pii: jc-00489-16 http://dx.doi.org/10.5664/jcsm.6516

JCSM
Journal of Clinical Sleep Medicine

LETTERS TO THE EDITOR

Retrospective: When Were Oronasal Masks First Used to Treat Obstructive Sleep Apnea?

Richard B. Berry, MD

University of Florida, Gainesville, FL

Two articles[1,2] and a commentary[3] concerning the use of oronasal (ON) masks for treatment of obstructive sleep apnea (OSA) were published in a recent issue of the *Journal of Clinical Sleep Medicine* (*JCSM*). Such interfaces are also known as full face masks. Physicians who have entered the field of sleep medicine in the past 15 y probably cannot remember a time when ON masks were not available for use for positive airway pressure (PAP) treatment of OSA. From the first description of continuous positive airway pressure (CPAP) as a treatment for sleep apnea in 1981[4] until 1994, the terms CPAP and nasal CPAP were virtually synonymous. Essentially all CPAP treatment of OSA was via a nasal mask (or nasal pillows mask). Use of ON masks had been described for treatment of acute respiratory failure but not OSA. In fact, it was believed that ON-CPAP would not work in patients with OSA.[5,6] However, in 1994 two papers were published asserting that ON masks might be an acceptable treatment alternative for OSA. The first paper was authored by Glen Prosise and myself[7] and the second a few months later by Sanders and coworkers.[8] Neither group was aware of the other's use of ON-CPAP. Because we had patients unable to tolerate PAP titration with a nasal mask due to severe nasal congestion, we chose to develop and study an ON mask. When we began the project, we were not aware of a commercially available ON mask for OSA treatment. Rather than use a mask designed for treatment of respiratory failure, Glen hand-made a custom mask for each patient using a thin rubber membrane wrapped over the opening of a full face mask designed for bag-mask ventilation. An appropriate-sized hole was cut in the membrane to allow entry of the nose and mouth. Pressure pushed the membrane out against the face and provided a reasonable seal without the need for an uncomfortable level of strap tightening. An orifice in the mask prevented rebreathing of carbon dioxide. We studied a group of 10 patients who did not tolerate CPAP titration because of severe nasal congestion. During titration with the ON mask the apnea-hypopnea index (AHI) was reduced from a baseline of 58.3 to 5.2 events/h. We were gratified to see that the ON mask worked but were hesitant to submit our findings for publication given the widespread view that ON-CPAP would not work. A potential objection to our findings was the possibility that our patients breathed entirely through the nose. We hypothesized that patients might breathe nasally, orally, or with a combined oral and nasal route during some portions of the night. Therefore, we studied 5 of the 10 patients using a dual-chamber mask that was partitioned into nasal and oral portions, each with a separate pneumotachograph to measure airflow. Using a Y connector both the nasal and oral mask chambers were administered the same PAP during a titration sleep study. The partition separating the two chambers was sealed to the face with an adhesive polymer. During wake, combined oral and nasal breathing was present for 89% of the time, but combined oral and nasal breathing was present for only 54% of the time during sleep. During wake and sleep, nasal breathing was present when combined breathing was absent. In three of five patients, ON breathing was noted less than 40% of the total sleep time with nasal breathing present during the majority of sleep. Of interest, we later converted 6 of our original 10 patients to nasal CPAP after intensive medical treatment of their nasal congestion. Four patients continued to use the ON mask until commercial masks were available. In the discussion of the publication, we pointed out several potential difficulties with ON masks, including the difficulty sealing over a large area and the potential for tight straps to pull the mandible down and posteriorly, potentially narrowing the upper airway. Sanders and coworkers[8] subsequently reported on 30 patients titrated with an ON-PAP after retrospective review of their titration experience over a 2-y period. The indications for using an ON mask were intractable mouth leak and inability to breathe nasally even with the use of heated humidification. ON-PAP was very effective in patients titrated with the ON interface. There was concern that success might be ascribed to a closed mouth under the ON mask. Therefore, the effectiveness of ON-CPAP was demonstrated in two patients who slept with a mouthpiece under the ON mask designed to maintain oral patency (but not move the tongue anteriorly). This ensured that a closed mouth was not needed for ON-PAP treatment success.

More than 20 y after the two 1994 publications, ON masks are widely used (perhaps too widely used). They continue to be a useful interface alternative but the patient responses may vary considerably. Some patients simply will not accept PAP treatment without the option of an ON mask. In other patients, as described in the recent *JCSM* publications, the use of an ON mask is associated with a higher treatment pressure, mask leak, and residual AHI. In some cases, a change to a nasal interface

from an ON mask can substantially lower the treatment pressure, reduce mask leak, and improve the AHI. The published evidence supports the recommendation to start with a nasal (or nasal pillows) mask with a switch to an ON mask only for the inability of a patient to breath nasally or a large mouth leak (assuming a chin strap fails).

In closing, there are a few considerations that could be added to the excellent commentary by Budhiraja and Bakker[3] concerning the ON mask issue. It has been our experience that unless properly supervised, patients often dramatically overtighten the straps (especially the lower strap) of the ON mask, which may increase the likelihood of secondary upper airway narrowing (as well as increasing leak). Supervised mask adjustment and a trial of the interface during mask fitting under the pressure the patient will use for treatment is essential. In addition, the use of chin straps is not without issues. Some patients refuse to use chin straps and often they are flimsy and ineffective (especially at high pressures). Certainly, one would like to see more resources applied to developing better chin straps (or oral devices) to prevent mouth leak as well as more clinical studies to document their effectiveness. The last point is that perhaps as sleep physicians, we could do a better job communicating in our sleep study interpretations that use of an ON mask during the initial titration does not mean an effort should not be made to utilize a nasal interface for chronic treatment (following treatment of nasal congestion and/or use of a chin strap as indicated), especially in the presence of intractable high mask leak or a high residual AHI. Hopefully, the recent publications and commentary about ON masks and interface selection will educate clinicians about the limitations of ON masks and spur further investigations concerning mask selection.

CITATION

Berry RB. Retrospective: when were oronasal masks first used to treat obstructive. *J Clin Sleep Med*. 2017;13(3):523–524.

REFERENCES

1. Ng JR, Aiyappan V, Mercer J, et al. Choosing an oronasal mask to deliver continuous positive airway pressure may cause more upper airway obstruction or lead to higher continuous positive airway pressure requirements than a nasal mask in some patients: a case series. *J Clin Sleep Med.* 2016;12(9):1227–1232.
2. Deshpande S, Joosten S, Turton A, et al. Oronasal masks require a higher pressure than nasal and nasal pillow masks for the treatment of obstructive sleep apnea. *J Clin Sleep Med.* 2016;12(9):1263–1268.
3. Budhiraja R, Bakker JP. CPAP use: unmasking the truth about interface. *J Clin Sleep Med.* 2016;12(9):1209–1210.
4. Sullivan CE, Issa FG, Berthon-Jones M, Eves L. Reversal of obstructive sleep apnoea by continuous positive airway pressure applied through the nares. *Lancet*. 1981;1(8225):862–865.
5. Kuna ST, Remmer JE. Neural and anatomic factors related to upper airway occlusion during sleep. *Med Clin North Am.* 1985;69(6):1221–1242.
6. Smith PL, Wise RA, Gold AR, Schwartz AR, Permutt S. Upper airway pressure relationships in obstructive sleep apnea. *J Appl Physiol.* 1988;64(2):789–793.
7. Prosise GL, Berry RB. Oral-nasal continuous positive airway pressure as a treatment for obstructive sleep apnea. *Chest.* 1994;106(1):180–186.
8. Sanders MH, Kern NB, Stiller RA, Strollo PJ, Martin TJ, Atwood CW. CPAP therapy via oronasal mask for obstructive sleep apnea. *Chest.* 1994;106(3):774–779.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication December 12, 2016
Submitted in final revised form December 12, 2016
Accepted for publication December 12, 2016
Address correspondence to: Richard B. Berry, MD, Division of Pulmonary, Critical Care, and Sleep Medicine, HSC Box 100225, University of Florida, Gainesville, Florida 32610; Tel: (352) 262-1575; Fax: (352) 379-4155; Email: Richard.Berry@medicine.ufl.edu

DISCLOSURE STATEMENT

Dr. Berry has indicated no financial conflicts of interest.