

Positional Sleep Therapy:

SomnoCushion® Pro, SomnoCushion® Standard, SomnoBelt® and SomnoShirt®

For managing position-related snoring and obstructive sleep apnoea by sleep posture correction

The following selected abstracts refer to clinical trial publications as listed in PubMed:

Dtsch Med Wochenschr. 2003 Jan 17;128(3):71-5.

Treatment of obstructive sleep apnea with a new vest preventing the supine position (Original publication in German]

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BACKGROUND AND OBJECTIVE: Prevention of the supine position has been a well known treatment option for decades in positional obstructive sleep apnoea. It was the aim of this study to test the efficacy of a recently patented commercially available supine position preventing vest.

PATIENTS AND METHODS: The vest is made of linen with a half cylindrical piece of hard foam in its dorsal part. 12 male patients slightly overweight (body mass index 26.5 +/- 2.6 kg/m(2)) and 55.8 +/- 11.6 years old were investigated polysomnographically prospectively.

RESULTS: The pretherapeutical respiratory-disturbance index (RDI) was 26.7+/-11.9/h increasing to 39.3+/-16.1/h in the supine position. When using the vest, patients no longer slept on their back and the RDI dropped to 7.6 +/- 5.1/h ($p < 0.005$). Total sleep time at an oxygen saturation below 90 % was reduced from 11.7 +/- 11.3 % to 1.5 +/- 2.1 %. 9 patients (75 %) were cured (RDI < 10/h and RDI reduction > 50 %), 2 patients (17 %) improved (RDI reduction > 50 %) and only the oldest patient (76 years old) remained unchanged. Even though snoring decreased from 180 +/- 125 minutes to 110 +/- 52 minutes, an increase was observed in 30 % of the patients. Sleep quality and structure did not change considerably.

CONCLUSION: The supine position prevention vest is a safe and simple treatment alternative of high efficacy in positional sleep apnea. As a complete remission cannot be predicted, polygraphic or polysomnographic controls are necessary.

Sleep. 2003 Mar 15;26(2):169-72.

Effects of body position on snoring in apneic and nonapneic snorers.

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STUDY OBJECTIVES: The positional dependency of obstructive sleep apnea (OSA) is well known, but objective evidence for the positional effect on snoring is lacking. The aim of this study is to elucidate the effect of body position on snoring, and that of sleep stage as well.

DESIGN: Retrospective analysis of the effects of body position and sleep stage on snoring in nonapneic snorers (snorer group) and OSA patients (apneic group).

SETTING: A sleep laboratory in a national hospital in Japan.

PATIENTS: Seventy-two patients who complained of habitual snoring and underwent overnight polysomnography.

INTERVENTIONS: N/A MEASUREMENTS AND RESULTS: In the lateral position, most subjects in the snorer group showed decreased snoring both in time ($p = 0.0004$) and intensity ($p = 0.0003$), but subjects in the apneic group showed variable changes. In the apneic group, the positional dependency of snoring (the ratio of lateral value to supine value) was correlated with supine apnea-hypopnea index (AHI), that is, OSA patients with higher supine AHI tended to show increased snoring in the lateral position. AS to the effect of sleep stage, snoring was increased in deeper non-rapid eye movement sleep and decreased in rapid eye movement sleep in a given position.

CONCLUSIONS: This study demonstrated that the positional dependency is different between nonapneic snorers and OSA patients. Most of the nonapneic snorers snore less in the lateral position than in the supine position in contrast to OSA patients who often fail to decrease snoring even in the lateral position.

Sleep. 2002 Feb 1;25(1):66-71.

Body position and obstructive sleep apnea in children.

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STUDY OBJECTIVES: In adults, sleep apnea is worse when the patient is in the supine position. However, the relationship between sleep position and obstructive apnea in children is unknown. The objective of this study was to evaluate the relationship between obstructive apnea and body position during sleep in children.

DESIGN: Retrospective analysis of the relationship between body position and obstructive apnea in obese and non-obese children.

SETTING: Tertiary care pediatric sleep center.

PATIENTS: Otherwise healthy children, aged 1-10 years, undergoing polysomnography for suspected obstructive sleep apnea syndrome. Obese and non-obese children were evaluated separately.

INTERVENTIONS: Retrospective review of the relationship between sleep position and obstructive apnea during polysomnography.

MEASUREMENTS AND RESULTS: Eighty polysomnograms from 56 non-obese and 24 obese children were analyzed. Body position was determined by a sensor during polysomnography, and confirmed by review of videotapes. Children had a lower obstructive apnea hypopnea index when supine vs. prone, and shorter apneas when supine then when on their side. There was no difference in apnea duration between the supine and prone positions. Obese and non-obese children showed similar positional changes.

CONCLUSIONS: In contrast to adults, children with obstructive sleep apnea breathe best when in the supine position.

Chest. 2001 Nov;120(5):1448-54.

Sleep-related disordered breathing during pregnancy in obese women.

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STUDY OBJECTIVES: This study was designed to evaluate sleep-related disordered breathing in obese women during pregnancy. Obesity is a known predisposition to sleep-related breathing disorders. During pregnancy, obese mothers gain additional weight, but other mechanisms may counteract this effect.

DESIGN: A case-control study to compare sleep-related breathing in obese pregnant women (mean prepregnancy body mass index [BMI] > 30 kg/m²) with pregnant women of normal weight (mean BMI, 20 to 25 kg/m²).

SETTING: University teaching hospital with a sleep laboratory.

PARTICIPANTS: We recruited 11 obese women (BMI, 34 kg/m²; mean age 31 years) and 11 control women (BMI, 23 kg/m²; mean age 32 years).

INTERVENTIONS: Overnight polysomnography was performed during early (after 12 weeks) and late (after 30 weeks) pregnancy.

MEASUREMENTS AND RESULTS: During pregnancy, obese mothers gained 13 kg and control women gained 16 kg. Sleep characteristics did not differ between the groups. During late pregnancy, the women in both groups slept more poorly and slept in supine position less. During early pregnancy, their apnea-hypopnea indexes (1.7 events per hour vs 0.2 events per hour; $p < 0.05$), 4% oxygen desaturations (5.3 events per hour vs 0.3 events per hour; $p < 0.005$), and snoring times (32% vs 1%, $p < 0.001$) differed significantly. These differences between the groups persisted in the second polysomnography, with snoring time further increasing in the obese. Preeclampsia and mild obstructive sleep apnea were diagnosed in one obese mother. One obese mother delivered a baby showing growth retardation (weight - 3 SD). **CONCLUSIONS:** We have shown significantly more sleep-related disordered breathing occurring in obese mothers than in subjects of normal weight, despite similar sleeping characteristics.

Sleep. 2001 Feb 1;24(1):90-5.

Effect of sleep position and sleep stage on the collapsibility of the upper airways in patients with sleep apnea.

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Collapsibility of the upper airways has been identified as an important pathogenic factor in obstructive sleep apnea (OSA). Objective measures of collapsibility are pharyngeal critical pressure (Pcrit) and resistance of the upstream segment (Rus). To systematically determine the effects of sleep stage and body position we investigated 16 male subjects suffering from OSA. We compared the measures in light sleep, slow-wave sleep, REM sleep and supine vs. lateral positions. The pressure-flow relationship of the upper airways has been evaluated by simultaneous readings of maximal inspiratory airflow (Vimax) and nasal pressure (p-nCPAP). With two-factor repeated measures ANOVA on those 7 patients which had all 6 situations we found a significant influence of body position on Pcrit ($p < 0.05$) whereas there was no significant influence of sleep stage and no significant interaction between body position and sleep stage. When comparing the body positions Pcrit was higher in the supine than in the lateral positions. During light sleep Pcrit decreased from 0.6 ± 0.8 cm H₂O (supine) to -2.2 ± 3.6 cm H₂O (lateral) ($p < 0.01$), during slow-wave sleep Pcrit decreased from 0.3 ± 1.4 cm H₂O (supine) to -1.7 ± 2.6 (lateral) ($p < 0.05$) and during REM sleep it decreased from 1.2 ± 1.5 cm H₂O to -2.0 ± 2.2 cm H₂O ($p < 0.05$). Changes in Rus revealed no body position nor sleep-stage dependence. Comparing the different body positions Rus was only significantly higher in the lateral position during REM sleep ($p < 0.05$). The results indicate that collapsibility of the upper airways is not mediated by sleep stages but is strongly influenced by body position. As a consequence lower nCPAP pressure is needed during lateral positions compared to supine positions.

Psychiatry Clin Neurosci. 2000 Jun;54(3):340-1.

The influence of sleep position and obesity on sleep apnea.

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The influence of sleep position and the degree of obesity were examined in 257 subjects with sleep apnea. Subjects were divided into three groups according to obesity: normal weight (body mass index (BMI) under 24.0 kg/m²), mild obese (BMI 24.0-26.4 kg/m²) and obese group (BMI 26.4 kg/m² and heavier). The apnea + hypopnea index (AHI), the intraesophageal pressure and the lowest oxygen saturation became significantly worse according to the degree of obesity. The subjects were also divided into two groups according to the reduction in the AHI by lateral position: good responders showed 50% or more reduction of AHI in lateral position and poor responders indicated less than 50% reduction. The percentage of good responders to sleep position change was 90.9% in normal weight group, 74.0% in mild obese group and 57.4% in the obese group. The ratio of the subjects who had indicated two or more obstructive sites in normal weight group was 36.0% in good responders and 40.0% in poor responders. The ratio in the mild obese group was 51.8% in good responders and 66.7% in poor responders. In the obese group, the ratio was 59.4% in good responders and 78.9% in poor responders.

Chest. 2000 Oct;118(4):1018-24.

Association of body position with severity of apneic events in patients with severe nonpositional obstructive sleep apnea.

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STUDY OBJECTIVE: To compare the severity of sleep apneic events occurring in the supine posture vs the severity of sleep apneic events occurring in the lateral posture in patients with severe obstructive sleep apnea (OSA).

DESIGN: A retrospective analysis of apneic event variables in a group of 30 OSA patients who underwent a complete polysomnographic evaluation in our sleep disorders unit.

PATIENTS: Thirty patients with severe OSA (respiratory disturbance index [RDI] = 70.1 ± 18.2) who were nonpositional patients (NPP), ie, in whom the ratio of the supine RDI to the lateral RDI is < 2 (supine RDI = 85.7 ± 11.7 , lateral RDI = 64.8 ± 17.3), and who had $>$ or $= 30$ apneic events in the lateral position and 30 apneic events in the supine position during sleep stage 2 were included in the study.

MEASUREMENTS: For the 30 apneic events in each body position, the following variables were evaluated: apnea duration (ApDur), minimum desaturation (MinDes), Delta desaturation (Delta-Des), duration of arousal (DurArous), maximum snoring loudness (MaxSL), and Delta heart rate (Delta-HR). In addition, three other variables assessed as a ratio of ApDur (Rate-D = $\Delta\text{Des}/\text{ApDur}$, R-HR = $\Delta\text{HR}/\text{ApDur}$, and R-Arous = $\text{DurArous}/\text{ApDur}$) were also

calculated.

RESULTS: For all variables evaluated, apneic events occurring in the supine posture were significantly more severe than those apneic events occurring in the lateral posture during sleep stage 2. ApDur of both body postures correlated significantly with DurArous, Delta-HR, and MaxSL, but not with Delta-Des and MinDes. ApDur correlated linearly with DurArous for both postures. The slopes of the two regression lines were similar ($p = 0.578$) but the regression line intercept for the supine apneas was significantly higher than that of lateral apneas ($p < 0.0001$). In addition, the average number of supine apneic events that did not end with an arousal was smaller than the average number of lateral apneic events not ending with an arousal (4.4 ± 6.0 vs. 10.5 ± 6.7 , respectively; $p < 0.0001$). Also, only 4 of 900 (0.44%) apneic events analyzed in the lateral posture ended with an awakening (> 15 s), whereas in the supine posture, there were 37 (4.1%) such events ($p < 0.001$).

CONCLUSIONS: These results show that even in patients with severe OSA who have a high number of apneic events in the supine and lateral posture, the apneic events occurring in the supine position are more severe than those occurring while sleeping in the lateral position. Thus, it is not only the number of apneic events that worsen in the supine sleep position but, probably no less important, the nature of the apneic events themselves.

J Hum Hypertens. 1997 Oct;11(10):657-64.

Avoiding the supine position during sleep lowers 24 h blood pressure in obstructive sleep apnea (OSA) patients.

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Obstructive sleep apnea (OSA), is a common clinical condition affecting at least 2-4% of the adult population. Hypertension is found in about half of all OSA patients, and about one-third of all patients with essential hypertension have OSA. There is growing evidence that successful treatment of OSA can reduce systemic blood pressure (BP). Body position appears to have an important influence on the incidence and severity of these sleep-related breathing disturbances. We have investigated the effect of avoiding the supine position during sleep for a 1 month period on systemic BP in 13 OSA patients (six hypertensives and seven normotensives) who by polysomnography (PSG) were found to have their sleep-related breathing disturbances mainly in the supine position. BP monitoring was performed by 24-h ambulatory BP measurements before and after a 1 month intervention period. We used a simple, inexpensive method for avoiding the supine posture during sleep, namely the tennis ball technique. Of the 13 patients, all had a reduction in 24-h mean BP (MBP). The mean 24-h systolic/diastolic (SBP/DBP) fell by 6.4/2.9 mm Hg, the mean awake SBP/DBP fell by 6.6/3.3 mm Hg and the mean sleeping SBP/DBP fell by 6.5/2.7 mm Hg, respectively. All these reductions were significant (at least $P < 0.05$) except for the sleeping DBP. The magnitude of the fall in SBP was significantly greater in the hypertensive than in the normotensive group for the 24 h period and for the awake hours. In addition, a significant reduction in BP variability and load were found. Since the majority of OSA patients have supine-related breathing abnormalities, and since about a third of all hypertensive patients have OSA, avoiding the supine position during sleep, if confirmed by future studies, could become a new non-pharmacological form of treatment for many hypertensive patients.

Chest. 1997 Sep;112(3):629-39.

Positional vs nonpositional obstructive sleep apnea patients: anthropomorphic, nocturnal polysomnographic, and multiple sleep latency test data.

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STUDY OBJECTIVES: To compare anthropomorphic, nocturnal polysomnographic (PSG), and multiple sleep latency test (MSLT) data between positional (PP) and nonpositional (NPP) obstructive sleep apnea (OSA) patients.

DESIGN: This is a retrospective analysis of anthropomorphic, PSG, and MSLT data of a large group of OSA patients who underwent a complete PSG evaluation in our sleep disorders unit. The patients were divided in two groups: the PP group, those patients who had a supine respiratory disturbance index (RDI) that was at least two times higher than the lateral RDI, and the NPP group, those patients in whom the RDI in the supine position was less than twice that in the lateral position.

SUBJECTS: From a group of 666 consecutive OSA patients whose conditions were diagnosed in our unit from September 1990 to February 1995, 574 patients met the following criteria and were included in the study: RDI > 10 ; age > 20 years, and body mass index (BMI) > 20 .

RESULTS: Of all 574 patients, 55.9% were found to be positional. No differences in height were observed but weight

and BMI were significantly higher in the NPP group, these patients being on the average 6.5 kg heavier than those in the PP group. The PP group was, on average, 2 years younger than the NPP group. Nocturnal sleep quality was better preserved in the PP group. In this group, sleep efficiency and the percentages of deep sleep (stages 3 and 4) were significantly higher while the percentages of light sleep (stages 1 and 2) were significantly lower than in the NPP group. No differences for rapid eye movement (REM) sleep were found. In addition, wakefulness after sleep onset and the number of short arousals (< 15 s) were significantly lower in the PP group. Apnea index and total RDI were significantly higher and the minimal arterial oxygen saturation in REM and non-REM sleep was significantly lower in the NPP. No differences in periodic limb movements data were found between the two groups. The average MSLT was significantly shorter in the NPP group. Univariate and multivariate stepwise logistic regression analysis showed that the most dominant variable that correlates with positional dependency in OSA patients is RDI, followed by BMI which also adds a significant contribution to the prediction of positional dependency. Age, although significant, adds only a minor improvement to the prediction of this positional dependency phenomenon. A severe, obese, and older OSA patient is significantly less likely to be positional than a mild-moderate, thin, and young OSA patient. In four obese OSA patients who lost weight, a much more pronounced reduction was seen in the lateral RDI than in the supine RDI, and three of these cases who were previously NPP became PP.

CONCLUSIONS: In a large population of OSA patients, most were found to have at least twice as many apneas/hypopneas in the supine than in the lateral position. These so-called "positional patients" are on the average thinner and younger than "nonpositional patients." They had fewer and less severe breathing abnormalities than the NPP group. Consequently their nocturnal sleep quality was better preserved and, according to MSLT data, they were less sleepy during daytime hours. RDI was the most dominant factor that could predict the positional dependency followed by BMI and age. RDI showed a threshold effect, the prevalence of PP in those with severe RDI (RDI \geq 40) was significantly lower than in those OSA patients with mild-moderate RDI. BMI showed a major significant inverse relationship with positional dependency, while age had only a minor although significant inverse relationship with it. Body position during sleep has a profound effect on the frequency and severity of breathing abnormalities in OSA patients.