

CASE REPORTS

Effects of the Association of nCPAP and Tongue Positioner Device in OSAS Treatment: A Case Report

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STUDY OBJECTIVES: Obstructive sleep apnea syndrome (OSAS) is a common disorder in middle-aged people associated with increased cardiovascular and cerebrovascular morbidity and mortality, excessive daytime somnolence, and impaired daytime cognitive function. Its management includes removal of risk factors (if feasible), nasal continuous positive airway pressure (nCPAP), surgical treatment (usually, reserved for cases in whom nCPAP failed), and, in non-severe cases, the application of oral appliances (mandible-advancement devices [MAD] or tongue positioner devices [TPD]). The beneficial effect of the association of TPD with nCPAP was investigated.

DESIGN: TPD associated with nCPAP was compared to other approaches: i.e., MAD, TPD alone, nCPAP alone.

PATIENTS: A 55-year-old man with moderate OSAS and a retrusive position of the mandible and the tongue.

INTERVENTIONS: series of polysomnographies and cephalometric evaluation.

MEASUREMENTS AND RESULTS: baseline parameters were: AHI (apnea-hypopnea index) 24.1 events/h, with 127 episodes of apnea (mean apnea period: 21.7 s), 90 episodes of hypopnea (mean hypopnea period: 37.2 s) and oxygen saturation (SpO₂%) between 84% and 94%. The best improvements were obtained with nCPAP associated with TPD: AHI 2.3 events/h, 7 episodes of apnea (mean apnea period: 13 s), and SpO₂% between 91% and 97%.

CONCLUSIONS: the association between TPD, which helps in opening the upper airway space, and nCPAP may significantly improve nighttime respiratory function and sleep efficiency using lower nCPAP pressure.

KEYWORDS: obstructive sleep apnea syndrome, oral appliances, CPAP, cephalometry, tongue position

CITATION: Ciavarella D, Sabato R, Battista G, Lo Muzio L, Campisi G, Cassano M, Lo Russo L, Foschino Barbaro MP. Effects of the association of nCPAP and tongue positioner device in OSAS treatment: a case report. *Journal of Dental Sleep Medicine* 2014;1(1):21–23.

Obstructive sleep apnea syndrome (OSAS) is a common disorder in middle-aged people (30–60 years), affecting 4% of men and 2% of women. OSAS may be associated with increased cardiovascular and cerebrovascular morbidity and mortality,¹ excessive daytime somnolence, and impaired daytime cognitive function, which may be recognized as a cofactor in the etiology of road traffic accidents.²

OSAS management includes removal of risk factors, if feasible, nasal continuous positive airway pressure (nCPAP), surgical treatment (usually, reserved for cases in whom nCPAP failed)³ and, in non-severe cases, the application of oral appliances (mandible-advancement devices [MAD] or tongue positioner devices [TPD]).⁴

In the present paper, the beneficial effect of the association of TPD with nCPAP in a moderate case of OSAS with a retrusive position of the mandible and the tongue.

REPORT OF CASE

A 55-year-old man with no sleep-related breathing disorders (SRBD) risk factors (e.g., obesity, increased neck circumference, anatomical abnormalities of the face⁵) experiencing daytime sleepiness, snoring and waking up at night was evaluated in the sleep laboratory of Respiratory Diseases center of the University of Foggia. The patient was continuously monitored in one night using a portable device (Embletta, Flaga, Reykjavik, Iceland).⁶ Recordings included airflow (by placing a nasal cannula at the

nose and at the mouth, and by oro-nasal thermistor); snoring (by a microphone placed at the neck); ECG; sleep position; thoracic-abdominal movements (detected through 2 piezo-electric belts); overnight oxygen saturation (by finger pulse-oximetry); electroencephalographic, electro-oculographic, and chin electromyographic recordings (by means of surface electrodes according to the international 10–20 electrode placement system for sleep).

Results from the baseline polysomnography (PSG) analysis are shown in Table 1. Briefly, an AHI of 24.1 events/h was calculated, with 127 episodes of apnea (mean apnea period: 21.7 s), 90 episodes of hypopnea (mean hypopnea period: 37.2 s) and oxygen saturation (SpO₂%) between 84% and 94%. The diagnosis of moderate OSAS was made and the patient referred to the School of Dentistry of the University of Foggia for evaluation of intra- and extra-oral conditions associated with SRBD. Cephalometric evaluation, made on a lateral-head x-ray film, revealed a severe maxillary and mandibular retrusive position with a large tongue.

A MAD (Figure 1A–C) consisting of 2 acrylic splints capable to reposition the mandible 4 mm forward (measured with a George gauge from the tip of central inferior incisors with the mandible in resting position) was fabricated and the patient instructed to wear it for one month. Then, a second lateral head film and a PSG were performed (Table 1); since many apnea events were still present, another oral appliance, i.e., TPD (AveoTSD) (Figure 1D–E) was used and results re-evaluated

Table 1—Results of PSGs

		Baseline	MAD	TPD	nCPAP	nCPAP and TPD
Time from baseline	(months)	0	1	2	3	4
BMI	(kg/m ²)	24.4	24.4	25	24	24
AHI	(events/h)	24.1	19.5	16.2	8.4	2.3
AHI supine position	(events/h)	37	32	31	8.1	2.4
AHI non supine position	(events/h)	19.7	3	13	6.3	0
Respiratory events	(n)	217	176	125	24	7
Apnea index	(apneas/h)	14	8.4	10.9	6.6	2.3
Mean apnea time	(sec)	21.7	30.6	25	15.5	13
Hypopnea index	(hypopnea/h)	10	11.1	5.3	1.7	0
Mean hypopnea time	(sec)	37.2	39.8	29	12.4	0
Snoring	(% sleep time)	46.7	46.4	15	0.4	0.7
Oxygen desaturation index	(desaturation events/h)	25.7	19.2	11.5	1.7	0.3
Desaturation events	(n)	232	173	88	5	1
Awake SpO ₂	(%)	94	95	95	97	97
Mean nocturnal SpO ₂	(%)	93	94	93	96	96
Minimum SpO ₂	(%)	84	85	84	89	91
Total sleep time (SpO ₂ <90%)	(%)	5.4	1.7	1	0.1	0
nCPAP pressure	(cm H ₂ O)	—	—	—	13.5	10.1
Registered sleep period time	(min)	390	405	460	410	405
Total sleep time	(min)	310	360	425	390	385
Sleep efficiency	(%)	77	85	91.7	88	92.5
NREM 1-2 periods	(%)	69	61	55	53	50
NREM 3-4 periods	(%)	11	22.5	26.2	28	26
REM periods	(%)	7	8	13.3	15	15
Arousal index	(arousals/h)	21	29.3	24.8	11	8.4

Figure 1

A-C: Patient with MAD; **D, E:** Extra oral view of TPD; **F, G:** Patient with TPD; **H, I:** Patient with nCPAP and TPD.

one month later with a new PSG. After, nCPAP treatment, with a self-adjusting device (Auto-CPAP, RES MED S9), was performed and evaluated with a PSG: an AHI of 8.4 events/h was calculated, with 19 episodes of apnea (mean apnea period: 15.5 s), 5 episodes of hypopnea (mean hypopnea period: 12.4 s) and SpO₂ between 89% and 97%. Although AHI was greatly improved, the overall results were not deemed satisfactory; thus, a course of nCPAP associated with TPD was performed

(Figure 1H, I); this provided the best results on nights respiratory function, sleep efficiency, and oxygen saturation, using a lower nCPAP pressure.

DISCUSSION

In the present paper, a patient with a retrusive mandibular position, closure of upper airway space, and moderate/severe OSAS who refused surgical treatment was treated with various approaches.

Recently, MADs and TPDs have received great interest as low-cost strategies for treatment of obstructive OSAS.⁷ In fact, the anterior mandible and tongue repositioning causes complex changes within the lateral pharyngeal walls, tongue, soft palate, epiglottis, and genioglossus muscle that induce an improvement of respiratory dynamics.⁸ However, minor (tooth pain, excess salivation, dry mouth, TMJ discomfort, and muscle pain) and severe complications (TMJ dysfunction, gagging, tooth movement, intractable muscle pain) are possible. Thus, adequate selection of patients is mandatory. Oral appliances are indicated and may succeed in non-severe OSAS. Based on the present case, oral appliances may also have a beneficial effect in moderate-severe obstructive cases in conjunction with nCPAP. In fact, the latter still remains the golden standard for such cases, but whenever a retrusive position of mandible and/ or the tongue is present, posterior airway space may be affected, possibly reducing nCPAP effectiveness. Our results confirm that in such a case the association between TPD, which helps in opening the upper airway space, and nCPAP may significantly

improve nighttime respiratory function and sleep efficiency using lower nCPAP pressure.

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SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication September, 2013

Submitted in final revised form January, 2014

Accepted for publication January, 2014

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DISCLOSURE STATEMENT

This was not an industry supported study. The authors have indicated no financial conflicts of interest.