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A feasibility study in the treatment of obstructive sleep apnea syndrome and snoring: Nasopharyngeal stent

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ABSTRACT

Objective: The objective of this study is to create a new choice of treatment with nasopharyngeal stent in isolated retro palatal obstruction and snoring for the treatment of obstructive sleep apnea syndrome (OSAS).
Material and method: The study included five patients with mild OSAS and snoring. Nasopharyngeal stents were applied in these patients with drug-induced sedation endoscopy.
Results: With the nasopharyngeal stents, we aimed to prevent the soft palate to fall backwards while sleeping, especially at supine position in order to prevent the occurrence of apnea and hypopnea, providing a way for the airway to remain open as well as a support behind the soft palate and thus prevent snoring based on the vibration created by draught.
Conclusion: We suggest a new alternative treatment approach to devices that need to be continuously used such as CPAP or intraoral devices or surgical methods that have many unwanted discomforts for the patients.

1. Introduction

The best treatment method in Obstructive Sleep Apnea Syndrome (OSAS) is continuous positive airway pressure (CPAP) therapy [1]. However, success of CPAP therapy is restricted because of low acceptance, poor tolerance and suboptimal compliance [1].

Non-PAP treatments include intraoral devices and surgical methods. Surgical success decreases in patient groups that are not well selected. In choosing the surgical method, correct evaluation of patients and determination of the location, degree and configuration of upper airway (UAW) obstruction significantly influence surgical success [1]. Drug induced sedation endoscopy (DISE) is the best adjuvant method in order to determine the surgical method to be selected [1]. In the present study, we intend to describe a nasopharyngeal stent (NS) technique which we implemented for the treatment of OSAS and snoring in patients with isolated retropalatal obstruction.

2. Patients and methods

This prospective study was approved by the Ethical Board for Clinical Research at Bezmialem Vakif University, Faculty of Medicine (03/08/2016, decision number 10/14). Our department recruited all five participants with either newly diagnosed or previously untreated OSAS (Tables 1 and 2). All subjects were fully informed about the study both verbally and in writing.

Inclusion criteria were patients aged 18–70 years, who were determined on DISE to have only retropalatal obstruction, with an AHI > 5 on polysomnography. We excluded patients who have moderate to severe OSAS, nasal polyps or an obvious deviated nasal septum, patients with a history of oropharyngeal surgery. We also excluded patients with known psychotic disease, heart disease and chronic obstructive pulmonary disease.

Nasopharyngeal stents were applied at the retropalatal level in patients who have only isolated retropalatal obstruction and rejected surgical intervention and CPAP therapy, by producing a sleep-like condition under DISE. Following the procedure, polysomnography was repeated to evaluate the effectiveness of NS implementation.

3. Technique

NS is a mesh-shaped structure produced from a single wire featuring a self-expandable, cone shaped nitinol structure which is wide at the proximal end and narrower at the distal end, designed to fit the anatomy of the nasopharyngeal region. Following topical anesthesia (e.g. xylocaine gel), the fiberoptic nasal endoscopy-guided nasopharyngeal stent was introduced into the nose as closed in a 2 mm diameter

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Table 1
Characteristic of patients.

Patient	Age	Sex	BMI	AHI	Minimum oxygen saturation (%)	Total sleep time (minute)	Total sleep time activity (%)	Epworth score
1	39	Female	28.3	8.4	88.5	408.5	80.3	6
2	38	Female	29.7	9.6	85.3	392.1	81.4	7
3	47	Male	32.5	11.3	77.7	380.3	76.7	9
4	56	Male	30.2	10.5	81.8	419.4	80.7	7
5	43	Male	31.8	12.6	70.0	357.3	70.9	8
Mean ± SD	44.6 ± 4.6		30.5 ± 6.1	5 < AHI < 15		391.5 ± 4.2		

Table 2
Demographics and laboratory data of patients before and after stenting.

Patient	Before stent	After stent	P
Apneas (mean)	56	13	
REM	7 ± 1	0	0,018*
Non-REM	49 ± 1	13	0,025*
Hypopneas (mean)	72	78	
REM	21	0	0,001**
Non-REM	51	78	0,793
Apnea hypopnea index (mean)	9.5	2.7	0,005**
RDI (mean)	21.7	19.1	0,415
REM	20.6	0	0,001**
Non-REM	22.1	19.1	0,473
Minimum oxygen saturation (%) (mean)	%80	%86	
Total sleep time (minute) (mean)	408.9 min	367 min	0,20
Total sleep time activity (%) (mean)	%86.5	%77.9	

* $p < 0,05$.
** $p < 0,001$.

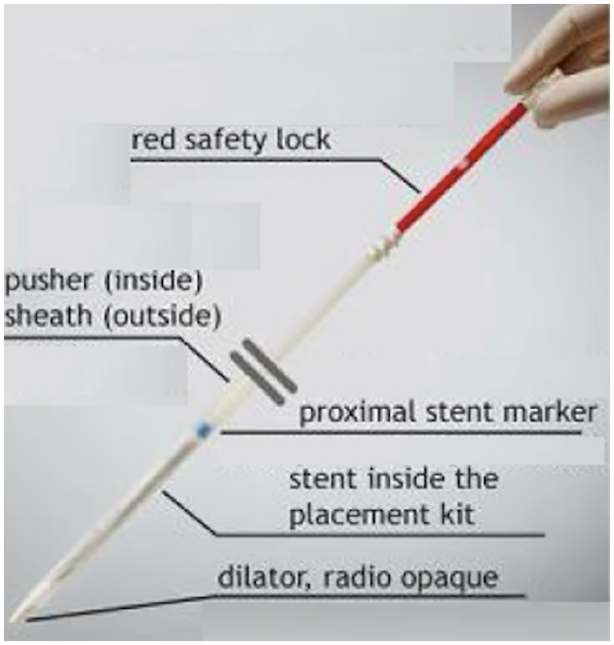

Fig. 1. Self-expanding nitinol-braided nasopharyngeal stent and introduction tube.

introducer (Fig. 1), advanced like a nasogastric tube and delivered to the retropalatal region in patients. The plastic introducer was slowly removed and the NS was opened in the nasopharyngeal region at the retropalatal level (Fig. 2). The procedure was finished after it was observed that a full opening was achieved by the NS in the posterior airway at the region of obstruction occurring during apnea and hypopnea.

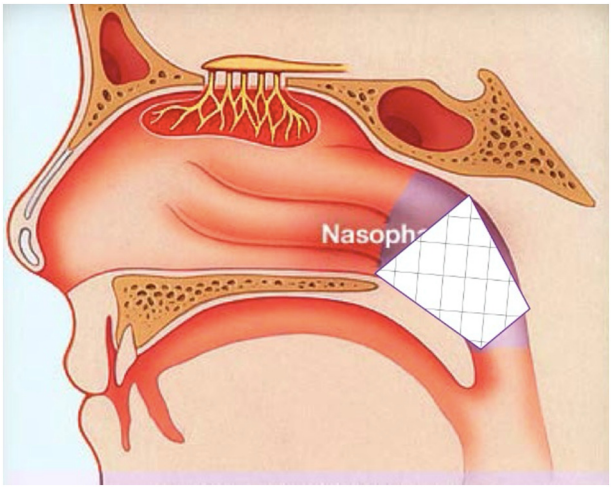

Fig. 2. Sagittal view with the inserted nasopharyngeal stent.

4. Result

We reviewed the 5 cases with the nasopharyngeal stent for isolated retropalatal obstruction with sleep-like conditions created under sedation at our department between September and November 2016. The patients (3 males and 2 females) had a mean age of 44.6 (range, 38–56) years. These patients with polysomnographically confirmed OSAS were treated with the manufactured nasopharyngeal stent and subsequently with CPAP the following night. Apnea and hypopnea were not observed at the control polysomnography in all patients.

5. Discussion

OSAS is characterized by repeating obstruction attacks due to dysfunction of muscles of the upper airway during sleep [2]. Tonic and phasic stenosis of the upper airway muscles during sleep due to increased fat deposits in the soft tissues of the oropharynx leads to hypopnea with partial obstruction and apnea with full obstruction [3].

Continuous positive air pressure (CPAP) from the upper airways is the gold standard in treatment of OSAS [3]. Adherence to treatment is often difficult in CPAP therapy because of emotional factors such as claustrophobia and being embarrassed with their partner, and clinical adverse effects including nose and throat drought, nasal bleeding, pressure sensation from the mask in certain points on the face, reflex with nasal congestion and conchal hypertrophy and sore throat [4].

Non-PAP treatments include intraoral devices and surgical methods. The most commonly used techniques include uvulopalatopharyngoplasty, lateral pharyngoplasty, anterior palatoplasty, pillar implant procedure and uvulopalatal flap [5]. The most effective surgical option, maxillomandibular advancement is used only in young, non-obese patients who have no comorbidity and cannot tolerate CPAP therapy [5]. These surgical methods include several risks such as velopharyngeal dysfunction, nasal regurgitation, hyper-nasal speech or sensation of a permanent foreign body in the throat [4]. Mandibular advancement

devices aim to expand the posterior airway by applying a splint to the lower jaw in carefully selected patients with mild to moderate OSAS [5]. The common goal of all surgical techniques is to keep the posterior airway between the nasopharynx and epiglottis open. A complete cure can not be achieved with the mentioned isolated surgical procedures for collapse occurring at different pharyngeal levels. In choosing the surgical method, success rate of surgery will be considerably increased with the correct evaluation of the patient and upper airway [1]. In drug induced sedation endoscopy (DISE), a sleep-like condition is produced by using Midazolam and Propofol anesthetic agents alone or in combination. When collapse and snoring occur in the patient, the location, degree and configuration of UAW obstruction is assessed through fiberoptic nasal endoscopy [1]. Therefore, in our new approach, we evaluated patients with DISE and implemented nasopharyngeal stent in posterior airway problems developing due to isolate soft palate pathology.

While weight loss is the only external factor which reduces soft palate pressure affecting the pharyngeal wall in the medium and long term, CPAP therapy exerts a pneumatic splint-like impact on the upper airway [3]. CPAP decreases stenosis which restricts air flow, increasing intraluminal pressure. Similarly, in the present study considering the same mechanism, we intended to create a splint impact on the upper airway as in CPAP therapy with the nasopharyngeal stent implemented in the airway posterior to the soft palate. In this way, we brought to the literature a novel approach by aiming to achieve the success obtained with CPAP, using nasopharyngeal stent in isolated retropalatal obstructions. Even though the procedure was performed under general anesthesia in some patients, this procedure can now be performed at the outpatient department (OPD) base.

However, this study was limited because this method was applied to patients who had soft palate lesions and was not applied to multi-level obstructive sleep apnea patients.

Additionally, this procedure cannot be conducted on patients who have moderate to severe OSAS. The postoperative follow-up period was relatively short. This method can produce side effects such as extrusion, foreign body sense, hypernasal voice, deglutition difficulties and nasal regurgitation. The main limitation of the study is small sample size. Further studies with larger number of patients are needed to confirm our findings. With further experience, we expect to get more promising results in the future.

6. Conclusion

We demonstrated that, the technique we performed could be successfully applied because it can be used as a simple and safe alternative to approaches such as CPAP, surgery or intraoral devices.

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None.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjoto.2020.102460.

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