

## LETTER TO THE EDITOR

**Obstructive sleep apnea syndrome**L. Giannini<sup>1,2</sup>, L. Garavelli<sup>1,2</sup>, E. Mainardi<sup>1,2</sup>, A. De Filippis<sup>1,2</sup> and L. Esposito<sup>1,2</sup><sup>1</sup>*Department of Biomedical, Surgical and Dental Sciences, School of Dentistry, University of Milan, Milan, Italy;* <sup>2</sup>*Fondazione IRCCS Cà Granda, Ospedale Maggiore Policlinico, Milan, Italy**Received September 16, 2020 – Accepted November 27, 2020*

To the Editor,

Respiratory disorders during sleep, or Sleep-Disordered Breathing (SDB), constitute a broad spectrum of clinical disorders, represented, by increasing gravity, from simple snoring, Upper Airway Resistance Syndrome (UARS), to Obstructive Sleep Apnea Syndrome (OSAS) (1, 2). Clinical manifestations of these disorders include night snoring, waking headache, daytime drowsiness, and decreased cognitive performance. Symptoms evolve depending on the severity of respiratory obstruction.

In simple snoring, the only disturbance is the habitual night snoring, which mainly involves the sphere of social relations. The individual presents himself in excellent psychophysical condition (1-4). The syndrome of increased resistance of the upper airways in addition to snoring is associated with excessive daytime sleepiness, while in the syndrome of obstructive sleep apnea entails headache on awakening and progressive fatigue that also leads to asthenia. Drowsiness can reach levels that interfere with the patient's everyday activity.

Failure to recognize this condition is particularly serious, as obstructive apnea syndrome during sleep is indiscriminately associated with an increased risk of high blood pressure, cardiovascular disease, daytime sleepiness, road accidents, home and work accidents, and a reduction in cognitive and work capacity with an overall deterioration in the quality

of life. For all these reasons, this syndrome is now a real socio-economic problem, therefore strategies are needed to reduce its prevalence and limit its consequences (4-7). These objectives can be achieved by strengthening prevention measures and planning an effective therapeutic approach, preceded by a valid diagnostic process, capable of connecting the condition once it has been established, to improve the quality of life of the patient and to stop the evolution towards long-term complications (8-12).

The purpose of this work is to carry out a systematic review of the literature on obstructive sleep apnea syndrome, highlighting its prevalence, incidence, risk factors, diagnosis, and therapy, with particular reference to orthodontic therapy.

**MATERIALS AND METHODS**

A systematic review of the literature on obstructive sleep apnea syndrome was conducted through the use of the Medline database ([www.ncbi.nlm.nih.gov/pub-med](http://www.ncbi.nlm.nih.gov/pub-med)). The key words used were: "SDB" sleep-disordered breathing and "OSAS" obstructive sleep apnea syndrome. The articles that provided information about etiology, diagnosis, treatment options, and results were therefore considered. Of the articles found, only those between 1980 and 2020 were selected. Using the limits options, only articles referring to "humans" were considered. Several articles published in unindexed

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journals and some considerations from relevant texts were also added.

## RESULTS

From the analysis of the literature and the comparison of the studies conducted by the different Authors, important discrepancies emerge in terms of sample stratification and diagnosis thresholds according to the apnea/hypopnea index. Studies based on a very restrictive definition of the sample population, which only considers individuals with moderate or severe disease who require a continuous positive airway pressure (CPAP) prescription, report a prevalence of 0.5% in the male population of the United States (average age 48.2 years) with Body Mass Index (BMI) of 24.9 kg/m<sup>2</sup> and 1.5% in a population with an average age of 52 years and BMI of 27.1 kg/m<sup>2</sup>. In Italy, the prevalence rates of OSAS have only been partially defined. A 1989 study of Italian males aged between 30 and 69 years showed a prevalence of 2.7% of individuals with an Apnea/Hypopnea Index (AHI) value of at least 10/hour and a

history of habitual snoring. This estimate rises to 3.5-5% among males in the 40-59 age group. The most recent data obtained from the International Literature Review suggest that the prevalence of OSAS is 2-4% in males and 1-2% in females of average age (3). These are significant values, especially considering that prevalence of obstructive apnea syndrome during sleep is highly underestimated. Even in countries where this condition is widely known, a large percentage of symptomatic individuals remain undiagnosed. Recent estimates attest to more than 5% of adults in Western countries suffer from undiagnosed OSAS and are candidates for treatment. In the United States in 1997, a study on 4,925 adults estimated that 82% of males and 92% of females with moderate or severe OSAS had not yet received diagnosis.

### *Risk factors and etiology*

To date, the interventions have been aimed at reducing body weight, also due to the epidemic spread, especially in Western countries, of food behavior anomalies and the consequent development of alterations in body mass. The causes of OSAS are of anatomical and functional/neurological nature: structural abnormalities, present even during wakefulness, can, however, become obstructive only during sleep due to the characteristic physiological changes in muscle tone; functional abnormalities, unlike structural ones, are present only during sleep (1). The etiology of OSAS is therefore multifactorial (Table I).

### *The role of sleep*

Sleep plays a two-fold role in OSAS pathophysiology. On the one hand, by reducing muscle tone at the level of the first airways, particularly during REM sleep, the genesis of apnoic/hypopnoic phenomena is an important contributing factor. On the other hand, it suffers the consequences of obstructive events to which the body responds with micro-awakenings that, although they do not reach the level of consciousness, they superficialize sleep and, by far exceeding their physiological number during REM sleep, impoverish it both in quantity and in quality, producing daytime hypersomnolence

**Table I.** *OSAS etiology*

|                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Anatomical factors</b>                                                                                                   |
| - adipose filling of the submucosa                                                                                          |
| - macroscopic anatomical abnormalities                                                                                      |
| - microscopic anatomical abnormalities                                                                                      |
| <b>Physiological functional factors</b>                                                                                     |
| - reduction in activity of the pharyngeal muscles during sleep with a consequent increased resistance to the passage of air |
| <b>Pathological functional factors</b>                                                                                      |
| - excessive reduction in activity of the pharyngeal muscles during sleep                                                    |
| - decreased reflexes during sleep                                                                                           |

and alterations of modulated activities during this phase of sleep, in particular endocrine functions, resulting in a systemic interest of the organism.

### *Diagnosis*

The typical symptoms of the syndrome should therefore be sought, before starting a patient with a suspicion of OSAS on the instrumental diagnostic pathway, with particular regard to habitual snoring (every night) and persistent (for at least 6 months), to respiratory sleep breaks reported by the partner, to awakenings with a feeling of suffocation in a snoring subject (not necessarily habitual), and to daytime drowsiness, possibly quantified through subjective and objective assessment tests (Table II). Useful for diagnostic guidance and possible differential diagnoses is the objective examination with the evaluation of Body Mass Index, abdominal circumference and neck, craniofacial ratios, nasal patency, oral cavity (dentition and tongue), oropharynx, and finally the recording of blood pressure and respiratory, cardiovascular and neurological objectivity, in order to reveal any conditions. Sleep studies represent the reference

diagnostic procedures, among which traditional polysomnography, despite changes in reproducibility between night and night in the same subject, is the gold standard for OSAS diagnosis and for the objective evaluation of therapeutic results.

### *The role of orthodontic therapy*

The selection criteria proposed by American Sleep Disorders Association (ASDA) are only polysomnographic and non-clinical criteria. Although most literature agrees with the limits of obstructive apnea symptoms in patients with initial AHI > 50 values, some authors, including Pancer and Coll. first (1999), support the efficacy of this type of therapy in treating patients with severe OSAS (3). In these cases, however, it is recommended to limit the use of the devices to those who do not run a serious risk to life if they suspend the use of CPAP and to those whose severity suggests tracheostomy as the only therapy. Contraindications relating to the use of an oral device as a first-choice treatment remain, however, cases of severe OSAS with excessive daytime hypersomnolence and marked desaturation of oxygen in the night. The presence of incongruous conservative or prosthetic restorations is also a contraindication of the application of Mandibular Advancement Devices (MAD) and a proper restoration before the application of the device is therefore indicated (9).

Therapeutic success is instead associated with a high percentage of cases of young subjects, who have a thin neck, low BMI, and prevalent or exclusive positionality of respiratory events (supine position). Significant improvements occur in the case of OSAS related to small and/or retruded jaw.

In 2002, Petit and Coll. reported an incidence of 34% of primary contraindications to the use of MAD in 100 patients examined who had carried out a polysomnographic study for a suspected respiratory disorder during sleep:

- insufficient number of teeth for each dental arch (minimum 8 teeth per arch);
- untreated periodontal diseases or excessive dental mobility;
- dysfunctional temporomandibular joint (TMJ) symptoms and/or severe malocclusion. TMJ

**Table II.** Signs and symptoms of obstructive sleep apnea

| Typical                                                |
|--------------------------------------------------------|
| - snoring                                              |
| - daytime sleepiness                                   |
| - difficulty concentrating                             |
| - unrefreshing sleep                                   |
| Frequent                                               |
| - morning headache                                     |
| - choking during sleep                                 |
| - testimony of apneas                                  |
| - irritability and/or personality change               |
| - restless sleep                                       |
| - nocturia                                             |
| Uncommon                                               |
| - secondary hypogonadism (decreased libido, impotence) |
| - enuresis                                             |

pathologies that represent a contraindication are joint and muscle pain, the presence of joint noises, and the limitations in the opening or protruding path of the jaw, need be evaluated individually, but they do not necessarily constitute a contraindication;

- limited mandible protrusion (< 6 mm);
- limited opening of the mouth (< 25 mm).

## DISCUSSION

The search for a therapeutic scheme that can effectively respond to the need to heal as many patients as possible still animates a lively scientific debate, open on several fronts, favored by the very nature of the syndrome. The versatility of the symptoms and signs with which OSAS presents itself to the observer from time to time has made the syndrome a subject of study for many specialists. It has been addressed in the recent story of medicine by neurologists specialised in the study of sleep-related pathology, by pneumologists and otolaryngologists, the latter being responsible for the introduction of surgical therapeutic options. The figure of the maxillofacial surgeon has more recently entered the panorama of the management of obstructive sleep apnea syndrome, but his contribution seems to occupy an increasingly important role.

It is now clear that this pathology, given the multisystemic involvement of the organism that characterizes it, is not the subject of one or a few of the specialists mentioned above, but all, with the addition of cardiologists, must be involved in a multidisciplinary diagnostic and therapeutic strategy in the effort to achieve satisfactory therapeutic results in the care of patients suffering from OSAS.

The orthodontist currently plays a major role in managing OSAS and preventing patients from developing snoring. First of all, the help of telerradiography of the skull and cephalometric tracing can identify patients at risk and those who need to undergo further checks. Early diagnosis is crucial in preventing or treating any medical complications when they are at an early stage. Furthermore, the orthodontist also has a role in the treatment of patients suffering from this syndrome: among the

therapeutic options, in selected patients, the use of an oral device (comparable to a functional device but to be worn only at night) can be chosen, which is the exclusive competence of the dentist concerning selection and follow-up. Finally, the orthodontist can also intervene in the pre- and post-surgical phase in subjects who must undergo maxillofacial surgery.

Moreover, OAs, and especially MAD, present a viable therapeutic alternative for patients with mild-moderate OSAS or for patients with severe OSAS who cannot tolerate CPAP treatment, as many studies claim. The multidisciplinary approach, therefore, allows better management of MAD therapy and significantly improves the effectiveness of the treatment. Since OSAS is a clinical condition that can seriously compromise the quality and lifespan of those who suffer from it, it is necessary to carry out an early diagnosis and therapeutic programming in order to allow the subject to re-establish his physiological functions. Epidemiological data show a prevalence of 2-4% in the population aged between 20-60 years and a mortality 4 years after diagnosis of 20%, describing the extent of a phenomenon that could become a major health and social problem in the near future. The high costs to public health related to the management of patients with this syndrome and the associated conditions, including cerebral and cardiovascular diseases, road and work accidents, and mood disorders, require the need, on the one hand, to raise awareness among the medical community to promote the recognition of the syndrome that still too often remains unknown and, on the other hand, to arrive at the definition of a diagnostic and therapeutic process that allows effective multidisciplinary classification and treatment for the greater number of patients.

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