Mouthpiece Ventilation: Just a Home-Care Support?

Noninvasive ventilation (NIV) is recognized nowadays as the first choice of treatment for COPD exacerbation. Compared with standard medical treatment, it can significantly reduce the intubation rate, hospital stay, nosocomial infection, and, above all, mortality rate.[1,2] Physiological studies have shown that the mechanism of action of NIV in this population is the ability to sustain alveolar ventilation by reducing the work of breathing,[3] as during

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invasive mechanical ventilation.[4] For this reason, in COPD exacerbation, NIV may be considered not only the first line of treatment after failure of medical therapy but also, in expert hands and a monitored environment, an alternative to invasive mechanical ventilation.[5] NIV failure is due mainly to the cause of COPD exacerbation and its severity.[6,7] However, other clinical and technical situations have been described as possible causes for NIV failure. These include increases in upper airway resistance, sputum retention and/or cough impairment, agitation, mask leakages, and poor mask tolerance.[8,9] Patient tolerance is often influenced by the shape and fitting of the interface.[10,11] It has been suggested that using different masks in the same patient can be helpful in promoting tolerance and comfort.[10-13] In a particular group of subjects with a do-not-intubate order and with a previous NIV trial failure, a change in mask increased the success and hospital discharge rates.[14]

Open-circuit mouthpiece ventilation is a type of NIV delivered via a mouthpiece as interface. It was proposed many years ago in the home-care setting to treat chronic respiratory failure in neuromuscular diseases, especially in North America.[15-17] The use of mouthpiece ventilation was reported for the first time at a conference on post-poliomyelitis respiratory equipment in 1953.[18] The author observed that an intermittent positive-pressure ventilator with a mouthpiece circuit could be used to relieve dyspnea in ventilator-dependent polio subjects when switched from negative-pressure ventilation to spontaneous breathing for nursing care or physical therapy.

In subjects who required several hours of ventilatory support, Bach et al[16] reported the sequential use of a narrow flexed mouthpiece during the day and a nasal mask during the night. They suggested the possible use of a standard mouthpiece with lip-seal retention or custom-molded orthodontic bites for overnight use. In this population of subjects, mouthpiece ventilation use has progressively become a valid alternative to tracheostomy, providing benefits in terms of prevention of respiratory infections, reduction of complications associated with tracheostomy procedure and maintenance,[19] reduction in swallowing problems,[20] and improvement in cough, voice, and quality of life.[16,21]

In this issue of RESPIRATORY CARE, Dr Nicolini and colleagues[22] report an interesting study in which they compared mouthpiece versus nasal mask ventilation to treat COPD exacerbation with mild to moderate acidosis. Subjects were randomly assigned to receive NIV via a nasal mask or mouthpiece. The primary outcome was improvement in arterial blood gases. The 2 groups had similar trends in arterial blood gases and breathing frequency. No differences in duration of NIV or hospital stay were seen. However, a significant difference in tolerance of interface was found: subjects preferred mouthpiece ventilation! The authors concluded that mouthpiece ventilation might be considered as a valid alternative to nasal NIV in mild to moderate COPD exacerbation.

The first questionable point of this article is the comparison with a nasal mask in an acute setting, which is usually not recommended because it leads to mask failure in $> 72\%$ of subjects[23] and seems to lower CO_2 to a lesser extent compared with a facial mask.[11,24] The application of mouthpiece ventilation in a setting other than neuromuscular disease was tested in 2 previous studies. A physiological study by Fraticelli et al[25] suggested that a mouthpiece is as effective as a full-face mask in reducing inspiratory effort and improves gas exchanges in subjects receiving NIV for hypercapnic and hypoxic acute respiratory failure. However, this study compared the short-term effects of different interfaces, and conclusions about the long-term tolerance and efficacy of the therapy adminis-

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tered with this interface cannot be made. Some long-term problems may be hypothesized if we consider the reported higher incidence of leaks and asynchronies with a mouthpiece.[25] A nonrandomized, retrospective, matched case-control study compared the use of mouthpiece ventilation with nasal NIV and standard medical treatment in acute respiratory failure with a mean pH of 7.30.[26] The study showed that mouthpiece ventilation was as effective as nasal NIV in reducing the rate of intubation. However, once again, the study considered a nasal mask as the reference mask. In the study by Nicolini et al,[22] more severely ill subjects were enrolled (pH 7.30–7.25) without worsening the outcomes. This probably occurred because there was only one recruiting center, which had acquired experience with mouthpiece ventilation in recent years. We showed that increased years of experience with NIV progressively allowed more severely ill patients to be treated in a less critical environment.[27]

Moreover, we need to consider that mouthpiece ventilation requires a longer learning period then other interfaces, so the need for more cooperative patients and more time spent by nurses and respiratory therapists, at least in the first hours, has to be considered. Finally, some experience with mechanical ventilation is required to use the majority of ventilators, except for a few with software designed for specific mouthpiece ventilation. In fact, the correct setting is required to avoid frequent alarms.[28]

Some limitations must be considered in the study by Nicolini et al.[22] First, it is a very short-term study. As a matter of fact, it would be of great interest to confirm these results with a longer follow-up. Second, the study is not powered to the primary outcome even for a non-inferiority study. Furthermore, the absence of NIV failure in both groups, which may be related to enrollment bias, is surprising. In fact, as mentioned above, although we reported that NIV experience enabled treatment of more severely ill patients, NIV could not reduce the minimum rate of failure, which is intrinsic to the chronic disease and the cause of COPD exacerbation.[27]

Despite these limitations, the study by Nicolini et al[22] gives us an important clinical message: mouthpiece ventilation may be considered as another tool in our armamentarium and as an alternative to other interfaces. However, due to its specific features and drawbacks (leaks, etc), it must be managed by an expert hand and in a well-monitored environment even in moderate COPD exacerbation.

Further clinically powered studies are clearly needed to clarify whether mouthpiece ventilation may represent a safe and effective alternative to NIV delivered by conventional masks. In the next few years, we hope that management of COPD exacerbation will be targeted to a specific approach for each patient in accordance with ethical and final therapeutic goals.

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