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Title: Effects of phasic electrical stimulation during expiration in elderly patients with chronic obstructive pulmonary disease: A randomised control trial

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Body: Background: The objective of this study was to shed light on the effects of phasic electrical stimulation during expiration (PESE) on ventilatory function during exercise in patients with chronic obstructive pulmonary disease (COPD). Methods: Twenty-four patients with COPD were randomised to either a sham group or a PESE group in a double-blind controlled study. Ventilatory functions (minute ventilation, tidal volume, respiratory rate, inspiratory time and expiratory time), oxygen saturation and the rate of perceived exertion (Borg scale) were measured at rest (5 min) and during exercise (5 min) before and after the intervention of both sham and PESE groups. A total of four electrodes were placed on the abdominal muscles. The stimulation protocols of sham consisted of square pulse at 25Hz, duty cycle of 10 s on and 10 s off, pulse time of 200 μs. The stimulation protocols of PESE consisted of square pulse at 20Hz, duty cycle of during expiration on and during inspiration off, pulse time of 200 μs. Results: Data obtained from 23 (12 from the electrical stimulation group and 11 from the sham group) of 24 patients with COPD were analysed. PESE improved tidal volume (sham: 1085.0 → 1237.0 ml, p = 0.075 vs PESE: 1104.0 → 1403.0 ml, p = 0.015) and respiratory rate (sham: 21.6 → 19.3 n/min, p = 0.061 vs PESE: 20.2 → 16.9 n/min, p = 0.028) during exercise. Oxygen saturation and the rate of perceived exertion (Borg scale) during exercise did not significantly change with PESE. Conclusion: This study indicates an improvement in ventilatory function due to PESE, which may be useful for rehabilitation of elderly patients with COPD.