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## Sleep-related breathing disorders and dentistry: What is the relationship?

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Non-restorative sleep has considerable consequences for daily life. A sleep disorder is recognized by symptoms such as daytime fatigue and performance or concentration disorders. Furthermore, it increases the risk of developing cardiovascular, metabolic, and neurologic diseases. The diagnosis and therapy of sleep disorders is not only in the sleep medicine doctor's

hands. A multidisciplinary approach reflects the affected patients' choice. Dentists can make an important contribution, especially to the therapy of sleep-related breathing disorder. (*Quintessence Int* 2016;47:617–621; doi: 10.3290/j.qi.a36172; Originally published in German in *Quintessenz* 2015;66(8):939–943)

**Key words:** mandibular advancement appliance, primary snoring, sleep apnea, sleep-related breathing disorder, upper airway resistance syndrome (UARS)

Dentists are entrusted with the treatment of nocturnal bruxism through the creation of individualized splints; however, not every dentist understands that bruxism represents one of the most common parasomnias. Somnology is becoming increasingly important in dentistry, together with sleep research and sleep medicine. Cooperation between the fields of dentistry and somnology began at the end of the 1980s.<sup>1</sup>

Sleep is a fascinating aspect of life; it is important not only for relaxation, but also for its decisive influence on neuronal regenerative processes, behavioral patterns, and metabolic recovery through physiologic and

cognitive factors.<sup>2</sup> During the course of human life, age-related changes of duration and depth of sleep occur. In addition, different events may affect healthy and normal sleep, which are first considered harmless because of their sporadic appearance, but have to be seen as pathologic when they persist over time. This includes sleep-wake cycle disorders, involuntary leg movements, somnambulism, nocturnal enuresis, nightmares, snoring, sleep talking, disorders of initiating and maintaining sleep, as well as sleep apnea.<sup>3</sup>

### CLASSIFICATION OF SLEEP DISORDERS

Sleep medicine deals with different aspects of sleep, its biology and architecture, and disease scenarios which occur before, during, and after sleep.

The American Academy of Sleep Medicine (AASM) published at the end of the 1970s the Classification of Sleep Disorders,<sup>4</sup> which led to the "International Classification of Sleep Disorders" (ICDS). In the last revised

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version of 2014 (ICDS-3),<sup>5</sup> sleep disorders were divided into six categories:

- insomnia
- sleep-related breathing disorders
- central disorders of hypersomnolence
- circadian rhythm sleep-wake disorders
- parasomnias
- sleep-related movement disorders.

Sleep-related breathing disorder belongs to the most common somnology disease pattern. It usually remains undiagnosed for a long time because of its insidious occurrence. The literature shows a prevalence range of 2% to 26%, which clarifies how significant sleep-related breathing disorders can be as a health problem.<sup>6-8</sup> Breathing disruption causes sleep architecture disorders because the oxygen deficiency leads to a waking reaction (arousal). A major symptom of such fragmented sleep is daytime sleepiness, with its corresponding increased tendency to fall asleep. This is a dangerous symptom, which not only affects performance, concentration, and sociability, but is also responsible for many working and traffic accidents. In addition, many aspects of daily life suffer deterioration because of sleep-related breathing disorders. Thus there is a rise in the incidences of depressive tendencies, loss of libido, and impotence. Also, in cases of untreated sleep-related breathing disorder there are increased risks of developing high blood pressure, cardiovascular diseases, cardiac arrhythmia and myocardial infarction, diabetes mellitus, and cerebrovascular accidents.<sup>9-11</sup> In addition to a general medical examination, a diagnosis of the sleep-related breathing disorder type should be performed, as well as a differential diagnosis of the primary snoring, usually in a sleep laboratory with polysomnography. The medical history is completed by a questionnaire about daytime fatigue, performance, and somnolence, as well as a craniofacial, oral, and otorhinolaryngology examination.<sup>3</sup>

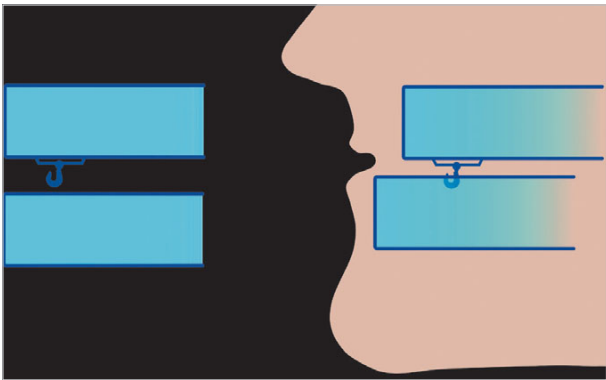
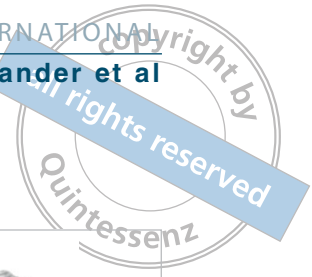
## TYPES OF SLEEP-RELATED BREATHING DISORDER

In cases of central sleep apnea, the breathing regulation is disturbed and there are no discernible inspiratory impulses. In cases of obstructive sleep apnea, the inspiration is not possible due to an upper-airway collapse.<sup>12</sup> When the upper-airway collapse makes inspiration difficult but not impossible, the process is referred to as hypopnea, which is recognized by a reduction in oxygen saturation. The events of apnea and hypopnea are recorded by the Apnea-Hypopnea-Index (AHI), and they define the severity of the disease.<sup>13</sup>

Primary snoring is caused when there is a vibration of soft tissues in a narrow airway during breathing while sleeping. This causes acoustic phenomena without a loss of oxygen saturation or leading to a waking reaction (arousal).<sup>14</sup> This primary snoring does not yet have a confirmed pathologic grade. However, it has been reported that there is a positive correlation between snoring and the development of an upper airway resistance syndrome (UARS).<sup>15</sup> In patients with UARS, there are no changes to the oxygen saturation, but for affected people it can lead to a waking reaction due to the increased inspiratory pressure. This can explain the consequences of fragmented sleep.<sup>16</sup> The social and interpersonal meaning of snoring is well known and is also a common reason for patient consultation.

## TREATMENT OF SLEEP-RELATED BREATHING DISORDERS

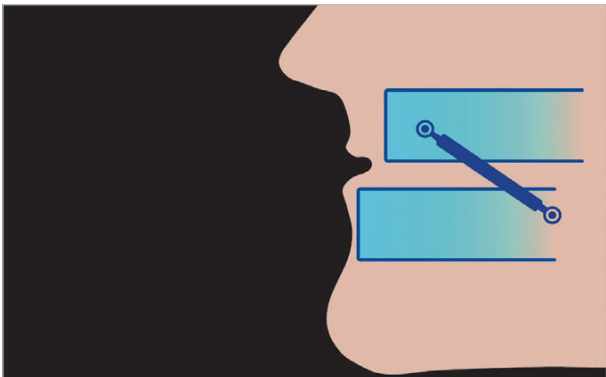
There are different therapeutic approaches for sleep-related breathing disorders and these are commonly recommended in a combined form (weight loss, proper sleep hygiene, surgical procedures). The goal of treatment is mostly focused on an enlargement of the upper airway. The gold standard is the nightly artificial overpressure respiration with a continuous positive airway pressure (CPAP) device, which helps to achieve a pneumatic expansion of the upper airway.<sup>17</sup> This very effective and conservative therapy requires wearing a mask



**Fig 1** Protrusion mechanism of the Thornton Adjustable Positioner (TAP).



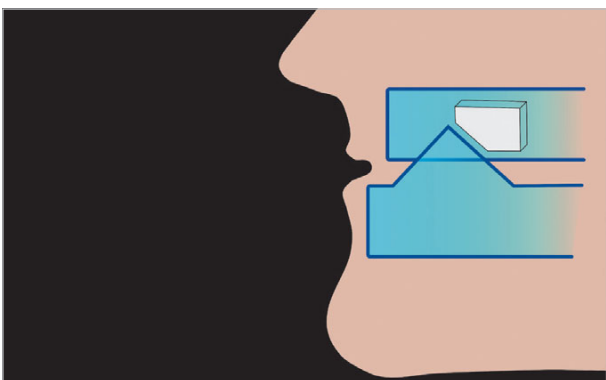
**Fig 2** Standard Thornton Adjustable Positioner (TAP; courtesy of Scheu-Dental).



**Fig 3** Intraoral sleep therapy (IST) classic appliance protrusion mechanism.



**Fig 4** Intraoral sleep therapy (IST) classic appliance (courtesy of Dr Hinz Dental Distribution Company).



**Fig 5** SomnoDent appliance protrusion mechanism.



**Fig 6** SomnoDent Flex appliance (courtesy of SomnoMed Europe).

at night, and demands a highly compliant patient despite various improvements for improved wear comfort (air humidification, alternating pressure compensation, different mask designs).<sup>18,19</sup> Another alternative for

a mechanical enlargement of the upper airway is achieved by advancing the mandible forward. In dentistry, this can be done in a nonsurgical way with the use of a mandibular advancement appliance.<sup>17,20</sup>



## Mandibular advancement appliances

According to the recommendations of the German Society for Dental Sleep Medicine, dental therapy is indicated for primary snoring, UARS, and for mild to moderate obstructive sleep apnea without major clinical symptoms, as well as a body mass index (BMI) under 30.<sup>21</sup> In order to meet these recommendations there must be an accurate initial diagnosis and proper patient selection. There must also be well-founded knowledge about the optimal mandibular advancement appliance. Patient's oral conditions, periodontal diagnostics, existing prosthetic treatments, and breathing habits have to be considered. The oral appliance has to be individually adapted and needs to provide an appropriate degree of protrusion. It also must ensure that the temporomandibular joint and the hard and soft tissues of the stomatognathic system will not be damaged.<sup>22</sup>

It is suggested that separate maxilla and mandible appliances are provided, instead of using a monoblock system. It is recommended that the selected mandible advancement does not exceed two-thirds of the maximal protrusion. The selected protrusion is ensured by supporting devices between the mandible and maxilla. Despite the chosen position a certain mobility range should be allowed.<sup>23</sup>

In Germany, these requirements are fulfilled by different manufacturers' advancement appliances. An example for this is the Thornton Adjustable Positioner (TAP; Oral Appliance Technologies, Scheu-Dental) in its different variations.<sup>24</sup> TAP is a maxillomandibular appliance that contains a hook-shaped joining element on the anterior area for the adjustment of the protrusion degree (Figs 1 and 2). Intraoral sleep therapy devices (IST devices; Dr Hinz Laboratory for Orthodontics) have holders on the lateral area. Both appliances are adjusted by lateral guiding telescopes (Figs 3 and 4).<sup>25</sup> Another example of a maxillomandibular appliance is the protrusion appliance SomnoDent (SomnoMed Europe). This design has a fin-like bulge on the posterior area of the mandible appliance. On the maxillary appliance, the fin is attached to an adjusted barrier and prevents the posterior displacement of the mandible (Figs 5 and 6).<sup>26</sup>

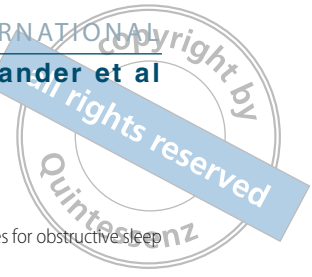
A complete presentation of all the existing appliances on the market would be beyond the framework of this article. However, regular controls are necessary for all oral appliances after being elaborated and adjusted to the patient. After an adjustment period there should be a sleep medical test, besides the oral examination, in order to check the expected result of the selected appliance. An additional protrusion may be necessary, or another therapy may be selected.<sup>27</sup>

## CONCLUSION

Sleep represents not only pleasant relaxation in daily life, but also an important part of cognitive and physiologic processes. A sleep disorder often remains unnoticed and can increase the risk of cardiovascular, metabolic, and neurologic diseases. Sleep disorders are often associated with a breathing restriction, which can be caused through a partial or a total upper airway obstruction. Treatment methods improve air flow during sleep by stabilizing and enlarging the upper airway. Dentists have an important role regarding early detection in affected patients. After diagnosis, dental devices are an important part of treatment.

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