Training and ventilatory assistance in chronic obstructive pulmonary disease

To the Editors:

It was with great interest that I read the paper by VAN'T HUL *et al*. [1], which was recently published in the *European Respiratory Journal*, regarding the effectiveness of training with inspiratory support in chronic obstructive pulmonary disease (COPD) patients.

In particular, I longed for an answer to the main question on this topic, *i.e.* which COPD patients should benefit most from the adjunct of assisted ventilation during training.

Despite brilliant results on the acute effects of assisted ventilation on exercise tolerance and dyspnoea in severe COPD based on a strong pathophysiological background, previous studies on the adjunct of assisted ventilation as an aid to exercise training have yielded conflicting results [2, 3].

Even after reading the paper by VAN'T HUL *et al*. [1], I am not thoroughly convinced that training the patients with all the ''paraphernalia'' needed for assisted ventilation is worth it. Of course, this does not diminish the value of the study, which is certainly conducted with a rigorous methodological and statistical approach and has added another piece of scientific research on this matter. However, to the extent that every paper has its clinical implications, I wonder if the results of the cited study are somewhat misleading to the readers, causing us to dangerously think that no clinical result can be expected from pulmonary rehabilitation without ''mechanical doping''.

When analysing the results of the study by VAN'T HUL *et al*. [1], I am particularly puzzled about the poor results from the rehabilitation programme on exercise tolerance and quality of life obtained in the control group. These results are certainly attributable to the lower intensity of training attained in the control group, particularly when compared to previous studies conducted in COPD patients with comparable severity of disease and trained with traditional methods. Likewise, it is questionable that the between-group difference observed by VAN'T HUL *et al*. [1] may be attributable to the mere effect of assisted ventilation, since similar results have been shown by EMTNER *et al*. [4] where the training was supplemented by oxygen, which is a much easier and cheaper ''doping''.

There is no doubt that exercise training is the cornerstone of pulmonary rehabilitation, even if other complementary treatments are likely to contribute to the final success of a pulmonary rehabilitation programme. Is it possible that the lack of these complementary treatments in the study by VAN'T HUL *et al*. [1] has contributed to the low rate of success in the control group? Moreover, it is still a matter of debate as to which are the best predictors of pulmonary rehabilitation responders. It is possible that nonresponders to traditional methods of exercise training are those who are most likely to benefit from assisted ventilation; unfortunately, these questions have not been fully addressed in the study by VAN'T HUL *et al*. [1].

L. Bianchi
Respiratory Diseases and Pulmonary Rehabilitation Unit, S. Maugeri Foundation, Institute of Gussago, Gussago, Italy.

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From the authors:

We would like to thank L. Bianchi for his letter to the editors and AMBROSINO [1] for his editorial regarding our paper on the effects of training with inspiratory pressure support in patients with chronic obstructive pulmonary disease (COPD) [2]. Both reactions focus on the important issue of whether noninvasive ventilatory support (NIVS) during training could now be recommended as an aid in the practical setting of pulmonary rehabilitation.

Is the complex game of assisted ventilation or ''mechanical doping'' during exercise training in COPD worth the candle? We agree with L. Bianchi that the literature on the effects of training with NIVS in COPD yielded some conflicting results. It must be noted, however, that the study lacking an additional effect of training with NIVS included patients with a relatively mild airway obstruction, well-preserved exercise performance and an absence of inspiratory muscle weakness [3]. In such patients, the ventilatory system is not the primary factor limiting exercise performance. In addition, relatively high levels of ventilation have to be supported, putting a significant demand on the capacity of the ventilator. In the absence of a clear indication for NIVS during exercise or, alternatively, insufficient ventilatory assistance, it is likely that NIVS may work as a deterrent rather than a support to exercise with poor compliance and high drop-out rate as a result.

Pulmonary rehabilitation is by definition a multi-component intervention based on the individual needs of a patient [4]. For methodological reasons, we deliberately chose to limit the experimental intervention to cycle exercise training, comparing the effects of two different intensities of NIVS on excercise performance. It is likely that this mono-component approach contributed to the relatively modest results with respect to walking distance and quality of life, especially in the control group. The outcome of the whole may be greater than the sum of its parts. For this reason, we recommend combining NIVS with other components if it is considered as aid during exercise training.

Undoubtedly, it is possible to achieve adequate exercise training intensities and physiological benefit from general exercise training in many patients with COPD without the use of any assistance at all. However, it is also documented that a considerable number of patients may be unable to reach a satisfactory training stimulus because of intolerable exertional dyspnoea [5]. As L. Bianchi suggested, it is likely that we can find the best candidates for ventilatory-assisted exercise training among such patients. Furthermore, in our study, the gain in training intensity in patients training with mechanical doping could be partly explained by the magnitude of the acute effect of ventilatory assistance on exercise tolerance at the start of training. That is, the more exercise performance improved acutely due to the application of NIVS, the more patients were able to tolerate higher intensities during training. Previously we have shown that acute effects of NIVS were inversely related to maximal inspiratory pressure [6]. Thus, the weaker the inspiratory muscles, the greater the gain in exercise tolerance. These findings may provide clues to the selection of patients for exercise training with NIVS.

Interestingly, a similar result was observed with supplementary oxygen during training; the greater the acute effect of oxygen on exercise tolerance, the greater the gain in exercise training intensity in patients using oxygen [7]. Obviously, supplementary oxygen is a much easier and cheaper adjunct to training compared to ventilatory assistance. However, it should be noted that in three out of the four randomised controlled trials on the effects of training with supplementary oxygen in COPD, no additional effects were found. In fact, in these studies, training on oxygen resulted in smaller, albeit nonsignificant improvements, compared to those in the patients trained on air [8].

Finally, noninvasive ventilatory support and supplemental oxygen relate to the treatment of different causes of respiratory failure. The application of oxygen is mainly involved in the treatment of hypoxaemia, whereas noninvasive ventilatory support aims to reduce hypercapnia. In this context, future research is needed that is directed at identifying patients responding to noninvasive ventilatory support and those responding to supplementary oxygen. This will further reveal fundamentals for tailoring programs to optimise the benefits.

A. van 't Hul* and R. Gosselink#
*Pulmonary Rehabilitation Unit, Rehabilitation Centre Breda, Breda, The Netherlands. #Respiratory Rehabilitation, Universitaire Ziekenhuizen, Leuven, Belgium.

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