 trials is taken with a rest period of 1 min [18].

Results

Data was meaningfully assorted through calculations of Mean, Standard deviations and ANOVA. A total number of participants were 90. Table 1 and Figure 1 shows the relation between MPAS and RDM. The result were significant. The value of mean and SD for Low Score is 0.27 ± 0.040 , the mean and SD for Moderate Score is 0.23 ± 0.027 and mean and SD for High Score is 0.20 ± 0.032 which indicates that the population with high MPAS score has less RT as compared to other group. The Probability value < 0.001 which is statistically significant.

Table 2 shows the Pearson's Correlation between the MPAS Score and Ruler Drop Method (RDM). The Mean and Standard Deviation for the RDM Score is 0.23 ± 0.046 and the Mean and Standard Deviation for the MPAS Score is 39.99 ± 12.262 . The table value of correlation is -0.656 which is less than 0.001.

Table 1: Ruler Drop method values.

Descriptive Score and ANOVA	Ruler Drop Method Score							
	Mean	Std. Deviation	Minimum	Maximum	N	F	P Value	Result
Low Score	0.27	0.040	0.21	0.34	30	42.403	<0.001	Significant
Moderate Score	0.23	0.027	0.17	0.28	30			
High Score	0.20	0.032	0.14	0.27	30			

*N is number participants or subjects. *F value is for ANOVA. *P value= probability value.

Which proves that there is a strong significant relation between the two tools (MPAS Score and RDM Score). Figure 2 depicts the direction of correlation between both the tools (MPAS and RDM).

Discussion

The study was carried out to determine the effect of Smartphone Addiction on Reaction Time in Geriatric Population. The result of the present study showed that the RT of the High Score group is comparatively less than the low and moderate

group which indicated that the old aged who were Smartphone addicted have better response time than the old aged who are not using the Smartphone. The reason behind the reduced RT in smartphone addicted are described as the brain activity in the somatosensory cortex was stronger when smartphone users did a lot of typing and swiping, and that signal strength depended on how recently such digital activity occurred [19]. The researchers found that the more the volunteers had used their smartphone in the days before the EEG recording session, the more intense their brain responses to tactile stimulation of the thumb [20]. Cortical Fingertip Representations in Touchscreen Phone Users Differ from those Found in Nonusers. The increased cortical activity in touchscreen users compared to nonusers could be due to a more intense usage of the hand, in the sense that the former group used the right thumb more than the latter group did this can explain the dominant hand activity while catching the ruler. Alternatively, it could be due to the development of touchscreen-specific motor routines or “skills” as the movements associated with push buttons (in nonusers, who used only old-technology mobile phones) versus taps or swipes on a smooth screen (in touch screen phone users) were distinct. [21] This is evident that Technology can be used as an assistive manner by the elderly, the elderly can be significantly helped through technology in different situations [22]. Technology may delay or prevent the onset of disability, stimulate new activities and interests, facilitate communication, enhance knowledge, elevate mood, and improve psychological well-being [23]. Memory function improves in older adults as carried out in Smartphone-based memory training for older adults [24]. Action game play can improve players’ ability to reduce interference between competing response tendencies in order to facilitate goal-directed action [25], so we can enhance the patient’s therapeutic exercises using the goal-directed strategy. Older people are able to use computers and that the videogames use can improve their cognitive skills. As we already know that RT is the testing parameter for cognition [26] and the technology including Smart phones improves the cognition directly or indirectly affects the RT. The results also supports that the videogames use maintain the self-concept and the quality of life of older people. Although it does not support that if older people play it during more time they can achieve better results. It seems, however, that when they have higher self-concept, they can achieve more cognitive improvements [27]. Connectivity between the different circuits of brain gives clear idea about their linking as the basal ganglia consist of a number of parallel circuits with similar homologous connectivity. In each case, multiple cortical areas feed into the basal ganglia which then target a specific cortical structure. For example, motor cortical areas (premotor, motor cortex, and supplementary motor area) project through the putamen and then target the supplementary motor area, while cognitive cortical areas (dorsolateral, prefrontal, lateral orbitofrontal cortex) project through the caudate nucleus and target the dorsolateral cortex. Limbic cortical areas associated with emotion (anterior cingulate, medial orbitofrontal cortex) project via the ventral striatum and target the anterior cingulate. Therefore, although motor behaviour represents only one domain in which slowing of processing can be documented, the findings in this area



Figure 1: Mean and Standard Deviation of Low, Moderate and High Scores.

Table 2: Shows correlation between the Ruler Drop Method Score and MPAS Score.

Pearson's Correlation	Pair1	
	Ruler Drop Method Score	MPAS Score
Mean	0.23	39.99
SD	0.046	12.262
N	90	
Correlation	-0.656	
Table Value	0.207	
P Value	<0.001	
Result	Significant	

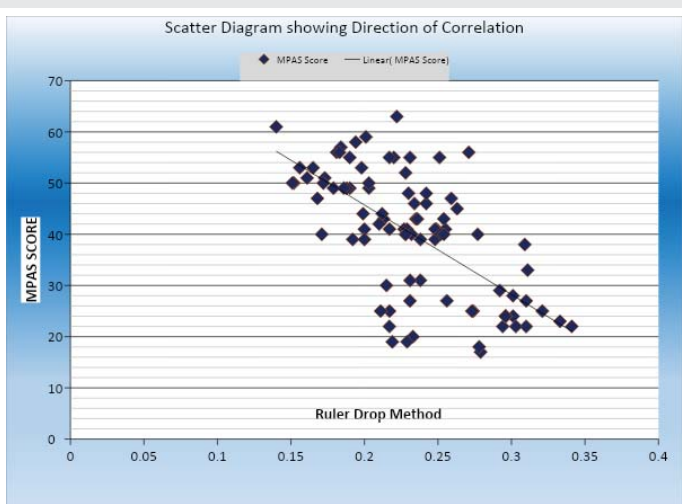


Figure 2: Shows the direction of correlation.

can potentially be generalized to other domains including cognition and emotion [28]. Moreover during exercise sessions old people take exercises as boredom to them so to reduce the boredom the introduction of Smartphones and Video Games not only excites the Geriatric population but also influence them to participate in the exercise sessions more actively and voluntarily.

Another study on Cognitive benefits of computer games for older adults found that there is great potential for digital action games originally developed for the entertainment of young adults to produce cognitive benefits in older adults and it is seen that one domain relate with the other, digital games improve memory and cognition in older adults would have important implications for using games as an intervention [29]. Games are relatively inexpensive, without the side effects of medications. In addition, games are inherently enjoyable, and may yield greater compliance than other kinds of beneficial interventions because they are fun, In addition, older adults, the fastest growing age segment of the USA population, are very concerned with 'brain training'. They are investing in software to improve cognitive function as they attempt to reduce their risk of cognitive decline [30]. A similar study showed that healthy elderly can benefit from a videogame based exercise program to improve balance and that all subjects were highly motivated to exercise balance because they found gaming challenging and enjoyable [31]. In digital era the introduction of these gadgets will be benefited.

Limitation of the study

1. Sample size was small, total number of participants were 90.
2. The ratio of males and females were unequal.
3. The age limit is 60-70 years which is small.
4. Only educated people were taken to fill the MPAS but illiterate people were not taken which may show variations in results.
5. Individuals with neurological disorders are excluded from the group.

Conclusion

The elder population who were smart phone addict have better response to the stimulus. The RT of the high MPAS Score is less than the moderate and low MPAS Score group. The study concludes on the basis of this relatively small study that, in order to prevent the problems of cognitive decline and functional disability to an extent usage of Smartphone and video games are proved to be useful. These are targeting our brain functions directly or indirectly and thus help in delaying the neurological decline in older people.

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