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COMPARATIVE RELIABILITY OF TINETTI MOBILITY TEST AND TUG TESTS IN PEOPLE WITH NEUROLOGICAL DISORDERS.

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ABSTRACT

Background: In recent years, many tests have been developed to evaluate the mobility and functional capacity of people with neurological disorders (Hemiplegia, MS). The purpose of this study was to test the reliability and additionally to determine the measurement error of TMT and TUG in adults with neurological disorders (hemiplegia, MS).

Methods: In the study of tests 20 adults (11 with multiple sclerosis and 9 with hemiplegia) who were retrospectively registered participated. The average age of adults was 38.7 ± 13.9 years old and their average body mass was 65.1 ± 13.1 kg. The Greek version of the tests and a Nikon 5300 digital camera for video recording were used for data collection. ICC was calculated by means of a two-way ANOVA model.

Results: The results showed that there were no statistically significant differences between the two independent evaluators and that the TMT (ICC > 0,936) and TUG (ICC> 0,996) had strong reliability.

Conclusions: Overall, the results of the present investigation provided considerable evidence suggesting that the tests TMT and TUG are reliable and can be used to evaluate kinetic and balance disorders. Therefore, it was concluded that the tests should be applied to reliably estimate the mobility and functional ability of adults with neurological disorders.

Keywords: Reliability, TMT, TUG, Hemiplegia, MS

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INTRODUCTION

Hemorrhagic stroke is the third common cause of death in developed countries after heart disease (coronary artery disease) and cancer. Moreover, stroke is considered to be the most common cause of disability; people who have survived a stroke, about 50% will show a significant long-term disability. A stroke usually refers to the rapid appearance of neurological disorders (hemiplegia). The disorder may occur within a few seconds, although in other cases it is developed after hours or even days.

In Europe, about 2.5 million people are suffering from stroke every year, 60% of stroke cases are men, and 28% of all other cases occur in people under 65 years old. 25-50 % of the survivors of stroke have a significant degree of disability, resulting in lifelong dependence on others. The stroke is responsible for the10-12% (in Greece 18%) of total mortality in developed countries (Western Europe-USA), while about the 88% of stroke deaths occur in people over 65 years old (deaths are most common for men). In Eastern Europe (Bulgaria, Hungary), deaths have increased in the last two decades. In general, strokes increase significantly with age. Thus, while at the age of 20-40 years old, only three strokes per 100,000 population are observed per year, at the age of 70-90 years old 300 strokes are observed [1] (Haniotis & Haniotis, 2002).

However, the key factor that causes serious problems in Everyday Life Activities (ADL) is balance problems, which are the most common symptoms in patients with hemiplegia [2] (Tyson, Hanley, Chillala, Selley & Tallis, 2006).

Multiple Sclerosis (MS) is a degenerative neurological disease of unknown etiology that causes structural and morphological changes in the CNS, brain and spinal cord. It is characterized by demyelination of the nerve fiber sheath, altering its normal function, which results in changes in various systems of the human body. The disease is more common in women than in men (1.5-2 to 1). The most common age in which this disease appears is 20-30 years old, but the appearance of the disease is not uncommon in the 5th decade of age. Rarely the disease appears before the age of 15 years old and after the 60 years old [3] (Pugliatti et al., 2006).

Physical therapy should be implemented to increase muscle strength, improve physical fitness, to improve the balance to allow the patient to be independent. Many strategies have been proposed to evaluate movement and balance in people with central nervous system damage such as hemiplegia and multiple sclerosis. To evaluate the effectiveness of intervention programs for these diseases, relative tests have been established, which have been assessed for both their reliability and their validity. In the last decade, many balance tests such as Tinetti Gait and Balance Instrument (Tinetti) and Time Up and Go Test (TUG) have been developed [4] (Cattaneo, Regola & Meotti, 2006).

Tinetti test is a reliable and valid clinical test that assesses the balance and walk of elderly patients and other categories of patients. The test categories can be used separately or both at the same time. A well-supported chair, a stopwatch, and a 4.5 meter walkway are required for its application. Its duration is 15 minutes and the score is measured from 0, corresponding to a low level of independence up to 2 that corresponds to an average level of independence. Performance in the test is the sum of the scores of the two modules and represents the total score of the test. The maximum overall score is 28, the maximum score of the unity of the balance is 16 and the race at 12. Tinetti can predict the falls; in particular, those who score 19-24 out of 28 have a moderate risk of falling, and those who score <19 have a high risk of falling [5] (Kegelmeyer, Kloos, Thomas, & Kostyk, 2007).

TUG has been designed and used by Podsiadlo and Richardson on older people suffering from stroke, Parkinson's, arthritis and other cerebellar disorders. The TUG test counts in seconds the time it takes for a patient to get out of a standard chair with arms, walk 3 meters and return to it. The person being examined wears shoes typically. The patient first makes an effort to familiarize himself with the test without timing, and then on the second walk, he takes the timing of the test with a stopwatch. Although the researchers included hemiplegic and multiple sclerosis data of patients in statistical analysis, other more specialized investigations are needed to evaluate the reliability of the test on patients with neurological disorders [6] (Shamay, Ng & Hui-Chan, 2005).

The purpose of this study was to test the reliability and additionally to determine the measurement error of TMT and TUG in adults with neurological disorders (hemiplegia, MS.

METHODOLOGY

Participants

In the study of tests' reliability on individuals with neurological disorders (hemiplegia, multiple sclerosis), 20 adults (11 with multiple sclerosis and 9 with hemiplegia) participated. The average age of individuals was 38.7 ± 13.9 years old, and their average body mass was 65.1 ± 13.1 kg. A specialized neurologist examined all participants. They were also selected according to the continuous sampling method, while for simultaneous control of the reliability and determination of the measurement error, each test was applied to the individuals two consecutive times in two different days (T1 & T2), which timing between them was one day.

Instrument

The following measuring instruments were used in the research:

- Tinetti Mobility Test (TMT). TMT is a test that evaluates the balance and walking ability of patients. A well-supported chair, a stopwatch, and a 4.5-meter walkway are required for TMT application. Its duration is 15 minutes and the score is measured from

0 correspondings to a low level of independence up to 2 that corresponds to a normal level of independence.

The test's performance is the total score of two modules and represents the total score of the test. The maximum total score is 28, the maximum score for the balance test is 16 and the walk test is 12.

- Timed get up and test (TUG). The TUG test counts in seconds the time it takes for a patient to get out of a standard chair with arms, to walk 3 meters, and return to the chair. The person being examined wears shoes typically. Timing begins with the word "start," so the patient gets up from the chair and has to maintain a comfortable and safe pace of walking on a 3-meter long line, turn around, return to the chair and sit down again (timer stops).

PROCEDURE

The reliability of tests on patients with neurological disorders (hemiplegia, multiple sclerosis) before the research, the written consent of the individuals who participated in the research, was required. Initially, when each individual arrived at the measurement area was obliged to complete his/her sheet with demographic and somatometric data.

All measurements were taken in private physiotherapy practice. The main measurements were carried out in two days. At the first measurement (T1), the two assessment tests (TMT, TUG) were applied to each individual randomly. During TUG tests, each individual was told what to do, and then they were trying to familiarize themselves with the test. The test was then performed in 3 attempts from which the examiners counted the one with the best time score. The second measurement (T2) was taken one day after the first measurement (T1). The performance of individuals in each test was recorded on a special sheet, while for re-checking of the correct scoring, we used a JVC mini DV camera recording all individuals' attempts at all measurements. All tests were performed twice on two consecutive days.

Data analysis

To examine the reliability, we used the intraclass correlation coefficient (ICC) to check the reliability of the tests, while for the determination of measurement error of each test we calculated the square root of average squares of different (RMSdif) performances of each test in two different applications (T1 and T2).

RESULTS

The intraclass correlation coefficient (ICC) was used to check the reliability of the tests regarding the performance of each test in the two different measurements. We calculated the ICC, using a two-way ANOVA model, where ICC: means the intra-class correlation coefficient between the two measurements, MSs: means the average square between the measurements, MSi: means the average square of interaction between the measurements and the subjects. Also, we have calculated: a) The typical error or standard error of measurement; and b) typical percentage error or the coefficient of variation. In order, the test to be reliable intraclass correlation coefficient of the test scores in two consecutive measurements should be ICC> 0.80. Also, the typical error should be as small as possible, while the coefficient of variation should be less than 10%.

Table 1: Demographic data of patients who participated in the research

NAME	AGE	WEIGHT	HEIGHT	DIAGNOSIS
S1	48	63	164	HEMIPLEGIA
S2	58	80	183	HEMIPLEGIA
S3	49	63	169	MS
S4	38	78	175	MS
S5	42	85	165	MS
S6	50	70	160	MS
S7	18	30	150	HEMIPLEGIA
S8	42	70	176	HEMIPLEGIA
S9	31	77	176	HEMIPLEGIA
S10	69	62	160	HEMIPLEGIA
S11	18	56	161	HEMIPLEGIA
S12	33	56	173	MS
S13	61	80	173	HEMIPLEGIA
S14	34	55	157	MS
S15	25	70	170	MS
S16	29	65	150	MS
S17	30	45	160	MS
S18	34	57	163	MS
S19	26	70	188	MS
S20	40	70	170	HEMIPLEGIA

Table 2: Average rate (± SD) performance of the two tests TMT, TUG.

Performances	1ST Measurement	2nd Measurement
TMT	19.70 ± 6.72	19.00 ± 6.48
TUG	18.94 ± 14.57	19.07 ± 14.73

Table 3: Intraclass correlation coefficients (ICC), differences at % (RMSdif), typical error (SEM), and coefficient of variation (CV%) of individuals' performance in TMT and TUG during the two measurements.

Performances	ICC	RMSdif (%) (mean±SD)	SEM	CV% (mean±SD)
TMT	0,936	5.87 ± 8.77	1.59	6.11 ± 9.82
TUG	0,996	2.93 ± 2.34	0.98	3.32 ± 2.49

* p<.001

Table 2, 3 shows excellent reliability of the tests.

TMT and TUG tests showed very good reliability in all their performances.

DISCUSSION

The results of the research showed that the tests were of high reliability in a patient with Hemiplegia and MS for TMT scale (ICC = 0.936, SEM=1.59) and TUG scale (ICC = 0.996, SEM=O.98). The results of the research are due to that the procedure was very well structured. A rigorous evaluation protocol was followed while the patients were at approximately the same functional level and all tests were performed twice on two consecutive days. The results of the research are in line with the findings of [7] [Blum & Korner-Bitensky, (2008); [8] Craven et al. (2010); [9] Deb et al. (2007); [10] Hui-Fen et al. (2002); [11] Learmonth et al., (2012) and [12] Noureddin et al., (2008)].

The results of the TUG test in adults with neurological disorders (Hemiplegia, MS) showed great reliability. In particular, the scores were ICC = 0.996, RMSdif (%) (mean ± SD) = 2.93 ± 2.34 with a typical error of 0.98 and coefficient of variation CV% = 3.32 ± 2.49; these findings are in line with findings mentioned in similar studies such as [10] [Hui-Fen et al., (2002) with ICC >0.95; [13] Bohannon et al. (2005) with ICC> 0.80, this study confirm those of other previous studies that support the reliability of the TUG test among cognitively intact individuals.; [14] Ellinor et al., (2006) with ICC> 0.90, sample were people with ADL living in nursing and the results showed that the cognitive level was not related to the reliability of th ; [15] Britt et al., (2007) with ICC> 0.99 ; [16] and Botolfsen et al., (2008) with ICC> 0.97, they investigated the reliability of TUG in elderly people with motor problems, the standard error was 2.8, Cronbach's alpha was 0.74. Therefore, the TUG test was highly reliable and can be used in research with people with motor problems].

As regards Tinetti test the scores were ICC = 0.936 MSdif (%) (mean ± SD) = 5.87 ± 8.77, with a typical error of 1.59 and a coefficient of variation CV% = 6.11 ± 9.82. The findings are in line with findings mentioned in similar studies such as [9] Deb Kegelmeyer et al., with ICC> 0.80 in 2007, they investigated Tinetti's reliability and validity as a fall predicted tool for people with Parkinson's disease. The results showed that the interrater and intrarater reliability were good to excellent. Tinetti's sensitivity to determine falls was 76% and 66% of the Unified Parkinson's Disease Rating Scale, respectively. TMT was a reliable and valid tool for assessing the mobility status and the risk of falling for people with Parkinson's.

CONCLUSIONS

During the research for the reliability of tests on patients with neurological disorders, TMT and TUG tests were found reliable in evaluating the movement and functionality in patients suffering from hemiplegia and multiple sclerosis. It should be noted that for the TMT test, the assessment time was about 20 minutes for each patient. On the contrary, the time for the TUG test was 3 minutes for each patient; however, it was difficult for some patients to return and sit on the chair due to high spasticity and imbalance. In conclusion, more research shall be carried out in the future on other patients with insufficient centralization to evaluate the reliability of the above tests. The TMT and TUG tests are reliable; they can be used to evaluate movement and functionality of people with neurological disorders.

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