Online Supplement

Saving Time for Patients with Moderate to Severe COPD: Endurance Test Speed Set Using Usual and Fast Walk Speeds

Thomas E. Dolmage, MSc,[1,2] **Dmitry Rozenberg, MD,**[1,3] **Nina Malek,**[1] **Rachael A. Evans, MBChB, PhD,** [3,4] **Roger S. Goldstein, MD**[1,2,3]

1   Department of Respiratory Medicine, West Park Healthcare Centre, Toronto, Canada

2   Respiratory Diagnostic & Evaluation Services, West Park Healthcare Centre, Toronto, Canada

3   Department of Medicine, University of Toronto, Canada

4   Department of Infection, Immunity and Inflammation, University of Leicester, United Kingdom

Summary of pilot study

After approval (Joint Bridgepoint/West Park/Toronto Central CCAC/Toronto Grace Health Centre Research Ethics Board (REB # 2011-46), we conducted a retrospective chart review including all patients with chronic lung disease, many but not all with COPD, who were assessed using a constant speed walk test at West Park Healthcare Centre between April 2009 and September 2011 and who had also had s_{usual} and s_{fast} measured during the same assessment. The individual's s_{test} and t_{limit}, from the control walk, were extracted from test records. Patient demographics, pulmonary function and recent 6 minute walk test (6MWT) distance were retrieved from clinical records. The average speed during the 6MWT (s_{6MWT}) was calculated.

In these clinical assessments, the speed of the constant speed endurance test (s_{test}) had been guided by the patient's most recent s_{6MWT} and the walk test was repeated if it could not be tolerated for greater than 1 minute or if it was insufficiently intense to result in symptom progression. For the constant speed endurance test, the participant followed a test administrator, guided by an audio signal, who walked on a marked floor at the pre-selected speed.[1] The audio signals were separate custom-made mp3 recordings for a range of speeds (34 speeds from 25 to 107.5 meters per min at 2.5 meters per min increments) created

using computer programs to generate (Viewdac v2.2) and record (StepVoice Recorder v1.0 beta; freeware). Endurance time (t_{limit}) occurred when the patient, despite encouragement, could not maintain their s_{test}.

The s_{usual} and s_{fast} were measured in these assessments to provide context for interpreting the endurance test. To measure these speeds, the patient walked unaccompanied on a level, enclosed, temperature controlled corridor. They were instructed to "walk at your usual pace until you reach the far pylon and return at a speed you consider to be fast." Usual and fast speeds were calculated over the middle 10 m of the 20 m at each speed.

In order to understand the relationship between the speed of the constant speed walk test (s_{test}) which was chosen from the 6MWT and the s_{usual} and s_{fast} we used the following equation:

$$(\text{equation } 1)$$

$$\text{relative test speed (\% high intensity domain)} = 100 \times \frac{s_{test} - s_{usual}}{s_{fast} - s_{usual}}$$

Based on observations that the s_{usual} approximated the sustainable walk speed ($s_{critical}$) and that a fast speed, on average, could be endured for 4 minutes (the point at which the fast speed intersected the speed to endurance curve),[1] we predicted the t_{limit} using:

$$t_{predicted} = \frac{4 \times (s_{fast} - s_{usual})}{s_{test} - s_{usual}} \qquad (\text{equation } 2)$$

Control walk tests, breathing air, from the records of 48 patients were analyzed. Twenty-five (52%) of 48 were men. Their age was 70 [11] years and body mass index was 24.7 [6.2] kg·m^{-2}. At the time of assessment, 18 patients used ambulatory oxygen at home and 17 used a rollator. Thirty-seven (77%) had a primary diagnosis of COPD. Others patients had pulmonary

sarcoidosis (3), pulmonary fibrosis (4), thoracic restrictive disease (2), bronchiectasis (1) and obesity hypoventilation syndrome (1). Four tests were redone at a slower speed because the first was not tolerated for greater than 1 minute and 10 tests were redone at a faster speed because the first was insufficiently intense to result in a significant progression of symptoms. In 43 (90%) of the reported tests, the speed selected from the 6MWT fell within the usual to fast walk domain. There was a moderate correlation between t_{limit} and the chosen speed expressed as a percent of the usual to fast domain (r=0.34; p=0.02) whereas it was negligible between t_{limit} and the chosen speed expressed as a percentage of the 6MWT (r = 0.08; p=0.62) as well as the usual (r=0.18; p=0.23) or fast (r=0.26; p=0.07) speeds on their own. Eighty percent of the measured t_{limit} fell within 6 minutes of the targeted t_{limit}. There were no significant correlations between the predictive agreement and individual characteristics such as disease severity.

We observed that an equation that incorporated s_{usual} and s_{fast} could predict the t_{limit} achieved by patients with chronic lung disease in a high-intensity constant-speed endurance test.

References:

1. Dolmage TE, Evans RA, Hill K, Blouin M, Brooks D, Goldstein RS. The effect of pulmonary rehabilitation on critical walk speed in patients with COPD: A comparison with self-paced walks. *Chest.* 2012;141(2):413-419.