"You can leave your mask on": effects on cardiopulmonary parameters of different airway protection masks

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Topic(s):
Exercise Testing

Background: During the current COVID-19 pandemic, the use of protective masks is essential to reduce contagions. However, public opinion reports an associated subjective shortness of breath. We aimed to evaluate cardiorespiratory parameters, both at rest and during maximal exertion, to highlight any differences with the use of surgical masks and FFP2 masks compared to standard conditions in healthy subjects.

Methods: Twelve subjects underwent three consecutive cardiopulmonary exercise tests (CPETs): without wearing protection mask, with surgical mask and with FFP2 mask (Figure 1). Subjects’ degree of dyspnea was assessed by Borg Scale. Standard pulmonary function tests were performed at rest.

Findings: All the subjects (40.8±12.4 years; 6 male) completed the study protocol with no adverse event. At spirometry, from no mask to surgical to FFP2 a progressive reduction of FEV1 and FVC was observed (3.94±0.91L/s, 3.23±0.81L/s and 4.70±1.21L, 3,77±1.02L, 3.52±1.21L, respectively, p<0.001) (Figure 2). Rest ventilation, O2 intake (VO2) and CO2 production (VCO2) were progressively lower due to a respiratory rate reduction. At peak exercise, subjects revealed a progressive higher Borg scale value when wearing surgical and FFP2. At peak exercise VO2 (30.96±23.40, 27.50±6.92, 28.24±8.79ml/Kg/min, p=0.001), ventilation (92.29±25.99, 76.19±21.62, 71.63±21.19L, p=0.003), respiratory rate (41.52±8.02, 37.73±5.52, 37.11±4.53, p=0.04) and tidal volume (2.28±0.72, 2.05±0.60, 1.96±0.65L, p=0.001) were lower from no mask to surgical to FFP2. We did not observe a significant inter-group difference in oxygen saturation.

Interpretation: Protective masks are associated with a significant but modest worsening spirometry and cardiorespiratory parameters at rest and peak exercise. The effect is driven by a ventilation reduction due to an increased air-flow resistance. However, since signs of exercise ventilatory limitation are far away to be reached, their use is safe even during maximal exercise, albeit with a slight reduction in performance.
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