

## The Effect of Dual-Tasking on 'Timed up and go' Performance in subjects with chronic nonspecific neck pain

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### ABSTRACT

In this study, score of a clinical test of physical mobility identified by Timed up and go (TUG) testing also effect of a cognitive task on TUG performance were compared between two groups of nonspecific chronic neck pain and healthy participates. 24 people with nonspecific chronic neck pain and 24 control subjects were participated in this study. Times required to complete TUG was measured in three conditions including test without cognitive task, test with easy and difficult cognitive task. Subjects with nonspecific chronic neck pain had slower speed than control group in all of conditions. Increase in level of cognitive difficulty increased the amount of time of TUG in two groups. Interaction of group by cognitive difficulty was not significant, meaning cognitive difficulty had no effect on time required to complete TUG between two groups. Results of this study suggest mobility problem in subject with nonspecific chronic neck pain. An implication of these findings is that assessment and treatment of functional mobility these subjects are considered in clinic. Time up and go is a simple test to measure functional mobility. It is recommended that further research be undertaken the effect of secondary test on postural control subjects with nonspecific chronic neck pain with advance analysis.

**Key words:** Nonspecific chronic neck pain; Timed up and go test; attention; dual-task methodology

### INTRODUCTION

Neck pain is known as the second common musculoskeletal problem in general people in worldwide which mainly caused by non-specific reason. Non-specific neck pain is the most common type of neck pain that refereed to physical therapy clinic in which is absence of definitive diagnosis or abnormal anatomical structure<sup>1-2</sup>.

The loss of motion, stiffness in one or both sides, reducing the accuracy of position and movement sense, decreased muscle strength and disturbance in balance and gait, account as problems of these patients were mentioned in clinical studies<sup>3-6</sup>.

The potential cause of impaired balance and gait is due to impaired cervical sensory information and mismatching this information with the visual and the vestibular systems<sup>7</sup>. In everyday activities, adult usually need to maintain postural stability while they perform other task simultaneously such as walking and talking so assessment of postural control concurrent other task is important<sup>8</sup>. In addition, recent approaches indicated postural control is not automatic and needs some degree of attention<sup>9</sup>.

Dual task methodology has been used to evaluate the effect of a secondary cognitive task on balance control which is similar to functional activities<sup>10</sup>. In this method, according to the theory

limited capacity of attention, resources of attention for processing are limit and performance of one or both task may be deteriorated<sup>11, 12</sup>.

Also decrease of cognitive function have been reported in patients with chronic neck pain<sup>13, 14</sup>. Individuals with nonspecific neck pain may have problem when they perform secondary task in walking relative to healthy age-matched due to both postural control and cognitive impairments. However, no research has been surveyed the effect of cognitive task on locomotion in patient with chronic non-specific neck pain.

Timed up and go (TUG) is a reliable and valid test which measured balance and mobility performance in single and dual-task condition<sup>15</sup>.

Previous research have been reported increased the time needed to complete TUG test under dual-task condition in stroke ,elderly and Parkinson subjects<sup>16-19</sup>.

However, effect of secondary tasks on TUG test in individuals with neck pain has not been investigated. Therefore, objective this study is assessment of TUG performance in single and dual tasks condition in subjects with chronic non-specific neck pain.

## METHOD

### Participants

24 people with nonspecific chronic neck pain and 24 control subjects were enrolled in this study. They were matched according to age, height and body mass index (Table 1). This study was performed in at the School of Rehabilitation Jundishapur University of Medical Science. Inclusion criteria for these subjects were neck pain without any special pathology, analogue scale pain less than grade 2 (VAS)<sup>17, 18</sup>, 10 to 50 percent of neck disability index<sup>6, 7, 19</sup>, corrected- to- normal visual acuity and detect color<sup>20</sup>. Patients with previous traumatic injury, sever osteoarthritis, neck surgery, certain history of vestibular, neurological or cognitive disorder, diabetes, rheumatoid arthritis ,structural deformities in the spine and lower extremities, musculoskeletal pain experience

except in the neck over the past three months were excluded<sup>6, 7, 19, 21</sup>.

### Procedure

First, the subjects were informed about the main rationale and aims of the study, and provided written informed consent approved by the ethics committee of Joundishapor University of Medical Sciences then they completed Neck Disability Index questionnaire for evaluation the amount of disability of patients with neck Pain. After this, Subjects were asked to put on comfortable and right size footwear (the same footwear with different sizes were provided for all subjects) and sit down on a chair with 45 cm in the height without handle for 5 minute before starting the test. A three meter path was signposted with tapes and a conical object was placed in the half of path that subjects turn the road. Individuals were instructed to stand up as soon as they hear start word by examiner and walk the three-meter path and sit down on the chair. In this experiment the walking speed was optional and subjects could walk in their usual speed<sup>22, 23</sup>. This test was performed in 3 levels of cognitive difficulty without cognitive trial, with easy and difficult cognitive task. Each condition was performed 3 times randomly with a rest period of five minute. Performance of the test in each condition was calculated time from the moment they stand up to when they sit back in seconds by stopwatch.

Cognitive test used in the present study was Stroop test. This test has 4 main colors; green, red, blue, yellow and three levels of difficulty which in this study the level one and three were applied<sup>25</sup>. For easy level, different colors in squares were displayed on the screen which is located in front of subject and the subject should say the name of every single color respectively. For difficult level, color of the words was different from the real meaning of the word. for example, the word yellow was shown in red and individuals were asked to recount the color without reading the word. The evidences express processing in the first level is automatic while difficult level requires considerable controlled processing and more attention<sup>24, 25</sup>. For each Stroop task, the number of errors was recorded to monitor performance of the cognitive task<sup>24</sup>.

**Data analysis**

Data were analyzed using SPSS (version 16). Data are expressed as mean  $\pm$  standard deviation(S.D). Descriptive statistic and frequency were determined for appropriate demographic variables. Performance of TUG after calculating mean of 3 trials was analysed using 2 (group) $\times$ 3 (cognitive difficulty) a mixed model analysis of variance (ANOVA). For multiple comparisons, the Bonferroni adjustment method was used. A value of  $P < 0.05$  was considered as statistically significant.

**RESULTS**

Mean and SD of time taken to complete of TUG for both groups in different conditions of cognitive difficulty has been shown in Table 2. Also, results of mixed ANOVAs for time taken complete of TUG revealed main effect group and cognitive difficulty were significant. This means subjects with chronic non-specific neck pain have increase in time of TUG than control group in all of condition. Interaction of group by cognitive difficulty was not

**Table 1: Demographic and functional characteristics of chronic neck pain and control groups. CNP: chronic neck pain, N/A: Not available**

Demographic data	CNP group(n=24)	Control group(n=24)	.P-value
Age (yr)	39.4 (6.9)	38.4 (7.9)	0.6
Height (m)	1.6 (.1)	1.6 (0.08)	0.38
Body mass index (kg/m <sup>2</sup> )	25.9 (3.5)	25.1 (3.6)	0.43
Time since disease (yr)	3.1 (2.7)	N/A	N/A
Neck disability index (scale 0–100)	32.6(2.7)	N/A	N/A

**Table 2: Time to complete, in seconds, by group and task. CNP: Chronic Neck Pain, TUG: Timed Up and go. The data are presented as Mean ( $\pm$ SD)**

	CNG group	Healthy group
TUG <sub>base</sub>	10.52(1.55)	9.05(1.34)
TUG <sub>easy</sub>	12.75(2.78)	10.54(1.67)
TUG <sub>difficult</sub>	13.40(3.03)	11.52(1.72)

**Table 3: Summary of analysis of variance of time taken complete of TUG for two groups: F-ratios and p-values**

Independent variable	Time to complete TUG	
	F-ratio	p-value
Main effect		
Group	11.28	<0.01
Cognitive difficulty	91.51	<0.01
Interaction		
Group $\times$ cognitive difficulty	2.05	0.24

significant and two groups have increase time in dual-task condition (Table 3). Because the mean number of uncorrected Stroop errors in all conditions never exceeded one ,we ignore it.

**DISCUSSION**

The results show patients with nonspecific chronic neck pain performed the experiment in longer period of time compared to healthy subjects. This may imply that in the performing of functional task, the patients group more likely act in a different way than the healthy individuals. It can be explained by walking consist of consecutive periods of balance and imbalance and during this process before the imbalance period that it led to falling, the patient must reach stability phase by taking another step and a new reaching surface substitute to prevent falling. It seems that slowing down of substitution may be a reason of increased timing period in TUG test in patients. Our findings are consistent with other studies which have reported gait problems in patients suffering from chronic neck pain<sup>6</sup>. Also, greater difficulty by performance TUG test in patients

this study in accordance with the results obtained in the study of TUG test in Parkinson, multiple sclerosis patients and elderly subjects<sup>23, 26-28</sup>.

Of other results of this study were increasing the amount of time of TUG test with increasing difficulty of cognitive task in two groups. This phenomena may be explained by allocating more attentional resource to difficult cognitive task than easy and no cognitive task and according to capacity sharing modal attention capacity is limit<sup>11</sup> and therefore persons need to reduce his or her speed for finding new surface to avert from falling.

There was no considerable difference in the performance of TUG test in dual-task condition in two groups. This is against to other studies in

adults with parkinson and stroke patients that they were slower under dual-task condition(16, 29, 30). It is recommended that for more orientation in this field more precise assessment by force plate is utilized.

In overall trend, The results of this study suggest that chronic neck pain lead to disturbance in TUG test and so it is suggested that functional mobility assessment and treatment this patients is considered in clinic and on based results of this study ,TUG is a simple clinical tools for assessment functional mobility subjects with neck pain that can be used. However, since addition the cognitive task did not affect functional mobility this patients, dual-task assessment of mobility by more difficult cognitive task is considered in future research.

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