



IJCRR

Section: Healthcare

Sci. Journal Impact

Factor: 6.1 (2018)

ICV: 90.90 (2018)

Scopus*

A Reliability Study of Shuttle Walk Test on Field and Treadmill in Healthy Individuals – Are the Responses Interchangeable?

Sayli D. Rane¹, Razia Nagarwala², Ashok Shyam³, Parag Sancheti⁴

¹Post Graduate Student; ²HOD, Cardiorespiratory Physiotherapy Department, Sancheti College of Physiotherapy; ³MD Orth, Sancheti Institute of Orthopaedic and Rehabilitation Centre; ⁴Chairperson, Sancheti Institute of Orthopaedic and Rehabilitation Centre.

ABSTRACT

Background: In healthy individuals, to achieve a favourable physical training response and enable the appropriate prescription of physical activities, functional physical capacity should be established. Shuttle walk test (SWT) is a standardized incremental field walking test which provokes a symptom-limited maximal performance and provides an objective measurement of disability and allows direct comparison of the individual performance.

Objective: To examine responses of SWT on the field and treadmill in healthy individuals.

Materials and methods: A reliability study was conducted to examine the responses of SWT performed on the field and on the treadmill for age group 18 – 50 yrs of both gender.

Result: Outcomes measured were distance covered, VO₂ max, HR, BP, RPE (6-20) after performing shuttle walk test on field and on treadmill. The distance covered between the 2 tests shows no correlation with insignificant p-value and with poor reliability (Cronbach's α : 0.221) whereas the other responses shows good correlation.

Conclusion: Shuttle walk test carried on field can be interchangeably used with SWT on treadmill in case of a healthy individual.

Key Words: Field, Shuttle walk test, Treadmill, VO₂ max

INTRODUCTION

Inactive lifestyle results in the development of chronic disabling conditions such as diabetes, obesity, coronary artery disease, and hypertension, which becomes the primary cause of mortality. To prescribe, monitor, and evaluate exercise programs, a reliable and valid exercise assessment is required¹

In the development of individual exercise programs, cardio-respiratory fitness assessment, be it maximal or submaximal plays an important role. There are a number of laboratory and field-based tests currently used for the assessment of exercise capacity. Incremental shuttle walk test is an externally paced (*i.e.* walking speed is dictated to the patient) in which there is a gradual increase in speed and useful for quantifying the benefits of the walking program designed for healthy individuals and appears to induce a maximal exercise response that is appropriate for assessing exercise capacity and for designing a walking program.² The American College of Sports

Medicine (ACSM; 1995) generally recommends exercising at a minimum intensity of 60% of maximal HR (50% of VO₂ max or HR reserve) for improving cardio respiratory endurance. In the treadmill test, there is an increase in the speed and inclination. Thus, as compared to field test we can appreciate the relative physiological demands required to assess cardio-respiratory responses.

Shuttle walk test is usually carried on the field which determines maximal performance but requires larger area and individual needs to judge pace correctly, whereas if the same test protocol is performed on a treadmill, speed will be fixed on the treadmill so that individual need not judge the speed. It will require less space and can be monitored efficiently. In addition, the need for continuous monitoring and oxygen supplementation in some of these patients makes performing the test difficult.³

Hence, the aim of the study is to assess whether the responses on the shuttle walk test carried in the corridor and on the treadmill are the same.

Corresponding Author:

Sayli D. Rane, Post Graduate Student.
Email: saylirane@hotmail.com

ISSN: 2231-2196 (Print)

ISSN: 0975-5241 (Online)

Received: 18.10.2019

Revised: 23.11.2020

Accepted: 04.12.2020

Published: 22.07.2020

MATERIALS AND METHODS

This reliability study was conducted on 30 patients of either sex, age between 18 to 50 years in physiotherapy OPD. Ethical clearance was received from the institutional ethical board and informed consent was obtained from the patients before the start of the study. Subjects with BMI <35kg/m² and a confirmatory PARQ and YOU questionnaire were included. Subjects having locomotor disability or any cardiovascular and pulmonary disorders were excluded. Subjects were randomly allocated to either perform the test first on the treadmill or in the corridor with the chit method. They were asked to perform SWT on the field which is a 10 m standardized incremental externally paced test developed by Singh and colleagues² and then on the next day (washout period of 24 hrs) they were asked to perform the same protocol on the treadmill.

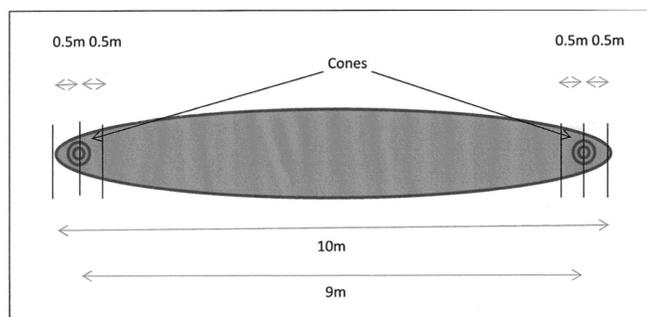


Figure 1: Layout of the modified shuttle walking test⁴

Pre-test and post-test vital parameters [blood pressure (BP), heart rate (HR), respiratory rate (RR), oxygen saturation (SpO₂), Rate of perceived exertion (RPE) (using 6-20 scale) and maximal oxygen uptake (VO₂ max)] were measured and recorded. The recovery of vital parameters was also monitored and recorded. VO₂ max was calculated using an equation, $VO_2\max = [(0.0289) (\text{distance in feet}) + 17.46]^5$ which is validated.

For statistical analysis, data were entered into a Microsoft excel spreadsheet and then analysed by SPSS 16.

RESULTS

Distance covered, VO₂max and RPE were measured after performing a shuttle walk test carried on the field and on the treadmill.

DISCUSSION

The evaluation of functional capacity is important to determine the responses to treatment and tolerance of exertion for an individualized prescription of physical exercise.

Maximal cardiopulmonary exercise testing (CPET) by direct analysis of VO₂max is the gold standard used to evaluate physical capacity, but it is an expensive method. The incremental shuttle walking test (ISWT) is a simple, external-paced test that evaluates exercise capacity⁶. Thus, there is often a need to determine functional capacity using a simple, widely available, and economically feasible test. In the present study, the ISWT on a treadmill proved to be a safe, simple, easy-to-administer, and viable test for the evaluation of functional capacity in individuals. We found that there is a difference between the distance covered on the field and on the treadmill with mean values 808m and 776m, respectively ($r = 0.437$, $p\text{-value} = 0.016$) with significant p -value but with poor reliability. If we compare walking on the ground to that on the treadmill, we have more dorsiflexion movement, larger hip extension movements and we use our hamstrings more⁶.

The VO₂ max achieved while performing a shuttle walk test on the field is similar to that achieved on the treadmill with mean values 97.40ml/kg/min and 93.84ml/kg/min respectively. The Rating of Perceived Exertion (RPE) is a self-assessment scale to rate breathlessness and fatigue during physical activity. In the present study⁷, we found out that rating of perceived exertion after completing shuttle test in the corridor and then on the treadmill to be highly reliable (Cronbach's alpha: 0.856) depicted in table 2. Significantly correlating with each other ($r = 0.748$, $p = 0.000$)

During exercise, the increase in intensity results in an increase in HR and a reduction in HR variability. Vagal modulation of HR disappears almost completely at approximately 50 to 60% oxygen uptake at the end of incremental exercise (peak VO₂); thereafter, the increase in HR is mainly mediated by sympathetic activation.⁸ In the present study, the participants showed resting HR at 78bpm before performing a shuttle walk test in the corridor and resting HR at 80bpm before performing a shuttle walk test on the treadmill. In the present study, there is a good correlation ($r = 0.808$, $p = 0.000$) between heart rate measured immediately after completing the shuttle walk test both on the field and on the treadmill.

There was no difference seen in arterial blood pressure with respect to systolic blood pressure (SBP) between the two measures of the same test (SWT on the field and on the treadmill). In both the tests protocol SBP was increased with mean of 132mm Hg (Resting SBP was 118mm Hg) on field and 128mm Hg (Resting SBP was 120mm Hg) on the treadmill. With respect to blood pressure they showed significant correlation ($r = 0.802$, $p = 0.000$). Normally during exercise, blood pressure increases to push the flow of oxygen-rich blood throughout the body⁹.

CONCLUSION

With the results of the study, we conclude that the shuttle walk test carried on field can be interchangeably used with a shuttle walk test carried on the treadmill in case of a healthy individual.

Acknowledgement: Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Conflict of interest: None

Financial support: None

REFERENCES

1. Stork, M., Novak, J., and Zeman, V. (2016). Cardiopulmonary exercise testing for vo2max determining in subjects of different physical activity. *Lékař a technika-Clinician and Technology*, 46(4), 91-101.
2. Singh, S. J., Morgan, M. D., Scott, S., Walters, D., and Hardman, A. E. (1992). Development of a shuttle walking test of disability in patients with chronic airways obstruction. *Thorax*, 47(12), 1019-1024.
3. Stevens, D., Elpern, E., Sharma, K., Szidon, P., Ankin, M., and Kesten, S. (1999). Comparison of hallway and treadmill six-minute walk tests. *American journal of respiratory and critical care medicine*, 160(5), 1540-1543.
4. Woolf-May, K., and Meadows, S. (2013). Exploring adaptations to the modified shuttle walking test. *BMJ open*, 3(5), e002821.
5. Lindsay, T. R., Noakes, T. D., and McGregor, S. J. (2014). Effect of treadmill versus overground running on the structure of variability of stride timing. *Perceptual and motor skills*, 118(2), 331-346.
6. Meyer, T., Welter, J. P., Scharhag, J., and Kindermann, W. (2003). Maximal oxygen uptake during field running does not exceed that measured during treadmill exercise. *European journal of applied physiology*, 88(4-5), 387-389.
7. Woolf-May, K., and Meadows, S. (2013). Exploring adaptations to the modified shuttle walking test. *BMJ open*, 3(5), e002821.
8. Dourado, V. Z., and Guerra, R. L. F. (2013). Reliability and validity of heart rate variability threshold assessment during an incremental shuttle-walk test in middle-aged and older adults. *Brazilian Journal of Medical and Biological Research*, 46(2), 194-199.
9. Bousquet-Santos, K., Soares, P. P. S., and Nóbrega, A. C. L. (2005). Subacute effects of a maximal exercise bout on endothelium-mediated vasodilation in healthy subjects. *Brazilian journal of medical and biological research*, 38(4), 621-627.

Table 1: Demographic details of participants

	Mean	Standard deviation
Age	23.13	±1.55
Weight (kg)	58.76	±7.27
Height (m)	1.58	±0.09
BMI (kg/m ²)	23.09	±2.53

Table 2: Reliability coefficient

	Field	Treadmill	Cronbach's alpha
Distance	776.66 ± 215.66	808.47 ± 138.74	0.221
VO ₂ max	97.41 ± 12.93	93.84 ± 13.34	0.942
RPE	14.16 ± 10.33	1.64 ± 0.71	0.856

Table 3: Correlation coefficient

	Field	Treadmill	r value	p value
Distance	776.6 ± 215.66	808.47 ± 138.74	0.437	0.016
VO ₂ max	97.41 ± 12.93	93.84 ± 13.34	0.942	0.000
RPE	14.16 ± 10.33	1.64 ± 0.71	0.748	0.000
SBP	132 ± 7.2	128 ± 4.71	0.808	0.000
Heart rate	131 ± 9.04	124 ± 10.85	0.808	0.000