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Review Article

Relationship between the six-minute walk test and the two-chair test in young adults: a brief review

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ABSTRACT

As a useful submaximal exercise test for determining functional capacity in cardio-respiratory disorders, the six-minute walk test (6MWT) has gained recognition. But its practical limitations—such as the requirement for a 30-meter corridor and time constraints—present difficulties, particularly for people with restricted mobility. As a quick and effective substitute, the Two Chair Test (2CT) is suggested and assessed in this study. The integrated physiological responses from several exercise-related systems are captured by the sub-maximal character of the 2CT and 6MWT. The 2CT examines post-exercise changes in PR and SpO2 for two minutes in a unique way, while the 6MWT primarily measures distance. The effectiveness and dependability of the 2CT will be verified using standard physiological assessment metrics from cardiopulmonary exercise testing. To summarise, the objective of this research is to thoroughly verify the Two Chair Test, investigate any potential associations with the Six-Minute Walk Test, and evaluate the effects of the test on arterial oxygen saturation and heart rate. The possible consequences encompass providing a more easily available, effective, and targeted substitute for evaluating functional capacity in various healthcare environments.

Keywords: Oxygen saturation, Pulse rate, Six minute walk test, Two chair test

INTRODUCTION

A common submaximal exercise test in the field of cardio-respiratory disorders is the six-minute walk test (6MWT).[1] When assessing physical activity in patients with chronic respiratory diseases, the 1 6MWT is a useful tool for interpretation. Unlike previous cardiology exams, this one is simple, reliable, and used to examine everyday activities in great detail.[2] A person's functional capacity is their ability to carry out everyday tasks that call for a continuous aerobic metabolism. An individual's ability to perform is determined by the state of their skeletal muscular, cardiovascular, and pulmonary systems as a whole. Cardiopulmonary exercise tests are frequently used to measure maximum oxygen consumption (VO2max) directly in order to determine functional capability. However, as most daily tasks don't call for maximum effort, the phrase "functional capacity" can also refer to a person's ability to carry out submaximal tasks. Thus, functional capacity may also be evaluated using physical performance tests such as the timed get up and go test, shuttle walk test, and 6-minute walk test (6MWT).Clinical practice uses the 6MWT extensively since it is simple to use and doesn't require any specialized equipment. The 6MWT is now known for its wider potential to predict capacity for functioning in all persons, despite its initial design for use with elderly or rehabilitative patients. Walker speed, standing balance, and mobility-related function have all been found to be associated with the 6MWT thus far.[3] It has been established that the test can predict mortality in cases of primary pulmonary hypertension, heart failure, and chronic obstructive pulmonary disease (COPD). Pre-treatment and post-treatment comparisons in heart failure, COPD, lung surgery, pulmonary hypertension and pulmonary rehabilitation have all shown it to be beneficial.[2] The most popular test for determining functional capacity in a clinical setting, the 6-minute walk test (6MWT) has been

validated for use with youth. However, several logistical challenges have been identified, including a 30-meter corridor and time constraints (20–25 minutes for the entire test). In addition, testing individuals with severely limited movement may not always be possible with the 6MWT. Six-minute walking distances, or 6MWD, are the distance traversed during the process, and they represent the general physiological reaction to exercise As a result, it is not a cardio-respiratory exercise test designed specifically to assess a subject's capacity or debility when they exhibit signs of cardiopulmonary compromise. Additionally, the exam necessitates a clear path of more than 100 feet within. In many cases, this still poses a logistical challenge.[1]

To complement the 6-minute walk test (6MWT), which requires a 100-foot corridor to complete, a quick and effective exercise test that can be completed in a short space is desirable. The suggested two-chair test (2CT) requires a subject to go between two chairs that are positioned face-to-face at a distance of five feet five times. The subject is then instructed to record changes in arterial oxygen saturation (SpO2) and pulse rate (PR) every 10 seconds for the next two minutes. The effects of the two-chair test on PR and SpO2 after exercise are repeatable and comparable to those of the 6-minute walk test. This new test seems to be more specific to cardiopulmonary reserve as well.

It Is hypothesised that the two chair test may be correlated with the 6MWT and, as such, a useful alternative for evaluating the functional capacity of young adults, particularly as a substitute test for patients with limited capacity to function, since both the 6MWT and the sit to stand tests are considered physical performance tests.[3] Before adopting it, it is necessary to compare the results of two chair tests with the 6MWT. A strong comparability must be interpreted as the test's "acceptability."

The sub-maximal nature of the 6MWT and the two chair test allows for the integration of the global physiological response of all exercise-related systems, including the circulatory, pulmonary, heart, haematological and neuromuscular systems. But although 6MWT records the distance travelled, 2CT accounts for changes in PR and SpO2 that occur after exercise for a duration of two minutes. Therefore, the two chair test must be validated using the typical physiological evaluation criteria of the cardiopulmonary exercise test.[3]

A comprehensive literature search was conducted using databases such as PubMed, Scopus, and Google Scholar. Keywords used in the search included "timed sit-to-stand test," "Six-Minute Walk Test," "physical performance," "functional capacity," "COPD," "knee osteoarthritis," and "healthy young adults." Articles published from (insert year range, e.g., 2000 to 2024) were included to ensure that recent and relevant studies were captured.

Table 1: Summary of studies conducted on relationship between the six-minute walk test and the two-chair test in young adults.

Authors Journal Year	Objective	Design	Characteristics of the participants sample size	Methods	Outcome measures	Results	Limitation / future research suggested
Hulya Nilgun Gurses et al in 2018[1]	The relationship of sit-to-stand test with 6-minute walk test in healthy young adults.	Cross-sectional study	Among 57 volunteers aged between 18 and 25,40 volunteers (20 females, 20 males) were eligible	All participants performed the 6MWT and the STS tests (10sSTS, 30sSTS, and 60sSTS tests) consecutively on the same day. The order of the 6MWT and STS tests and the order of the STS subtests were determined by a random draw. A 30 minute rest period was given between the 6MWT and	Fatigue and shortness of breath were rated using Borg category-ratio scale (CR10) before and after each test.	The study found weak correlation between the 10sSTS test and the 6MWT, while the 30s and 60s STS tests showed moderate correlation. Comparative analysis revealed no significant difference, suggesting no advantage of one STS test over another in predicting the 6MWT. This implies that even the less physically demanding	correlation results in the present study could not be compared to a similar aged population because in the literature STS studies generally include elderly population or broad age range groups. Future studies should

Continued.

Authors Journal Year	Objective	Design	Characteristics of the participants sample size	Methods	Outcome measures	Results	Limitation / future research suggested
				the STS tests. Five minute intervals were given between each STS test		10sSTS may offer evidence-based data on functional capacity.	analyze these correlations in healthy young adults and the young individuals with diseases that may affect the functional capacity.
Syed Tabish Rehman et al in 2019[2]	correlation of sit to stand test with six-minute walk test in chronic obstructive pulmonary disease patients	Cross-sectional study	Overall, 100 patients aged 40 to 70 years of either gender having moderate to severe COPD	The STST and 6MW Test was performed and compared with each other and with COPD Assessment Test (CAT).	Correlation between STST and 6MWT distance and FEV1 in COPD patients	In COPD patients, the functional capacity can be assessed through STST instead of 6 MW Test having the same results	The study has been done in a small number of patients in a single setup; therefore results may be different in multicenter studies.
Pathasarathi Bhattacharyya et al in 2020[3]	Two chair test: a substitute of 6 min walk test appear cardiopulmonary Reserve specific.	Cross-sectional study	A total of 40 and 60 volunteers were included for testing reproducibility and acceptability	The proposed two chair test (2CT) makes a person to sit and move five times between two chairs placed face to face at 5 feet apart and note the changes in pulse-rate (PR) and arterial oxygen saturation (SpO2) at every 10 s for 2min after that. Comparison of the post-exercise measurements (PR and SpO2) with a repeat performance in same patients was done for reproducibility	Pre and Post Oxygen saturation (SpO2) and Pulse rate (PR) were measured.	The proposed 2CT demands small space and appears reproducible and comparable with 6MWT in terms of its post-exercise impact on PR and SpO2. This novel test also appears more of cardiopulmonary reserve specific.	Limitation of this study is that, this test demands further validation in different disease states.

Continued.

Authors Journal Year	Objective	Design	Characteristics of the participants sample size	Methods	Outcome measures	Results	Limitation / future research suggested
				and doing the same after 6MWT and 2CT in another set of patients was meant for for acceptability			
Stephen Gill et al in 2022[4]	thirty second chair stand test: test–retest reliability, agreement and minimum detectable change in people with early-stage knee osteoarthritis.	Prospective test-retest reliability and agreement study.	A test–retest reliability study was performed with 93 people with mild radiological knee OA	Participants were asked to complete three attempts of the 30 CST 1–2 min apart according to a standardised protocol. Participants completed three attempts on two occasions: baseline and 6 months later.	Pre and Post Oxygen saturation (SpO2) and Pulse rate (PR) were measured. Change between tests within each session was assessed with ANOVA's and post-hoc t-tests. Reliability was assessed with intra-class correlation coefficients (ICC[2,1]). Measurement error was expressed as MDC for an individual (MDCind) and a group (MDCgroup). Floor effects were considered present if more than 15% of participants scored zero for a test.	The 30 CST is a recommended performance-based outcome measure for people with knee OA, but it's clinimetric properties have received little research attention. The current study is the first to assess score stability across three tests. Test scores demonstrated excellent test-retest reliability with ICCs(2,1) > 0.9. To exceed measurement error and demonstrate 'real change', an individual's score needs to change by at least 2.5 stands and a group's score needs to change by at least 0.3–0.4 stands.	They did not objectively assess pain, fatigue or motivation during the testing procedure and are uncertain how these factors influenced results.

DISCUSSION

The present review synthesized evidence from multiple studies to evaluate the relationship between various sit-to-stand (STS) tests and the Six-Minute Walk Test (6MWT) across different populations, including healthy young adults, patients with chronic obstructive pulmonary disease (COPD), and individuals with knee osteoarthritis (OA). The findings highlight the potential of STS tests as a practical alternative to the 6MWT for assessing functional capacity and physical performance.

Correlation between STS tests and 6MWT

The review found that the 10-second STS test (10sSTS) exhibited a weak correlation with the 6MWT, while the 30-second and 60-second STS tests (30sSTS and 60sSTS) demonstrated moderate correlations. Despite the

differences in correlation strength, the comparative analysis indicated no statistically significant advantage of one STS test over another in predicting the results of the 6MWT. This suggests that all three STS tests, regardless of duration, can provide valuable data on an individual's functional capacity.[1]

Interestingly, the weaker correlation observed with the 10sSTS test implies that while it is less physically demanding, it may still offer reliable evidence on functional capacity, particularly in populations where longer-duration tests may not be feasible due to physical limitations or safety concerns. The moderate correlations found in the 30sSTS and 60sSTS tests further reinforce their utility in clinical and non-clinical settings as alternatives to the more resource-intensive 6MWT.1

Implications for COPD patients

In patients with COPD, the STS test demonstrated a strong correlation with the 6MWT, supporting its use as a reliable alternative for assessing functional capacity in this population. The study conducted in Jinnah Hospital, Karachi, revealed that the STS test, particularly the 30sSTS, could be used instead of the 6MWT without compromising the assessment's accuracy. Given the practicality of the STS test, which requires minimal space and time, it offers a significant advantage in clinical settings where the 6MWT may not be feasible due to space constraints or patient limitations.

The findings also suggest that the STS test could be an effective tool in monitoring disease progression and treatment response in COPD patients. The correlation between the STS test and the COPD Assessment Test (CAT) score further supports the STS test's role in comprehensive COPD management.

The moderate positive correlation between the STS test and the 6MWT distance, as well as the CAT score, indicates that the STS test not only reflects physical performance but also correlates with the perceived impact of COPD on a patient's life.

Two chair tests (2CT) as a novel alternative

The proposed Two Chair Test (2CT) emerged as a promising alternative to the 6MWT, particularly in settings where space is limited. The 2CT, which involves moving between two chairs placed five feet apart, was shown to be reproducible and comparable to the 6MWT in terms of its impact on post-exercise pulse rate (PR) and arterial oxygen saturation (SpO2).

The test's design, which focuses on cardiopulmonary reserve, makes it particularly relevant for populations with compromised respiratory or cardiovascular function. The 2CT's potential lies in its simplicity and ease of administration, making it a valuable tool for assessing functional capacity in diverse populations, including those with limited mobility or those in environments with space constraints. However, further research is needed to fully establish the 2CT's validity and reliability across different populations and to compare its performance with established tests like the STS and 6MWT.[3]

Reliability of the 30-second chair stand test (30CST) in Knee OA patients

The 30-Second Chair Stand Test (30CST) demonstrated excellent test-retest reliability in individuals with knee OA, as evidenced by intra-class correlation coefficients (ICCs) greater than 0.9. This high reliability underscores the 30CST's utility as a performance-based outcome measure in clinical trials and routine practice for knee OA patients. The observed practice effect between the first and second tests, where scores initially improved before stabilizing or slightly decreasing, highlights the importance of familiarizing patients with the test protocol to obtain consistent and accurate measurements. Moreover, the minimum detectable change (MDC) analysis revealed that a change of at least 2.5 stands is required to exceed measurement error and reflect a 'real change' in an individual's performance. For group-level assessments, a change of 0.3-0.4 stands is sufficient to detect meaningful differences. These findings provide clinicians and researchers with critical thresholds for interpreting changes in 30CST performance, ensuring that observed improvements or declines are clinically significant.[4]

Clinical and research implications

The findings of this review have important implications for both clinical practice and research. The STS tests, particularly the 30sSTS and 60sSTS, offer practical and accessible alternatives to the 6MWT for assessing functional capacity in various populations. Their moderate correlation with the 6MWT suggests that they can be used interchangeably in settings where time, space, or patient limitations restrict the use of the 6MWT. For COPD patients, the STS test's strong correlation with the 6MWT and CAT score makes it a valuable tool for monitoring disease progression and guiding treatment decisions. The 2CT presents an innovative approach that warrants further investigation, particularly for use in space-constrained environments or with populations that have limited mobility.

While this review provides valuable insights, several limitations must be acknowledged. The variability in study designs, populations, and test protocols across the included studies may introduce heterogeneity, potentially affecting the generalizability of the findings. Additionally, the review primarily focused on correlation analysis, which does not establish causality. Future research should aim to explore the causal relationships between STS tests, the 6MWT, and functional capacity across different populations.

Further studies are also needed to validate the 2CT and to compare its performance with established tests like the STS and 6MWT in diverse clinical settings. Longitudinal studies assessing the predictive value of these tests for long-term outcomes, such as hospitalization and mortality, would also be valuable in solidifying their role in clinical practice.

CONCLUSION

In conclusion, the STS tests, particularly the 30sSTS and 60sSTS, offer practical and reliable alternatives to the 6MWT for assessing functional capacity in various populations, including healthy young adults and COPD patients. The 2CT presents a novel alternative that requires further validation but shows promise in space-constrained environments. The 30CST has proven to be a reliable measure for assessing functional capacity in knee OA patients, with clear thresholds for detecting meaningful change. These findings support the broader use of STS tests in clinical practice and highlight the need for further research to explore their full potential.

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