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Nasal airway evaluation in obstructive sleep apnoea patients: volumetric tomography and endoscopic findings

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Abstract. Obstructive sleep apnoea (OSA) results from the recurrent collapse of the upper airway during sleep. Nasal abnormalities influence the stability of the pharynx. The aim of this study was to evaluate the volumetric and anatomical changes of the nasal cavity in patients with OSA. The Nasal Obstruction Symptom Evaluation (NOSE) scale was used to grade nasal obstruction. Sleep-related breathing disorders were evaluated by polysomnography. The nasal airway volume was obtained from computed tomography scans through volumetric reconstruction of the nasal airway. Alterations to the nasal anatomy were identified by nasal fibre-optic endoscopy. Ninety-four patient charts were analyzed. The final sample comprised 32 patients with severe OSA, 16 with moderate OSA, 23 with mild OSA, and 20 without OSA. Three groups were established based on nasal obstruction and OSA. The groups were compared for nasal airway volume ($P = 0.464$) and body mass index ($P = 0.001$). The presence of nasal septum deviation and inferior turbinate hypertrophy were related to the NOSE score ($P = 0.05$ for both), apnoea–hypopnoea index ($P = 0.03$ and $P = 0.05$, respectively), and nasal airway volume ($P = 0.71$ and $P = 0.78$, respectively). In this nasal airway evaluation of OSA patients, the presence of sites of obstruction was correlated with the severity of OSA; this was not the case for the evaluation of the nasal airway volume dimensions.

Key words: nasal airway volume; obstructive sleep apnoea; nasal endoscopy.

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Obstructive sleep apnoea (OSA) is a disease that has been increasingly recognized and diagnosed in recent years. Accurate diagnosis and appropriate treatment are key to the management of this illness, which has socioeconomic repercussions and complications, including an increased incidence of cardiovascular morbidity. The increasing prevalence of overweight in the Western population has been associated with a greater risk of developing OSA and snoring[1,2].

The American Academy of Sleep Medicine has defined OSA as a recurrent collapse of the upper airway during sleep, resulting in a total (apnoea) or partial (hypopnoea) reduction in airflow. Primary snoring is a low frequency snore caused by

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soft palate and uvula vibrations during sleep[3].

A large epidemiological study in the USA involving 5201 adult patients, showed that 19% of women and 33% of men over the age of 65 years snore[4]. Another study demonstrated that approximately 18% of men and 7% of women have snoring problems[5]. An epidemiological study conducted in Sao Paulo, Brazil reported a prevalence of OSA of 32.8% in the adult population[6].

Risk factors for OSA and snoring include age between 40 and 65 years, male sex, obesity, smoking, alcoholism, and a sedentary lifestyle[7]. The main physical examination findings associated with OSA include increased neck circumference, oropharyngeal obstruction, web palate, nasal obstruction, turbinate hypertrophy, septal deformity, nasal cavity tumours, enlarged tonsils, macroglossia, and retrognathia. Anatomical findings such as vibration factors and a collapsed upper airway have been described in studies that have used cephalometry, computed tomography (CT), magnetic resonance imaging, and nasal fibre-optic endoscopy[8].

Symptoms may vary among patients, depending on the severity of disease. The most frequent are snoring and excessive daytime sleepiness. Witnessed nocturnal apnoea episodes, choking during sleep, non-restorative sleep, fragmented sleep, enuresis, morning headaches, cognitive decline, memory loss, reduced libido, and irritability are also observed with the development of OSA[9].

The role of the nose in the pathophysiology of OSA remains uncertain. This is an upper airway disease, in which the main site of obstruction is in the oropharynx. The nose itself may not collapse, but nasal abnormalities influence the stability of the pharynx. Increased nasal resistance limits the airflow, which can decrease intraluminal pressure in the cranial segments of the upper airway[10]. Thus the upper airway may resemble a Starling resistor, wherein the upper airway is characterized as a hollow tube, with the nose representing partial obstruction at the inlet and the pharynx representing a collapsible downstream segment[11].

Most studies on nose function have been conducted by means of rhinomanometry and acoustic rhinometry evaluations and have shown a diminished nasal volume in OSA patients[12,13]. A few studies have used CT, but no study has evaluated nasal airway volume by means of CT scans.

The aim of this study was to evaluate the volumetric changes of the nasal cavity in patients with OSA and nasal obstruction.

Methods

This study was conducted in compliance with the rules laid down by the Declaration of Helsinki and was approved by the Ethics in Research Committee of Araraquara Dental School – UNESP.

This article describes a cross-sectional study conducted by reviewing the medical records of adult patients attending the Oral and Maxillofacial Surgery Clinic, Dental School at Araraquara (UNESP) and the Otorhinolaryngology Clinic, Araraquara University (UNIARA). Patients were evaluated at a specific sleep outpatient clinic.

The following information was obtained from the medical records: dental physical examination, classification of facial morphology, otorhinolaryngology (ENT) examination, upper airway endoscopy, anthropometric variables, body mass index (BMI), baseline polysomnography, and CT scans to define the nasal cavity volume.

Evaluation of nasal obstruction

The Nasal Obstruction Symptom Evaluation (NOSE) scale was used to grade nasal obstruction. The scale consists of five questions, each with a score range of 0 to 4. The scores are added together and multiplied by 5. Thus, the NOSE scale score ranges from 0 to 100. In this study, individuals whose NOSE scale score exceeded 60 points were considered to have nasal obstruction[14] (Fig. 1).

Nasal Obstruction Symptom Evaluation (NOSE) Instrument

→ **To the Patient:** Please help us to better understand the impact of nasal obstruction on your quality of life by **completing the following survey**. Thank You!

Over the past 1 month, how much of a problem were the following conditions for you?

	Please circle the most correct response				
	Not a problem	*very mild problem*	*moderate problem*	*fairly bad problem*	*severe problem*
1. Nasal congestion or stuffiness	0	1	2	3	4
2. Nasal blockage or obstruction	0	1	2	3	4
3. Trouble breathing through my nose	0	1	2	3	4
4. Trouble sleeping	0	1	2	3	4
5. Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

Fig. 1. The Nasal Obstruction Symptom Evaluation (NOSE) instrument used in this study; adapted from Stewart et al.[14].

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