Training Programs for Patients with Severe Chronic Obstructive Pulmonary Disease

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Key words: chronic obstructive pulmonary disease, pulmonary rehabilitation, training effect, training intensity

IMAJ 2005;7:196–197

Pulmonary rehabilitation is one of the main treatments for patients with chronic obstructive pulmonary disease. A successful rehabilitation program improves quality of life and ameliorates disability in these patients.

There is wide agreement that for a rehabilitation program to succeed we must achieve a significant training effect – i.e., a reduction in exercise lactic acidosis and, as a result, a reduction in CO_2 production and increased demand for ventilation [1–3]. It is quite clear that in order to achieve a training effect, the training should be performed at high intensity rate (above the anaerobic threshold, or at least about 65–70% of peak oxygen uptake or work rate-max in each subject). Duration of training should be at least 30 minutes each session and frequency should be as high as possible but not less than twice a week [1,4–6]

However, since most patients with severe COPD are ventilatory-limited, high intensity training is impossible [7,8]. For this reason the results of rehabilitation programs in this subgroup of COPD patients with severe disease are disappointing [6,9,10]. Various attempts have been made to overcome the ventilatory limitation in order to achieve a training effect. Most of the investigators tried oxygen supply during training, assuming that increased oxygen supply during exercise will reduce ventilation for a given effort. However, the results of these attempts were unsatisfactory, with most proving that oxygen has no benefit over room air on the training effect in these patients [11,12]. Another approach to minimize the ventilatory limitation during the training of ventilatory-limited COPD patients applied bi-level positive pressure ventilation during the training. By applying BiPAP in this subgroup of ventilatory-limited patients, ventilation is augmented, the ventilation limitation is removed, and training intensity and effect

COPD = chronic obstructive pulmonary disease

BiPAP = bi-level positive pressure ventilation

should improve. While this is a very logical approach, unfortunately several studies failed to prove any benefit of the training effect on severe ventilatory-limited COPD patients [13,14]. Nevertheless, the fact that some studies using BiPAP have shown a significant increase in endurance, walking distance, exercise duration above the AT and attenuation of dyspnea sensation [15,16] encourages further attempts to achieve an even better training effect in these patients using Bi-PAP during exercise.

In this issue of *IMAJ*, Reuveny and colleagues from the Sheba Medical Center [17] demonstrate that the use of BiPAP during training in severe COPD patients results in an augmentation of the training effect, i.e., increased training intensity and improved exercise tolerance in patients who were trained with BiPAP compared to those trained without it. These results are very encouraging for this group of severe patients who have very few options for medical treatment owing to the ineffectiveness of the drugs available for this stage of their disease. Their only option for the future, if training is not effective, is lung volume reduction surgery or lung transplantation. Neither is very promising, nor are they always available.

The mechanisms by which the supported training leads to a better training effect are not completely clear from the results of this study. But we can speculate that BiPAP increases training intensity by increasing ventilation and therefore enables training at higher intensities (assuming that most of these severe COPD patients are ventilatory-limited). We propose some other mechanisms to explain the promising results of Reuveny's study [17]. One of these mechanisms is supported by the work of Polkey et al. [16] who demonstrated that patients with severe COPD can sustain exercise-induced lactatemia for longer periods, if assisted with inspiratory pressure support. As a result, these patients can exercise to higher levels and achieve a better training effect. Another mechanism that may explain the improved training outcome is the effect of the ventilatory support on the strength of the inspiratory and expiratory muscles. There are sufficient data to support the fact that respiratory muscle training improves exercise tolerance in COPD patients [18,19]. Furthermore, Gething and co-workers [20] showed that inspiratory resistive loading improves inspiratory muscle strength and endurance and by this mechanism improves the exercise tolerance of ventilatory-limited COPD patients. We certainly cannot rule out the training effect induced by BiPAP on respiratory muscles in the study of Reuveny et al.

Whatever mechanism was involved in achieving the improvement reported by Reuveny and colleagues, their results are promising. These findings should encourage us to use this training technique to treat severe COPD patients proven – by means of a cardiopulmonary exercise test – to be ventilatory-limited. On the other hand, such promising results should encourage us to conduct further studies that will throw light on the physiologic changes that occur during supported training in order to achieve even better results in the future.

AT = anaerobic threshold

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