

ORIGINAL RESEARCH ARTICLE

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Effects of breathing maneuver and sitting posture on muscle activity in inspiratory accessory muscles in patients with chronic obstructive pulmonary disease

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Abstract

Background: To determine the influence of breathing maneuver and sitting posture on tidal volume (TV), respiratory rate (RR), and muscle activity of the inspiratory accessory muscles in patients with chronic obstructive pulmonary disease (COPD).

Methods: Twelve men with COPD participated in the study. Inductive respiratory plethysmography and surface electromyography were used to simultaneously measure TV, RR, and muscle activity of the inspiratory accessory muscles [the scalenus (SM), sternocleidomastoid (SCM), and pectoralis major (PM) muscles] during quiet natural breathing (QB) and pursed-lips breathing (PLB) in three sitting postures: neutral position (NP), with armm support (WAS), and with arm and head support (WAHS).

Results: Two-way repeated-measures analysis of variance was employed. In a comparison of breathing patterns, PLB significantly increased TV and decreased RR compared to QB. Muscle activity in the SM and SCM increased significantly in PLB compared to QB. In a comparison of sitting postures, the muscle activity of the SM, SCM, and PM increased in the forward-leaning position.

Conclusions: The results suggest that in COPD, PLB induced a favorable breathing pattern (increased TV and reduced RR) compared to QB. Additionally, WAS and WAHS positions increased muscle activity of the inspiratory accessory muscles during inspiration versus NP. Differential involvement of accessory respiratory muscles can be readily studied in COPD patients, allowing monitoring of respiratory load during pulmonary rehabilitation.

Keywords: Forward-leaning position, Inspiratory accessory muscles, Pursed-lips breathing, Quiet natural breathing, Sitting postures

Background

Breathing training [1] and a sitting posture with a forward-leaning trunk [2] have been advocated as therapeutic interventions in patients with chronic obstructive pulmonary disease (COPD) to relieve dyspnea and improve pulmonary function. Previous studies suggested that pursed-lips breathing (PLB) increased tidal volume (TV) [3] and reduced respiratory rate (RR) [4] in patients with

COPD. Additionally, PLB has been shown to lead to increased rib cage movement and accessory muscle recruitment during inspiration and expiration in patients with COPD [5].

Relief from dyspnea is often experienced in patients with COPD by assuming a forward-leaning position [2]. Sitting with a forward-leaning trunk and resting the forearms on the thighs is a modified position for relaxation in chest physical therapy [6-10]. A previous study indicated increased end-expiratory level and active expiration in sitting with a forward-leaning trunk compared to sitting leaning back [11]. In addition to the forward-leaning position, placing the head and neck in proper

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