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Original Research Article

Comparison of effect of concurrent phone texting on gait speed in young and middle aged healthy subjects

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ABSTRACT

Background: Around the world today, adoption of mobile media phones and its advancement have been growing at dizzying pace in all age groups. People use phone while walking on/crossing roads, climbing stairs, driving cars, etc. Using a smartphone while walking has shown decrease in walking speed and affect dynamic balance by reducing cognitive ability. The objective of study is to see and compare effect of concurrent phone texting while obstacle walking on walking time in young and middle-aged healthy subjects.
Methods: An observational study with 100 healthy individuals (50 young and 50 middle-aged) were taken and had to walk on a 15 m walkway with obstacle (approximately 10% of subject's height) at 8m distance from start without and with texting. The text messages used were all short objective questions and were sent to them approximately 2 steps prior to reaching the obstacle. Their walking time was analyzed.
Results: Wilcoxon test used to analyze difference within group. In young people without phone texting it was11.41±1.24 seconds and with texting was14.79±2.67seconds, ($z=-6.101$, $p<0.001$) and in middle aged was14.93±1.20 seconds and 20.52±1.87 seconds respectively ($z=-6.154$, $p<0.001$). Mann Whitney test used to analyze difference between groups. For without texting in young and middle aged walking time ($U=48.0$, $p<0.001$), with texting young and middle aged walking time ($U=122.00$, $p<0.001$) and comparing the difference in walking time between young and middle aged with and without phone texting ($U=372.5$, $p<0.001$).
Conclusions: Phone texting increases walking time in young and middle aged with difference in walking time more in middle aged adults.

Keywords: Phone texting, Obstacle walking, Walking time, Healthy subjects

INTRODUCTION

Around the world today, the adoption of mobile media phones and its advancement have been growing at dizzying pace in all age groups.[1] In recent times, there seems to have been a transformation of cell phone from a status symbol to a necessity.[2] Mobile phone growth in India has been fast and has reached all segments of society.[3] Presently, 64% of all mobile phone users are in the developing world.[4] People use phone while talking, walking on or crossing the roads, climbing stairs, driving cars, etc.[1] While using mobile phones person needs to concentrate, whereas walking requires postural control and visual information regarding walking environment which is reduced when using the phone.[5] Using a smartphone while walking such as sending a message has shown to affect the dynamic balance necessary for functional activities by reducing cognitive ability.[6] A decrease in walking speed may be seen because of decrease in cognition due to dual tasking.[1] Cognitive motor interference of dual tasking refers to deterioration of either motor or cognitive task performance when they are attempted simultaneously. It is seen that when confronted by two attention demanding activities, humans explicitly prioritize one task over the other based upon counterbalancing capabilities and available cognitive and/or motor reserves.[7]

Studies have been done on geriatric population and dual tasking. Studies on cellular phone texting are limited to unobstructed level walking. So the need of this study is to see the effect of cellular phone texting while complex walking conditions like obstacle walking in a young and middle aged population.

The aim of the study is to see and compare the effect of concurrent phone texting while obstacle walking on gait speed in young and middle-aged healthy subjects.

METHODS

An observational analytical study was conducted on 100 healthy community dwelling subjects, both male and female (50 young and 50 middle–aged adults) not having cognitive, visual or balance impairments were included using convenience sampling. Permission to conduct the study was obtained from the head of the institute. Subjects who were willing to participate and of age group 18-35 years (young) and 36-65 years (middle aged) not having cognitive, visual or balance impairments and were able to use smart phones were included using convenience sampling.[8] They were explained the nature of the study and consent for participation was taken. They could leave the study whenever they wished.

Each participant was asked about his experience with mobile phone usage and explained that texting is priority. When performing the task they were asked to perform two different gait task conditions: obstacle-crossing only (OC) and texting while obstacle crossing (OC+ texting). In the OC condition, participants were instructed to walk toward the obstacle (approximately 10% of subjects height) placed at 8 m of a 15 m walkway, cross over it and continue walking towards the end of the walkway at their self-selected speeds and manners.

In the OC+ texting condition, they were asked to perform the same obstructed gait task as in the OC condition, but were required to concurrently respond to a text message. The text messages used in OC+ texting condition were short questions with specific answers (for example: Which day is it today?). The message was sent to a mobile phone held by the participant when an individual was approximately two steps prior to reaching the obstacle.The walking time was taken both for OC and OC+ texting condition by using stopwatch for both young and middle aged healthy individuals and compared.[9]

For statistical analysis, SPSS software was used and non-parametric tests were used to compare the walking times. For within groups comparison Wilcoxon test was used and for between groups Mann Whitney U test was used. Level of significance was kept at 5%.

RESULTS

In total 100 participants completed the study which consisted of 50 young and 50 middle aged individuals. Wilcoxson test was used within the groups and for between the groups, Mann Whitney test was used.

Along with the above results, out of 50 young individuals, 9 individuals gave wrong answer while 7 individuals were not able to give answer while walking. Out of 50 middle aged individuals, 6 individuals gave wrong answer while 19 individuals were not able to give answer while walking.

Table 1 shows the mean age and gender distribution of subjects in each group.

Table 1: Demographics of participants.

	Mean age (years)	Gender	
		Male	Female
Young	22.02	16	34
Middle aged	41.58	27	23

Table 2 shows Mean and SD of walking time(s) in young and middle aged subjects with and without phone texting.

Table 2: Walking time of participants.

Groups	Mean (s)	SD
Young (without phone texting)	11.49	1.24
Young (with phone texting)	14.79	2.67
Middle–aged (without phone texting)	14.93	1.2
Middle–aged (with phone texting)	20.52	1.87

Table 3 shows mean difference in walking time (s) of subjects with and without phone texting-within the groups.

Table 4 shows mean difference in walking time (s) of subjects with and without phone texting between the groups.

Table 5 shows the mean and SD of gait speed (m/s) in young and middle aged subjects with and without phone texting.

Table 6 shows mean difference in gait speed (m/s) of subjects with and without phone texting-within the group.

Table 7 shows mean difference in gait speed (m/s) of subjects with and without phone texting- between the groups.

Table 3: Difference in walking time within the group.

Groups	Mean (s)	SD	Z value	P value
Young (with and without phone texting)	3.39	2.38	-6.125	<0.001
Middle aged (with and without phone texting)	5.58	1.31	-6.154	<0.001

Table 4: Difference in walking time between the groups.

	Mean	SD	U value	P value
Young and middle aged without phone texting	3.53	1.56	48	<0.001
Young and middle aged with phone texting	5.72	2.86	1.22	<0.001

Table 5: Gait speed of participants.

Group	Mean gait speed (m/s)	SD
Young (without phone texting)	1.32	0.15
Young (with phone texting)	1.03	0.16
Middle aged (without phone texting)	1.00	0.08
Middle aged (with phone texting)	0.73	0.06

Table 6: Difference in gait speed within the groups.

Groups	Mean	SD	Z value	P value
Young (with and without phone texting)	0.28	0.14	-6.126	<0.001
Middle aged(with and without phone texting)	0.49	0.05	-6.158	<0.001

Table 7: Difference in gait speed between the groups.

Groups	Mean	SD	U value	P value
Young and middle aged without phone texting	0.31	0.15	55.5	<0.001
Young and middle aged with phone texting	0.30	0.16	123	<0.001

Table 8 shows moderate positive association between the mobile phone usage and phone texting in the subjects using Spearmann's correlation coefficient.

Table 8: Spearmann's correlation coefficient.

Correlation coefficient	P value
0.471	<0.01

DISCUSSION

This study showed that concurrent phone texting decreases the gait speed and increases the walking time in both the groups and difference was seen to be more in middle aged adults. It also showed that as the experience of mobile phone usage increases the speed of texting is found to be increased. Along with that there are some cognitive disturbances too.

Similar findings have been seen by Chen et al had done a study to see the effect of phone texting while obstacle walking on gait and balance. In this study, 10 young individuals (5 male and 5 female) participated and were made to walk on a pathway with obstacle with phone and without phone texting. This study showed that obstacle crossing behavior and balance control were affected by concurrent cellular phone texting and a conservative gait pattern with slower walking speed and greater toe-obstacle clearances was observed. This gait pattern was, however, accompanied by a greater body sway in the frontal plane during crossing, which could be an indication of perturbed gait balance control.[9] Schabrun et al have studied about cognitive demand on working memory and cognitive motor interference phenomenon. Typing or reading text on mobile phones may alter walking speed as a result of increased cognitive demand placed on working memory, executive control during performance of dual tasks, decreased availability of visual information of surroundings, or modified physical/ mechanical demands associated with manipulation of phone (e.g., requirement to maintain a stable relationship between eyes and phone in hands) as seen in this study.[10]

Cognitive motor interference is a phenomenon that happens when simultaneously performing two tasks that interfere with each other, such as performing a cognitive task and motor task. It interferes with the cognitive activity as more concentration ability is required. Slowing down under dual task conditions suggests that control of gait speed involves high-order cognitive systems. Gait speed control areas seem to be interlinked with the networks of higher level cognitive functions, in particular executive function that include prefrontal cortex activation. It is seen that cognitive tasks involving internal interfering factors (e.g., mental tracking) seem to disturb gait performance more than those involving external interfering factors (e.g., reaction time). Cognitive tasks such as mental tracking and verbal fluency tasks, share complex neural networks connecting different brain regions, which are interlinked with those of gait control, and the demand placed by cognitive tasks may be enough to interfere with these networks and, therefore, disturb gait. In contrast, cognitive tasks that involve external interfering factors (e.g., reaction time tasks), share "stimulus driven" lower order networks with those of gait control, hence, less interference compared to high-order shared networks.[11]

With mobile phone usage, there is increased risk of cellular phone distraction-related injuries causing safety issues and sometimes may be fatal. Cell phone use creates dual-task situation for pedestrians and can negatively affect walking behaviours. With increasing age, the difference is also seen to increase. Brustio et al investigated the differences in dual task performance both in mobility and cognitive tasks and additive dual task costs in older, middle-aged and young adults. The results showed that dual task activity affected mobility and cognitive performance, especially in older adults who showed a higher dual task cost, suggesting that dual task activities are affected by age and consequently also mobility and cognitive tasks are negatively influenced.[12] Increased visual-attentional demand from a concurrent phone texting could negatively impact individual's safety during obstacle crossing. Cognition level can be measured to see correlation with smart phone use.The effect of physiotherapeutic exercises, (balance, cognitive or combination of intervention) on dual tasking time can be seen. Dual tasking using a smart phone can also be done and effect on cognition levels and balance can be seen.Future studies may also focus on gait changes while using different mobile phone functions in a variety of environments affecting gait.

Limitations

Gait speed changes were only tested during texting and not with other mobile functions. A limitation of this study was that older subjects were not included in study as older individuals comfortable with texting on mobile phones were not available. In the present study, all subjects were made to walk without texting first and then with texting. However no practice effect has been seen as all participants had increased walking time with phone texting.

CONCLUSION

Obstacle crossing behavior was affected by concurrent cellular phone texting and showed slower walking speed in both young and middle aged adults with the difference increasing with age.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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