

# Evaluation of Exercise Tolerance in South Indian COPD Population Using 5 Sit to Stand Test (5STS) vs. 6 Min Walk Test (6 MWT)

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## ABSTRACT

**Background:** Sitting to standing is a common activity of daily living. The five-repetition sit-to-stand test (5 STS) is a test of lower limb function that measures the fastest time taken to stand five times from a chair with arms folded. 5 STS is reliable, correlates with exercise capacity and quadriceps strength and is responsive to PR in COPD but the data in chronic obstructive pulmonary disease (COPD) populations are lacking.

**Aims:** The primary objective of this study was to analyze the exercise tolerance of south Indian COPD population using 5 STS patients. The secondary objective was to analyze and compare the course of exercise tolerance measured by 5 STS and 6 MWT in COPD

**Methods:** All COPD patients were evaluated for dyspnea and cardio respiratory stress tolerance level and the sample size has been divided into two groups, group A underwent recording of exercise tolerance by performing 6 MWT and group B perform 5 STS. Then these patients received conventional cardio respiratory techniques for 4-5 min per session and 2-3 times per day for six weeks. Responsiveness was determined by measuring 5 STS, 6 MWT patients.

**Conclusions:** The 5 STS is reliable, valid and responsive in patients with COPD. It is a practical functional outcome measure suitable for use in COPD patients.

## Keywords

COPD patients; Pulmonary rehabilitation; Exercise tests

## Introduction

Chronic obstructive pulmonary disease (COPD) is a lung disease marked by extra pulmonary manifestations and an increased risk of disability and death pulmonary rehabilitation helps in improvement of dyspnea, exercise tolerance, and quality of life [1-3]. Exercise tests are commonly used to measure exercise tolerance of patients with COPD. Cardiopulmonary exercise testing (CPET) allowing investigation of the pathophysiological mechanisms is responsible

for exercise intolerance [2]. CPET requires various expensive equipments. However, there is an exercise test that is reliable and valid in measuring the exercise tolerance of south Indian population. The 6-min walk test (6 MWT) is a validated test for most chronic lung diseases; it is easy to perform and does not require any specific equipment [4]. 6 MWT must be performed in an unobstructed 30 m hallway, but such a space is rarely available in the patient's home or in respiratory medicine departments [5]. A recent study has however proposed performing the 6

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MWT over a distance of 10 m. On the other hand, the 6 MST consists of a self-paced test performed on a step with fixed dimensions and it is considered a simple and effective alternative because it requires less physical space in addition to being portable; however, 6 MST requires limited amount of space and equipment to evaluate exercise tolerance [6-8].

To overcome these technical and spatial limitations, there is a need for reliable physical performance tests that are easy and quick to perform in most clinical settings, including the bedside. 5 STS – Sit to Stand Test has been proposed. The Sit-to-Stand (STS) maneuver is a common activity of daily living. Variations of the STS maneuver have been adapted as functional performance measures, including time taken to perform a given number of STS manoeuvres or the maximum number of STS maneuvers in a given time period, usually 30 or 60s [4,7-9]. These have been shown to correlate well with other objective physical performance measures such as 6MWT in healthy older community-living populations [9]. The five-repetition STS test (5 STS), which measures the time taken to stand five times from a sitting position as rapidly as possible, is the best described STS test in older adults. But there is scarce data collection in COPD populations. 5 STS is feasible, easy to perform, sensitive, well tolerated, and reproducible in COPD patients [6].

### ■ Statement of Problem

This study was carried out to evaluate the exercise tolerance in south Indian COPD patients using Five Sit to Stand Test *vs.* Six minute walk test.

### ■ Objective

The primary objective of this study was to analyze the exercise tolerance of south Indian COPD population using 5 STS patients. The secondary objective was to analyze and compare the course of exercise tolerance measured by 5 STS and 6 MWT in COPD.

### Methodology and Materials

Following tools were used to evaluate the patient's response.

- Wooden chair with back rest
- Countdown timer (or) stopwatch
- Two small cones to mark the turnaround points

- A wheel chair that can be easily moved along the walking course
- Worksheets on a clipboard
- Oxygen cylinder
- Stethoscope
- Measuring Tape
- Sphygmomanometer
- Automated electronic defibrillator

### ■ Methodology

**Study design:** The study design was Quasi Experimental design.

**Sample size:** Total 30 patient were selected.

**Duration of the study:** The study was conducted over a period of 6 months.

**Sampling:** The patients were collected by convenient sampling.

### Inclusion criteria

- All stable Chronic Obstructive Pulmonary Disease patients of age 45-65 years.
- Both male and female patients.

### ■ Exclusion criteria

- Patients with tachycardia
- Exertional dyspnea
- Exertional chest pain
- Unstable angina
- Resting heart rate >120
- Systolic BP >180 mm Hg
- Diastolic BP >100 mm Hg
- Osteoarthritis
- Rheumatoid arthritis
- Lower Extremity Edema and surgery
- Musculoskeletal pain
- Morbid obese person

### ■ Parameters

The following parameters are assessed for analysis of the outcome.

- Time taken to complete 5 complete sit to stand – using 5STST, baseline and after 6 week.
- Dyspnea – Using visual analogue scale.

### ■ Statistical tools

For using the above said tools, data were collected from Quasi Experimental study. Then related 't' test was performed to know the significant changes.

The 't' values are calculated using dependent 't' test formula.

$$t = \frac{d' \sqrt{n}}{s}$$

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

### ■ Technique

All the patients were evaluated for dyspnea and cardio respiratory stress tolerance level and the sample size has been divided into two groups, group A underwent recording of exercise tolerance by performing 6MWT and group B perform 5STS. Then these patients received conventional cardio respiratory techniques for 4-5 min per session and 2-3 times per day for six weeks.

### ■ Measurements

Repeat testing should be performed about the same time of the day to minimize intraday variability. A "warm-up" period before the test should not be performed. Before beginning the test, check for contraindication, measure pulse, Blood pressure, baseline dyspnea and fatigue using visual analogue scale, saturation of % of oxygen (spo2) using pulse oximetry. For 6 MWT, set the lap counter to zero and the timer to six minutes. Instruct the patient like "You have to walk back and forth around the cones for 6 min". Measure the distance in meters. For 5 STS, Measurements were made in A straight-backed armless chair with a hard seat was stabilized by placing it against a wall. Floor to seat height was 48 cm. Seated participants were asked to come forward on the chair seat until the feet were flat on the floor and to fold their upper limbs across the chest. Participants were then instructed to stand up all the way and sit down once without using the upper limbs. For those unable to complete the initial manoeuvre or who required assistance, the test was terminated. If successful on the initial sit to stand, participants were then asked to stand up all the way and sit down landing firmly, as fast as possible, five times without using the arms [7]. Timing with a stopwatch was started on the command 'go' and stopped at the end of the completed fifth stand; the time taken was

recorded as the participant's score. Congratulate the patient for good effort, for safety issues. Testing should be performed in a location where a rapid, appropriate response to an emergency is possible. Supplies that must be available include oxygen, sublingual nitroglycerine, aspirin and albuterol (metered dose inhaler or nebulizer). A telephone or other means should be in place to enable a call for help. The technician should be certified in cardiopulmonary resuscitation [10]. If a patient is on chronic oxygen therapy, oxygen should be given at their standard rate or as directed by the physician or according to the treatment protocol.

### Discussion

Clinical presentation of Chronic Obstructive Pulmonary Disease is the decreased functional activities and decreased exercise tolerance, which is having an influence on ADL. Hence there is a need to evaluate their exercise tolerance and perceived exertional rate to improve the quality of life. In this study 5 STS and six minute walk test was used as an evaluation procedure for COPD patient to evaluate their exercise tolerance here are obvious advantages to the 5 STS as an assessment tool in COPD. First, it is quick to perform and our data suggest there is no learning effect. This contrasts with the 6 MWT and the ISW, both of which require repeat walks with adequate rest between tests (usually 30 min) [2,3]. Second, the 5 STS is cheap to perform with easily available equipment (chair and stopwatch). Third, the test requires only limited space, which makes it feasible in most healthcare settings including the home setting. Based on the findings, 15 patients participated in GROUP A has completed six minute walk test was evaluated in the stable clinical background, 80% of patients in Group A had completed six minute walk distance (6MWD) without any dyspnea and about 20% of the patients had impairments which is prominent in their VAS score and Walking distance. 15 patients in Group B had completed 5 STS, 95 % of patients in Group B had completed five sit to stand test without any dyspnea and about 5% of the patients had limitations which is prominent in their VAS score. The obtained dependent 't', values for Rate of perceived exertion was 6.34 and dependent 't' value for five sit to stand test was 10.01 for the level of significance  $P = 0.05$ . In **Table 1**, value with 14 degree of freedom at  $P = 0.05$ . Hence the obtained dependent 't' values were greater than table value (**Tables 2-4**).

**Table 1: Visual Analogue Scale of Group A.**

S. No	Pre test	Post test	d
1	1	3	2
2	2	3	1
3	3	5	2
4	1	3	2
5	3	4	1
6	0	1	1
7	2	3	1
8	2	3	1
9	1	3	2
10	3	4	1
11	0	3	3
12	3	4	1
13	0	1	1
14	1	2	1
15	2	3	1

**Table 2: Six Min Walk Distance (In Meters).**

S. No	Pre test	Post test	d
1	200	225	25
2	215	230	15
3	100	120	20
4	110	135	15
5	195	210	15
6	120	130	10
7	205	220	15
8	285	305	20
9	215	225	10
10	210	230	20
11	290	300	10
12	100	105	5
13	195	210	15
14	320	335	15
15	290	305	15

**Table 3: Visual Analogue Scale of Group B.**

S. No	Pre test	Post test	d
1	1	3	2
2	1	3	2
3	2	5	3
4	1	5	4
5	1	4	3
6	0	2	2
7	1	2	1
8	2	4	2
9	1	5	4
10	2	4	2
11	1	3	2
12	3	4	1
13	0	2	2
14	1	3	2
15	2	4	2

**Table 4: Group- B: 5 STS Test (In Seconds).**

S. No	Pre test	Post test	d
1	30	15	15
2	40	20	20
3	20	15	5
4	60	30	30
5	30	25	5
6	30	15	15
7	40	20	20
8	30	15	15
9	25	20	5
10	50	30	20
11	40	20	20
12	30	25	5
13	35	20	105
14	40	20	30
15	90	35	15

## Conclusion

Based on the result obtained, there is significant improvement in the functional activity of COPD patients who underwent formal training by six minute walk test, 5 Sit to Stand test along

with visual analogue scale for rate of perceived exertion. Hence the 5 STS is reliable, correlates with exercise capacity and quadriceps strength and is responsive to PR in COPD. It is a practical functional outcome measure suitable for use in most healthcare settings.

## References

1. Spruit MA, Polkey MI, Celli B, *et al.* Predicting outcomes from 6-minute walk distance in chronic obstructive pulmonary disease. *J. Am. Med. Dir. Assoc* 13(3), 291–297 (2012).
2. American Thoracic Society. ATS statement: guidelines for the six-minute walk test. *Am. J. Respir. Crit. Care Med* 166(1), 111–117 (2002).
3. Singh SJ, Morgan MD, Scott S. Development of a shuttle walking test of disability in patients with chronic airways obstruction. *Thorax* 47(12), 1019–1024 (1992).
4. Dall PM, Kerr A. Frequency of the sit to stand task: an observational study of free-living adults. *Appl. Ergon* 41(1), 58–61 (2010).
5. Bohannon RW. Body weight-normalized knee extension strength explains sit-to-stand independence: a validation study. *J. Strength Cond. Res* 23(1), 309–311 (2009).
6. Lord SR, Murray SM, Chapman K, *et al.* Sit-to-stand performance depends on sensation, speed, balance, and psychological status in addition to strength in older people. *J. Gerontol. A. Biol. Sci. Med. Sci* 57(8), M539–M543 (2002).
7. Bohannon RW. Reference values for the five-repetition sit-to-stand test: a descriptive meta-analysis of data from elders. *Percept. Mot. Skills* 103(1), 215–222 (2006).
8. Jones CJ, Rikli RE, Beam WC. A 30-s chair-stand test as a measure of lower body strength in community-residing older adults. *Res. Q. Exerc. Sport* 70(2), 113–119 (1999).
9. Ozalevli S, Ozden A, Itil O, *et al.* Comparison of the sit-to-stand test with 6 min walk test in patients with chronic obstructive pulmonary disease. *Respir. Med* 101(2), 286–293 (2007).
10. Schaubert KL, Bohannon RW. Reliability and validity of three strength measures obtained from community-dwelling elderly persons. *J. Strength Cond. Res* 19(3), 717–720 (2005).