Performance Stability of Timed Up and Go Cognitive (TUG-COG) Test in Healthy Adults of age 18 to 60 years: An Analytical Study

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Abstract

Background: TUG-cognitive is a modification of the Timed Up and Go test which is commonly used to examine balance and functional mobility in community-dwelling, frail older adults. While doing previous studies it was observed that, the TUG-COG performance keeps enhancing even after 3 trials. Thus, till when the practice effect lasts and which trial should be taken as a final reading for TUG-COG is yet unknown.

Methods:420 number of participants of age 18 to 60 years were asked to perform TUG-COG 10 times as per the pilot study findings. ANCOVA was used as a statistical analysis tool to analyse the performance stability of TUG-COG.

Results: Cognitive performance for TUG-COG improved in the 5th trial. Motor performance for TUG-COG improved after 3rd trial.

Conclusion: The 3rd trial should be recorded as the final trial for the motor component of TUG-COG or the best of 3 trials can be considered as the final reading. 4 practice trials should be given and the 5th trial should be considered as the final reading for the cognitive component of TUG-COG.

Keywords: *Performance Stability; TUG-COG*

1. Introduction

A fall is defined as an event which results in a person coming to rest inadvertently on the ground or floor or other lower level. [1] In elderly population, falls is the most common cause of injury. Most of these falls are associated with decreased dual-task performance.[2]

When an individual performs more than one task at the same time it is called as dual tasking. It requires good balance, coordination, attention and judgment.[2]

When the postural and cognitive tasks are performed simultaneously, there is a decrease seen in the performance of postural stability measures rather than cognitive measures. When postural stability is impaired, even simple cognitive task have an impact on balance. [3, 4, 5]

Timed Up and Go test is commonly used to examine balance and functional mobility in community dwelling, frail older adults. The test requires a subject to stand up, walk 3 m (10 ft), turn, walk back, and sit down. Time taken to complete the test is strongly correlated to level of functional mobility. [6]

The addition of a secondary task increases the time taken to complete the TUG by 22 to 25%. Simultaneous performance of a secondary task has a deleterious effect on functional mobility. [6, 7, 8, 9]

TUG-cognitive is a modification of Timed Up and Go test. It includes counting backwards in threes from a random start point while completing the Timed Up and Go test. [7] It has a specificity of 73.7% and sensitivity of 76.5%. [7] The test-retest reliability is excellent (0.98). the intra-rater reliability is also very high with an ICC of 0.94. [8]

Since, TUG-cognitive has a more sensitivity and specificity, hence it is commonly used to differentiate between fallers and non-fallers in elderly population. [10] It is commonly used in other conditions as well like Parkinson, Stroke, etc. [12, 13]

Usually, 3 timed trials are performed for TUG and the best performance amongst them is considered. [11]

While doing previous studies it was observed that the TUG-COG performance keeps enhancing even after 3 trials. Thus, till when the practice effect lasts and which trial should be taken as a final reading for TUG-COG is yet unknown.

Therefore, this study was performed to find out how many trials are needed to achieve performance stability in TUG-cognitive which will help to know the practice effect and thus help in getting the accurate reading of the test.

This study was done by assessing and comparing the performance of healthy adults from 1st to 10th repetition using ANOVA for motor and cognitive components of TUG-COG.

2. Materials and Methodology

The study design and procedure were approved by the ethics committee. The procedure was explained to the selected participants and after taking their consent, a demonstration of TUG and TUG-COG was given. 420 healthy adults (chosen after pilot study) of age 18 to 60 years, participants from both genders who were able to follow the commands were chosen. Any person with Neurological or Musculoskeletal problems, people with impaired cognition/speech were excluded. Participants were selected by convenience method. 10 repetitions of TUG-COG were taken with 1 minute break between each repetition. Both the motor and cognitive responses were recorded. Analysis was done using ANCOVA.

3. Results

Table 1 – Distribution of Participants as per Gender

Gender	Males	Females	Total
Number	166	254	420

Table 2 – Comparison of TUG-COG motor component score from trial 1 to trial 10

Trials	Mean time (seconds)	Std. Dev.	p value	Inference	Test used
1	8.013197619	1.493	0.1691	Not significant	Repeated Measures ANCOVA using Non parametric methods as the data did not pass normality
2	7.953833333	1.456			
3	8.509190476	**6.789**			
4	7.930166667	1.335			
5	7.909976191	1.247			
6	7.930380952	1.289			
7	7.943976191	1.297			
8	7.976071429	1.297			
9	7.972357143	1.284			
10	7.955452381	1.287			

Table 3 – Comparison of TUG-COG cognitive component score from trial 1 to trial 10

Trials	Mean accuracy (%)	Std. Dev.	p value	Inference	Test used
1	83.82845238	23.571	<0.0001	Significant	Repeated Measures ANCOVA using Non parametric methods as the data did not pass normality
2	85.0529761905	23.236			
3	84.9921428571	23.110			
4	**84.3191904762**	23.775			
5	89.355952381	20.905			
6	86.8378809524	22.048			
7	85.7701190476	22.895			
8	84.706047619	23.296			
9	86.3420238095	22.114			
10	84.8761666667	23.868			

Table 4 – Comparison between Accuracy scores from trial 1 to trial 10

Comparison	Rank Sum Difference	Inference	P value
Column A vs. Column B	-64.500	Not significant	P>0.05
Column A vs. Column C	-48.000	Not significant	P>0.05
Column A vs. Column D	-60.000	Not significant	P>0.05
Column A vs. Column E	-350.50 **	Significant	P<0.01
Column A vs. Column F	-171.00	Not significant	P>0.05
Column A vs. Column G	-120.50	Not significant	P>0.05
Column A vs. Column H	-57.500	Not significant	P>0.05
Column A vs. Column I	-118.00	Not significant	P>0.05
Column A vs. Column J	-60.000	Not significant	P>0.05
Column B vs. Column C	16.500	Not significant	P>0.05
Column B vs. Column D	4.500	Not significant	P>0.05
Column B vs. Column E	-286.00	Not significant	P>0.05
Column B vs. Column F	-106.50	Not significant	P>0.05
Column B vs. Column G	-56.000	Not significant	P>0.05
Column B vs. Column H	7.000	Not significant	P>0.05
Column B vs. Column I	-53.500	Not significant	P>0.05
Column B vs. Column J	4.500	Not significant	P>0.05
Column C vs. Column D	-12.000	Not significant	P>0.05
Column C vs. Column E	-302.50 *	Significant	P<0.05
Column C vs. Column F	-123.00	Not significant	P>0.05
Column C vs. Column G	-72.500	Not significant	P>0.05
Column C vs. Column H	-9.500	Not significant	P>0.05
Column C vs. Column I	-70.000	Not significant	P>0.05
Column C vs. Column J	-12.000	Not significant	P>0.05
Column D vs. Column E	-290.50 *	Significant	P<0.05
Column D vs. Column F	-111.00	Not significant	P>0.05
Column D vs. Column G	-60.500	Not significant	P>0.05
Column D vs. Column H	2.500	Not significant	P>0.05
Column D vs. Column I	-58.000	Not significant	P>0.05
Column D vs. Column J	0.000	Not significant	P>0.05
Column E vs. Column F	179.50	Not significant	P>0.05
Column E vs. Column G	230.00	Not significant	P>0.05
Column E vs. Column H	293.00 *	Significant	P<0.05
Column E vs. Column I	232.50	Not significant	P>0.05
Column E vs. Column J	290.50 *	Significant	P<0.05

Column F vs. Column G	50.500	Not significant	P>0.05
Column F vs. Column H	113.50	Not significant	P>0.05
Column F vs. Column I	53.000	Not significant	P>0.05
Column F vs. Column J	111.00	Not significant	P>0.05
Column G vs. Column H	63.000	Not significant	P>0.05
Column G vs. Column I	2.500	Not significant	P>0.05
Column G vs. Column J	60.500	Not significant	P>0.05
Column H vs. Column I	-60.500	Not significant	P>0.05
Column H vs. Column J	-2.500	Not significant	P>0.05
Column I vs. Column J	58.000	Not significant	P>0.05

4. Discussion

As seen in table 2, the performance stabilized after the 3rd trial for the motor component of TUG-COG. This is in accordance with the previous studies done on TUG test.[11,14] This could be due to the learning effect which occurred for the first 3 trials. After the 3rd trial the performance stabilized for a few trials after which it became inconsistent. This could happen due to reduced attention span and fatigue. Thus, while taking into consideration the motor component of TUG-COG, at least 3 trials should be given and the best of 3 should be selected as the final reading.

As seen in table 4, the accuracy of cognitive responses for each trial are compared by ANCOVA using non-parametric methods. It can be seen that there is a significant difference in reading of 1st and 5th trial for cognitive component of TUG-COG. After the 5th trial, the performance deteriorated and was inconsistent. The peak performance after 4 trials could be due to the Dual Task Practice Advantage phenomenon.[31] The deterioration and inconsistency of performance after 5th trial could be due to depletion of cognitive resources.

Performance stability of other performance tests like Star Excursion Balance Test and Postural control measurement has been reported previously. Accordingly, 4 practice trials are required for the Star Excursion Balance Test and 3 practice trials for postural control measurements during weight-shifting in healthy older adults.[11,27,32] Thus at least 3 trials should be recorded and best of 3 should be considered as the final recording for motor component of TUG-COG. For cognitive component of TUG-COG test, performance stability is achieved at 5th trial. Thus, 4 practice trials should be recorded and the 5th trial should be considered as the final reading for TUG-COG.

The limitations of this study were that the data was recorded in healthy adults. The data was collected in individuals' homes and outside in community, where the environmental distractions could not be avoided, thus standardization of task condition for all participants was not possible. Also, chances of manual error are increased as the same person was simultaneously calculating the motor task duration and noting down the cognitive responses.

In future, this study can be performed in standardised environment like Physiotherapy OPD. Data can be collected specific to age, gender and medical condition such as, Stroke, Parkinson's disease, etc. to further facilitate the analysis and proper result categorization.

5. References

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