Original Article

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Effect of Dual Task Activity on Visual and Auditory Reaction Time in First Year Medical Students

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ABSTRACT

Introduction: The dual task activity has been used to investigate the performance of simultaneous tasks in individuals. The purpose of this study was to analyze audio-visual reaction time during dual task (mobility and cognitive) performance in the first year medical students.

Methodology: This observational descriptive cross-sectional study was conducted in the Department of Physiology, in a Medical College among 74 first year healthy medical students. The reaction time was recorded for auditory and visual stimuli. Dual task activity included mobility task (the Timed Up and Go test) and cognitive task. The internal assessment marks of all study participants were also recorded and compared.

Results: Mean reaction time was less for visual activity during dual task activity ($p<0.001$), it means in all participants, visual response was quick and earlier than audio response. Females were faster responsive than males and similarly cognitive task of visual activity and academic performance was better in females than males however results were not found to be significant.

Conclusion: Improvement in reaction time will ultimately improve person's performance. Reaction time can be reduced by practice.

INTRODUCTION

In the technologically advanced era, a prompt response and ability to do multitasking is of utmost importance for all humans. Majority of the motor work is done by using visual and auditory information in human beings. Visual reaction time (VRT) is the time required to give response to visual stimuli and auditory reaction time (ART) is the time required to give response to auditory stimuli.[1] Dual task conditions basically involve attention and executive function processes and typically require performing a primary task such as balance or walking tasks while simultaneously carrying out a concurrent secondary task such as cognitive tasks (e.g. discrimination and decision-making, working memory tasks) or manual tasks (e.g. upper manipulation of an object).[2-5] Studies have emphasized the role of the cognitive system during mobility performance and the dependency of automatic and high-level cognitive processes, especially with increasing age. Indeed, mobility performance is a multi-dimensional process and requires a high level of motor control and cognitive flexibility, in order to pay attention to various external features and stimuli. Studies suggested that with age the stability of posture becomes less automatic and more controlled by the cognitive resources.[6,7]

Therefore, dual-task performance may be a useful clinical test of the functional decline and frailty in adults, and consequently it can identify changes at an earlier stage for allowing a quick intervention to prevent adverse outcomes.[8] Investigating the effect of mobility performance on cognitive tasks and its evaluation may be useful to explore and to better understand the possible onset of difficulty in dual-task performance during the medical carrier of a student. Accordingly, the purpose of the study was to use different mobility and secondary cognitive tasks to investigate the changes occurring during dual task performance in medical students.

METHODS

This observational descriptive cross-sectional study was conducted in the Department of Physiology in a Medical College in Rajasthan from January 2018 to March 2018. A total of 74 first year healthy medical students were enrolled in this study (males-48, females-26). A pre-assessment was performed for their vision and hearing ability. The test was performed on Audio Visual Reaction Time (AVRT) machine of Medi systems. Dual task included mobility task i.e. timed up and go (TUG) test and cognitive task.

Mobility task Timed Up and Go (TUG) test: Timed up and go test measures the time taken by a subject to stand up from an arm chair, walk a distance of 3 meters, turn, walk back to the chair, and sit down.[13] The timed performance, in seconds, of each mobility task was measured with a stopwatch, recorded and used for analyses.

Cognitive tasks: The cognitive tasks were arithmetic tasks and consisted of a serial subtraction of 3 and 7 from a random number between 80 and 99.[14,15]

After screening for inclusion criteria, informed consent was taken from the participants. Thereafter they attended a single data collection session and were tested under both the single- and dual-task conditions and reactions times (ART, VRT) were noted. Dual task activity results were compared with perfor-mance in internal assessment on two topics viz cardiovascular and central nervous systems. The methodology of assessment was written assessment, viva voce, multiple choice questions, and practical assessment.

Reaction time was taken as mean ± standard deviation (SD). The level of significance of difference in auditory reaction time (ART) and visual reaction time (VRT) was tested by student's t-test (paired). Data analysis was done by SPSS (version 20).

RESULTS

In the study 74 (males-48, females-26) first year medical students were enrolled. Table 1 depicts the baseline auditory mean reaction time and visual activity mean reaction time and, visual response was found to be significantly faster than auditory response in normal conditions. After applying mobility task (TUG), auditory mean reaction time was 1.858±2.035s and visual response mean reaction time was 0.684±0.676s (p value<0.001). After cognitive task in the same participants, on statistical analysis results showed that after dual task activity, visual response was significantly faster than auditory.

After comparing normal activity reaction time with mobility task (TUG) and cognitive task reaction time, no statistically significant difference was found. In terms of comparison between reaction time (Table 2) of males and females during normal auditory activity, reaction time of females was lesser than males. Similarly, during mobility task, auditory response of females was faster than males and cognitive response was slower than males but this difference was not statistically significant. Reaction time of males was lesser than females during normal visual activity i.e. males were faster responsive. During mobility task of visual response, females were faster responsive than males and similarly cognitive task of visual activity was faster in females than males. There was no significant difference in auditory and visual reaction time during normal activity and dual task (TUG + cognitive) in males and females (Table 2). There is a significant positive association between academic performance and reaction time on analysis. Female students that have reaction time 1.75±1.065s, had better academic performance (6.962 ± 1.248) compared with male students which had reaction time 1.95±3.068s and academic performance (6.27 ± 1.198). p value was found to be significant .

Table 1: Reaction time after mobility and cognitive task in study participants

	Normal	Mobility task (TUG)	Cognitive
Auditory (mean ±SD)	1.858±2.523s	1.858±2.035s	1.6±1.5s
Visual (mean ±SD)	0.69±0.54s	0.684±0.676s	0.65±0.47s
p value (paired t test)	<0.001	<0.001	<0.001

Table 2: Auditory and visual reaction time in study participants

		Auditory (Mean ± SD)			Visual (Mean ± SD)		
	n (%)	**Normal**	**Mobility**	**Cognitive**	**Normal**	**Mobility**	**Cognitive**
Male	48 (64.9%)	1.95±3.068s	1.95±2.376s	1.46±1.61s	0.68±0.611s	0.73±0.824s	0.70±0.548s
Female	26 (35.1%)	1.75±1.065s	1.74±1.268s	1.77±1.128s	0.71±0.389s	0.62±0.267s	0.59±0.289s
p value (unpaired t test)		0.747	0.682	0.395	0.86	0.513	0.355

DISCUSSION

Reaction time has mainly two components; one is mental processing time i.e. it is the time required for responder to perceive stimulus, identifying and analyzing of stimulus, and decide the proper motor response and the other one is movement time i.e. it is time required to perform movement after selection of response.[16] This implies that the faster the stimulus reaches the motor cortex; faster will be the reaction time to the stimulus.[17] Reaction to sound is faster than reaction to light. Perhaps this is because an auditory stimulus only takes 8-10 ms to reach the brain, but a visual stimulus takes 20-40 ms.[18] Therefore, since the auditory stimulus reaches the cortex faster than the visual stimulus, the auditory reaction time is less than the visual reaction time.[19] In this study, we found that visual reaction time is faster than auditory reaction time. After applying dual task activity i.e. mobility task (TUG) and cognitive task, it showed that visual response was significantly faster than auditory response. Results showed that there is a significant positive association between academic performance and reaction time. Differences in reaction time between these types of stimuli persist whether the subject is asked to make a simple response or a complex response.[20] In other study, it has been observed that auditory reaction time is less than visual reaction time.[17,19,21]

RT is affected by the intelligence of the subject[22]. Few studies have been conducted on the medical students.[23] Students success in learning process depends on attention, concentration, arousal level, and processing speed. All the above parameters affect the response time to significant extent. Further studies clarify that there is a significant relation between response time and learning and that response time is parallel with learning speed.[24] Also in learning skills, perception-motor development has a significant place and in meeting effective learning functions, there is a need for perception-motor development. Since response time is closely related to perception-motor development,[25] it can be used to assess the effectiveness of learning process. Individuals with low level of arousal and attention deficit are known to have high response time and prove that they do not care about stimulant coming from outside.[26] There are various factors that affect the reaction time to a stimulus. Factors like intensity and duration of the stimulus, age and gender of the participant, effect of practice can affect the reaction time of an individual to a particular stimulus.

CONCLUSION

The study concludes that after applying dual task activity visual reaction time was significantly less than auditory response and there is a significant positive association between academic performance and reaction time in medical students. Academic performance and perception-motor develop-ment are of significance in medical profession. Performance enhancing program can be added to the medical education, exposure to adequate stimuli, and repeated exposure to stimuli during practice may lead to an improvement in performance.

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