

Original Research Article

## Comparison between Incremental Shuttle Walk Test (ISWT) and 6 Minute Walk Test (6MWT) to Assess Vital Parameters, Peak VO<sub>2</sub> and RPE in COPD Patients

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### ABSTRACT

Field walking tests such as 6 minute walk test and incremental shuttle walk test are used in pulmonary rehabilitation as assessment tools for exercise capacity as well as outcome measures in pulmonary rehabilitation program. Study design was cross sectional observational study with 30 subjects was selected having mild COPD (stage 1) according to GOLD criteria for COPD. 6 minute walk test and incremental shuttle walk test were performed in one day with 30 minutes of interval between the two tests. 10 minutes of warm up and cool down was given to the patient. Pre and post heart rate, respiratory rate, blood pressure, RPE and peak vo<sub>2</sub> were taken for both the tests. When both the tests were compared, there was significant change between diastolic B.P, respiratory rate and rate of perceived exertion in ISWT as compared to 6MWT. Parameters which were not found to be changed are systolic B.P, heart rate and peak VO<sub>2</sub>. Present study concluded that either of the two tests can be used for COPD patients as there was not much significant change in vital parameters, vo<sub>2</sub> peak and RPE of the tests.

**Keywords:** COPD, 6 minute walk test, Incremental shuttle walk test.

### INTRODUCTION

Diseases of respiratory system are major causes of illness affecting population worldwide. [1] COPD is a disorder characterized by the presence of airflow obstruction that is generally progressive accompanied by airway hyperactivity and may be partially reversible. Exercise limitation is a prominent complaint in patients with chronic obstructive pulmonary disease. The reduction in exercise tolerance is due to different factors: abnormal lung mechanics (e.g. airflow limitation or dynamic hyperinflation), inefficient pulmonary gas exchange, peripheral muscle weakness, abnormal oxygen transport and energy production in exercising muscle. [2] COPD is a major

cause of morbidity and mortality across the globe. [3] Several epidemiological studies have addressed the prevalence of COPD in India. [3] WHO estimates 65 million people have moderate to severe COPD. It kills more than 3 million people every year and it has been estimated that by the year 2030, COPD will become the third biggest cause of death. [3] As laboratory assessment is not widely available and may be expensive and intimidating to the patient, field tests of walking ability are often used. [1] 6MWT is self paced & ISWT is an externally paced, field tests. The tests are safe, reliable and inexpensive. [4] Distance walked during field walking test has been used to indicate the disability, to prescribe the intensity of a walking programme and to assess outcome

following rehabilitation. <sup>[1,5]</sup> 6 MWT is a self paced ,time limited walk test used to evaluate functional status in COPD patients. It can be continuous or intermittent depending on whether the subject rests during the test. <sup>[6]</sup> The degree of therapist's encouragement can be crucial in setting walking speed. <sup>[6]</sup> Such self-paced tests may provide an imprecise estimate of functional capacity, since they are subject to the effects of mood and encouragement. <sup>[11]</sup> ISWT is an externally paced and requires an incremental increase in walking speed each minute on audio beep to a point at which the test is terminated because of breathlessness or the inability to sustain the walking speed. <sup>[7]</sup> It is a symptom limited walk test, less influenced by the therapist encouragement. <sup>[6]</sup> It is a tool to assess functional capacity in patients with COPD. <sup>[7]</sup> It is fast and easy to administer. It is widely known that pulmonary rehabilitation can improve exercise tolerance and consequently the quality of life and daily living. <sup>[5,8]</sup> The ISWT is externally paced and requires an incremental increase in walking speed each minute, to a point at which the test is terminated because of breathlessness or the inability to sustain the walking speed. <sup>[12]</sup> The ISWT is a simple and reliable test that evaluates domains of exercise capacity other than those evaluated by the 6MWT. <sup>[9,13]</sup> To date, mostly 6 min walk test is used clinically to assess the functional capacity, the incremental shuttle walk test which also assess the same outcomes but which is not frequently used. <sup>[10]</sup> However, there is no consensus about which test is the most appropriate or use in patients with COPD. <sup>[14]</sup> In spite of being field tests, In comparison with ISWT, 6MWT is the most frequently used, so the study was undertaken to see the response of vital parameters, peak VO<sub>2</sub>& RPE to both field tests.

## **MATERIALS AND METHODS**

Aim of the study was to compare between ISWT and 6MWT to assess vital parameters, peak VO<sub>2</sub> and RPE in COPD patients. Objectives were to find out vital parameters, peak vo<sub>2</sub>, RPE in 6MWT,to find out vital parameters, peak VO<sub>2</sub>, RPE in Incremental shuttle walk test and then to find out the changes from baseline in systolic blood pressure, heart rate, respiratory rate, dyspnoea Borg index, VO<sub>2</sub> peak at the end of the test. Study design was Cross Sectional Observational Study conducted in SKNMC & GH, IPD and OPD setup of pulmonary medicine department with 30 male and female COPD patients between age of 35-70 years for the duration of 3 months. Sampling was done by convenient sampling. Subjects having any co morbid conditions like, acute cardiovascular disease (acute MI, IHD etc.), musculoskeletal disorders, neurological disorders were excluded from the study. Materials used for the study were stop watch, B.P apparatus, Borg index scale, Measuring tape, Two small cones, Chair, Pen, paper, Shuttle walk test kit including audio signal.

Ethical committee approval was taken. Permission from HOD of chest department was taken. Patients were selected having mild COPD i.e stage 1 of GOLD, COPD criteria (forced expiratory volume (FEV<sub>1</sub>) numbers at less than 80% of normal). <sup>[15]</sup> After taking written consent from the patients, medical history was taken and checked for contraindications to exercise testing was done. Patient's usual medications were kept continued. Patients were allowed to wear comfortable clothes and footwear. Patients were given prior instructions, not eat anything at least one hour before the test. Both the tests were performed in one day (30 minutes interval between both the test was given). Warm up of 10 minutes was given before the test. The study procedure was explained in detail to the patient. Patients were instructed to stop the test in between or

take rest if they experience shortness of breath, giddiness, leg cramps etc. Vital parameters (B.P, heart rate, respiratory rate), RPE and VO<sub>2</sub> peak were recorded before and after the test. Both the tests were performed in a spaced out corridor. As per ATS (American thoracic society) guidelines, 6 minute walk test was performed and B.P, respiratory rate, heart rate and VO<sub>2</sub> peak, RPE and was calculated. Mean VO<sub>2</sub> peak (ml/kg/min) – 4.948+ 0.023\*mean 6MWD (meters). [16] Incremental shuttle walk test was conducted according to the international standardization. The test was performed in

a 10meter course identified by two cones placed 0.5m from each point. Patient was asked to walk (or run) around the course according to the speed dictated by an audio signal. The initial walking speed is 0.5m/sec and it increased by 0.17m/sec each minute. The speed increment was always indicated by a triple beep. The audio signals continued until patients reach their maximal effort. Formula for calculating by Turner et al in 2004 VO<sub>2</sub> peak=6.82+ (0.02\* distance SWT) was used. [7]

**Statistical analysis:** Statistical analysis was done using paired T test.

## RESULT

**Table no.1: Comparison between pre and post vital parameters and RPE in 6 minute walk test**

Serial. no	Variable	T statistics	Degree of freedom	P value
1	Systolic B.P (mmHg)	-9.479	29	<0.0001
2	Diastolic B.P (mmHg)	-1.316	29	0.1999
3	H.R (beats per minute)	-20.310	29	<0.0001
4	R.R( breaths per minute)	-12.434	29	<0.0001
5	RPE	-29.773	29	<0.0001

**Table no.2: Comparison between pre and post vital parameters and RPE in incremental shuttle walk test**

Serial no.	Variable	T statistics	Degree of freedom	P value
1	Systolic B.P (mmHg)	-11.282	29	<0.0001
2	Diastolic B.P (mmHg)	1.227	29	0.230
3	H.R (beats per minute)	-20.403	29	<0.0001
4	R.R (breaths per minute)	-21.062	29	<0.0001
5	RPE	-33.463	29	<0.0001

**Table no.3: Comparing vital parameters, peak vo2 and RPE between 6MWT and ISWT.**

Serial no.	variable	Test statistics	Degree of freedom	P value
1	Systolic B.P (mmHg)	-1.841	58	0.071
2	Diastolic B.P (mmHg)	2.184	58	0.033
3	H.R (beats per minute)	-1.454	58	0.151
4	R.R (breaths per minute)	-4.416	58	<0.0001
5	RPE	-2.804	58	0.007
6	Peak vo2	1.789	58	0.079

In 6MWT, p value for systolic B.P 9(mmHg), heart rate (beats/min), respiratory rate (breaths/min) and rate of perceived exertion is <0.0001 which was highly significant. P value for diastolic B.P (mmHg) was 0.1999 which was not significant.

In ISWT, p value for systolic B.P (mmHg), heart rate (beats/ min), respiratory rate (breaths/min) and rate of perceived exertion is <0.0001 which was highly significant. P value for diastolic B.P (mmHg) was 0.230 which was not significant.

When both the tests were compared, there was significant change between diastolic B.P (mmHg), respiratory rate (beats/min) and rate of perceived exertion in ISWT as compared to 6MWT. Parameters which were not found to be statistically significant were systolic B.P (mmHg), heart rate (beats/min) and peak VO<sub>2</sub>.

## DISCUSSION

Heart Rate is one of the objective parameters in determining the cardiorespiratory responses. [1,17] 6MWT and ISWT when performed individually

there was significant change found in heart rate, respiratory rate, blood pressure, peak vo2 and RPE. The increased heart rate during both the test is mainly because of vagal withdrawal and increase sympathetic tone. During 6MWT and ISWT when performed individually, there was no significant change in diastolic B.P as it is specifically the minimum arterial pressure during relaxation and dilatation of the ventricles of the heart when the ventricles fill with blood so we do not expect much change in diastolic B.P. When both the test were compared it showed that there was no significant difference between systolic B.P, HR & peak VO2. According to the previous studies, there was no significant difference in peak heart rate (Sains Malaysiana et al in 2010) [21] which is consistent with this study also. But study conducted by Reshma et al showed that there was significant change in heart rate and blood pressure when performed 6MWT and ISWT. In the present study, we observed that the 6MWT and ISWT evoked equivalent peak HRs and dyspnea responses. While this finding is consistent with those of two other reports, [18,19] it contrasts with the findings of an earlier study by Singh et al, [20] who showed that HR and dyspnea were lower in 9 of their 15 subjects during the 6MWT than during the ISWT. Greater cardiorespiratory stress in response to ISWT compared to 6MWT has been described by some authors. [21-23] Many of the studies showed that only a small portion of the patients with COPD were ready to exercise themselves to a level at which the intensity of the symptoms were maximal.(Killian et al, 1992). [24] Systolic B.P, heart rate and peak VO2 are not found to be significantly different in spite of ISWT being externally paced. This may be because many of the patients did not walk to their maximum level due to dyspnoea and as there is reduced lung functional capacity in COPD patients. 6MWT was more familiar than ISWT hence there was increased learning

time during ISWT than in 6MWT which induced same walking capacity. As patients did not walk maximally there was no significant difference in peak VO2, systolic B.P and even heart rate. The finding that peak HR and dyspnea were similar among the two tests suggests that the ISWT and 6MWT are not only strenuous, but can provide a valid measure of exercise capacity in patients with COPD

## CONCLUSION

Based on the study findings, it was concluded that either of the two tests can be used for COPD patients as there is not much significant change in vital parameters, VO2 peak and RPE of the tests. As these both the tests are simple, requiring little technology, with good reproducibility and reduced cardiopulmonary risk, both can be used clinically to assess COPD patients. In future, same study can be conducted after implementation of exercise programme to see the responses of vital parameters, peak vo2 and RPE in COPD patients. Small sample size was the limitation of the study.

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