

Chronic Obstructive Pulmonary Disease

Clinical Exercise Testing Recommendations, Procedures, and ACSM Guidelines for the COPD Patient

Test Type	Mode	Protocol Specifics	Clinical Measures	Clinical Implications	Special Considerations
Cardiorespiratory	Treadmill or cycle ergometer (preferred) 6 min walk Incremental and endurance shuttle walk	<ul style="list-style-type: none"> Duration of 8-10 min (5-9 min in severe and very severe COPD), small incremental increases in workload and slow progression individualized to the patient Treadmill: 1-2 METs per stage Cycle ergometer: unloaded cycling for 3 min followed by ramped protocol 5, 10, 15, or 20 W/min, stage protocol Constant work rate protocols for treadmill or cycle ergometer testing Field walking tests can be either self-paced or externally paced and conducted over a predetermined time or distance 	<ul style="list-style-type: none"> HR, 12-lead ECG (Mason-Likar placement) BP RPE, rating of perceived dyspnea, and leg fatigue using the modified 0-10 category-ratio Borg scale Oxygen saturation (pulse oximetry/arterial PaO₂) Ventilation measures and gas exchange Blood lactate Distance Duration Power output Inspiratory capacity Walking distance 	<ul style="list-style-type: none"> Serious dysrhythmias, >2 mm ST-segment depression or elevation, ischemic threshold, T-wave inversion with significant ST change SBP >250 mmHg or DBP >115 mmHg Maximum ventilations, VO_{2peak}, lactate/ventilatory threshold Note rest stop distance or time, dyspnea index, vitals 	<ul style="list-style-type: none"> Arm ergometer testing results in increased dyspnoea, which may limit the intensity and duration of exercise. Clients with COPD often have coexisting CAD. Breathing pattern and inspiratory capacity manoeuvres may help identify COPD patients with dynamic hyperinflation. Lactic acidosis may contribute to exercise limitation in some patients. Exercise should be terminated in the event of severe arterial oxyhaemoglobin desaturation ≤80%. Exercise testing in mid- to late afternoon is desirable. Constant work rate cycle ergometer testing is useful for measuring improvements in physiological and exercise performance responses following therapeutic interventions. Constant work rate treadmill testing is useful for evaluating the effects of inhaled bronchodilators on exercise endurance. Walk testing may be more suitable in severe COPD.

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Muscular strength and endurance	<ul style="list-style-type: none"> • Isokinetic, isotonic, or both • Sit-to-stand • Stair climb–descent • Lifting • Push-up • Curl-up 	<ul style="list-style-type: none"> • Cable tensiometers • Handgrip dynamometers • Repetition maximum (RM) 	<ul style="list-style-type: none"> • Peak force development or maximum voluntary contraction • Maximum number of reps without rest • Time to 10 reps • Absolute 1RM or multiple RM • Duration of static contraction before fatigue 		<ul style="list-style-type: none"> • Clients may become more dyspnoeic when lifting objects (teach appropriate breathing strategies for lifting). • Specific evaluation and training may be needed. • 10RM-15RM within the appropriate training recommendations may be more appropriate in COPD.
Flexibility	<ul style="list-style-type: none"> • Sit-and-reach • Goniometry • Gait analysis • Balance 	Hip, hamstring, and lower back flexibility	<ul style="list-style-type: none"> • ROM • Furthest distance reached with fingertips on sit-and-reach test 		<ul style="list-style-type: none"> • Body mechanics, coordination, and work efficiency are often impaired.

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Exercise Test Responses in Patients with COPD Compared with Normal Healthy Subjects

Parameter	Finding
Peak work rate	Decreased
Peak oxygen consumption	Decreased
Peak heart rate	Decreased
Peak ventilation	Decreased
Heart rate reserve	Increased
Ventilatory reserve	Decreased
Arterial partial pressure of oxygen	Decreased
Arterial oxygen saturation	Decreased
Lactate threshold	Occurred at a lower work rate
Ventilatory threshold	Decreased or absent
Ventilatory equivalent for carbon dioxide	Increased
Leg fatigue	Increased
Dyspnoea	Increased
Inspiratory capacity	Decreased

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Dynamic hyperinflation	Increased
Breathing frequency	Increased
Tidal volume	Decreased