Chapter 6
Management of Sleep Disorders-Sleep Technology on Positional Therapy

Chol Shin and Jung Bok Lee

Abstract Positional patients are defined as obstructive sleep apnea (OSA) patients in whom respiratory disturbance index (RDI) or apnea-hypopnea index (AHI) is at least twice as high in the supine position than in the non-supine position. Positional therapy (the avoidance of the supine posture during sleep) is a simple behavioral therapy for mild and moderate sleep disordered breathing. In this chapter, we 1) provide an overview of position dependent sleep and positional therapy for sleep disordered breathing, 2) update the clinical evidence for positional therapy and position dependent sleep advances in sleep technology, and 3) discuss issues regarding implementing positional therapy.

Keywords Position dependency • Body posture • Collapsibility • Lateral position • Sleep disordered breathing

6.1 Introduction

It has been reported that obstructive sleep apnea syndrome (OSAS) and sleep disordered breathing (SDB) are very prevalent in the general population across regions and populations [1, 2]. SDB has been identified as a severe risk or prognostic factor for many chronic diseases [3–6]. There are different treatment options for OSAS and SDB, which consist of (1) behavioral therapy including

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weight loss, reduction of alcohol intake, stopping sedatives or sleep medication; (2) conservative interventions including mandibular repositioning, continuous positive airway pressure (CPAP) titration; and (3) medication and surgical therapy [7]. Of the many treatment options, CPAP treatment has been recognized as the most efficacious therapy and has been recommended as the primary option for OSA [8, 9]. However, major concerns about CPAP treatment include not only non-adherence with CPAP therapy [10], but also the limited therapeutic benefits of CPAP treatment in mild OSAS patients [11]. This was illustrated by Rosenthal et al. [12] who demonstrated that adherence to CPAP in mild OSAS was suboptimal. The success of CPAP therapy was even more problematic, even though the initial acceptance of CPAP was relatively good [13].

As an alternative, positional therapies for OSAS and SDB have been highlighted. Cartwright [14] made critical contributions to positional therapy, even defining positional patients. Positional therapy has not only had limited acceptance, but has also been regarded as a secondary or supplemental therapy for OSAS and SDB. This difficulty in therapeutic acceptance is due to the lack of reliable evidence, as well as the non-elaborate (or naive) devices used to correct body posture. However, recently many studies have investigated the efficacies and beneficial aspects of positional therapy, including comparative studies with CPAP treatment and combinational effects of other treatments.

In this chapter, we briefly describe reviews of position dependency and positional therapy in Sect. 6.2 and present updated clinical evidences in Sect. 6.3. Oksenberg and colleagues comprehensively explain most issues on positional therapy in their excellent review [15].

6.2 Overview of Positional Therapy

6.2.1 Definition of Positional Sleep Apnea

Cartwright [14] first defined positional patients as OSA patients who had an overall apnea-hypopnea index (AHI) that was greater than 5. Additionally, these patients had a supine AHI that was at least two times greater than in the non supine position [15] (Table 6.1).

Some researchers have even more strict requirements including (1) AHI < 15 in the non-supine position, or (2) at least one rapid eye movement (REM) period [16], or (3) more than 1 h of sleep in a non-supine position [17]. For diagnosis of positional dependency, body position monitoring during a full polysomnography is recommended. There is no accepted guideline for the minimum time in which to assess positional differences. Mador et al. [18] demonstrated that there were no differences between a minimum of 15 and 30 min in each position.

As shown in Table 6.1, the definition of positional sleep apnea is very simple, but there are some points to consider. Oksenberg and Silverberg [15] summarized practical points to diagnose positional sleep apnea:

Table 6.1 Summary of positional sleep apnea

	Definition	Remark
Requirements	Overall AHI > 5	
	AHI in supine > 2 × AHI in non-supine position	
Optional criteria	More than two supine positions	Selection of options may apply
	>1 h of non-supine position	
	AHI < 15 in the non-supine position	
	At least one REM period in the non-supine position	
	More than 15 min per supine or non-supine posture	

- The monitoring and recording of body position should be included.
- Sufficient sleep time in supine and non-supine positions is necessary for diagnostic evaluation.
- The severity of the disease is related mainly to the sleep time spent or not spent in the supine position.

These practical points are why some researchers include some of the optional criteria listed in Table 6.1.

An example hypnogram of a typical positional sleep apnea patient is shown in Fig. 6.1. The patient's overall AHI was 14.3, whilst their AHI in supine and non-supine positions were 26.3 and 2.9 respectively. During supine position sleep, apnea, hypopnea events, and snoring increased, even when other events were dramatically decreased. Oksenberg [19] also compared hypnograms of non-positional and positional patients. He emphasized that the OSA severity of position dependency was entirely dependent on the sleep time spent or not spent in the supine position.

Mador et al. [18] emphasized the importance of accurate recording and scoring. Digital position monitoring, when compared to direct review of videotape recordings of the patient, has not been disappointing. Mador et al. [18] recommended that real-time position scoring by on-site technicians appeared to be highly accurate. Direct comparison of real-time position scoring with video recording has shown that direct patient observation provides an accurate record. Real-time observation of the patient by the on-site technician can be an acceptable method for posture scoring.

6.2.2 Prevalence of Positional Sleep Apnea

During the 1980s–1990s, the prevalence of positional patients in OSA covered a broad range, from 9 to 60% [14, 20–25]. Oksenberg and Silverberg [15] explained that this wide variation was due not only to small sample sizes, but also the different types of OSA patients studied. Cartwright [14] reported that the prevalence of positional patients was 58.3% of 24 OSA patients in one study, and 55.9% of 574 OSA patients in another study by the same group [24].

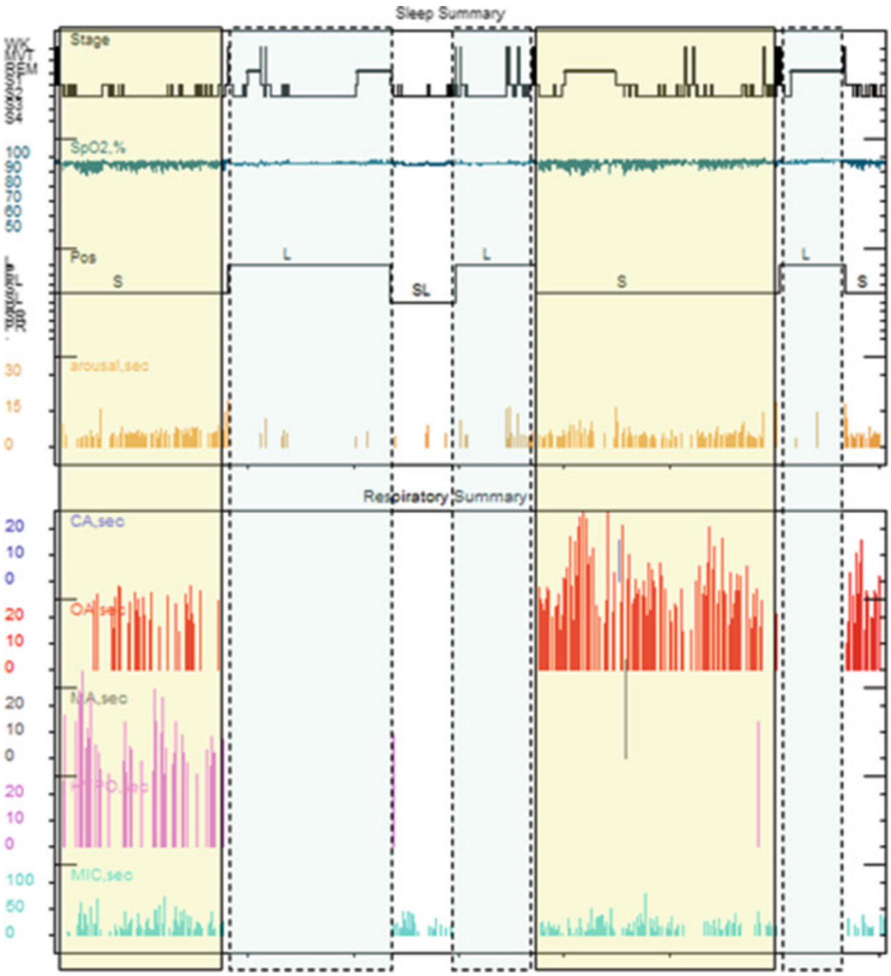

Fig. 6.1 Hypnogram example of positional sleep apnea: *Box* with *solid line* indicates supine position and with *dashed line* indicates non-supine position

In the 2000s, three prevalence studies of relatively moderate OSA patient sample sizes were reported in the US, Europe, and Korea [18, 26, 27]. In the study by Richard et al., 55.8% of the 120 patients had dependent OSAS. Mador et al. [18] and Kim et al. [26] reported the prevalence of positional OSA according to the OSA severity in US and Korean patients (Fig. 6.2). In Mador et al.'s study, 49.5% of mild OSA patients were positional, whilst the percentages in moderate and severe decreased to 19.4 and 6.5% respectively. Kim et al. [26] also reported similar prevalence rates to Mador et al.'s study.

From the studies cited above, it becomes evident that (1) positional OSA is more prevalent in mild OSA; that is to say position dependency is highly related to OSA severity, and (2) that the prevalence of positional OSA is approximately 50% or

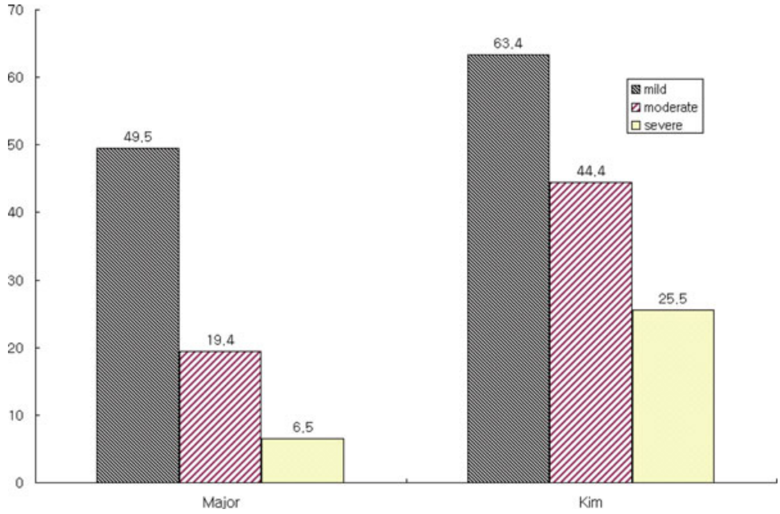

Fig. 6.2 Prevalence of positional sleep apnea according to OSA severity

Table 6.2 Summary of position dependency predictors

Factors	Conditions	Statistical significance
Age	Younger age	Borderline
Gender	No significance	Non significant
Obesity	Less obese	Significant
Severity (or AHI)	Highly correlated: mild or moderate	Significant
Snoring	Change apnea events to snoring Reduce intensity	Significant
Sleep stage	Less AHI in positional patients during REM	Significant

more in mild OSA patients. Since position dependency may be a characteristic of the natural development of OSA, positional OSA may develop to a non-positional condition as the severity increases [24].

6.2.3 Factors Influencing Position Dependency

- Age

  As a predictor of positional dependency, there are discrepancies between prevalence studies. In Oksenberg et al. [24], two younger groups showed equal prevalence of positional patients, while in the elderly group, the prevalence of positional patients decreased. This finding was of borderline statistical significance. In Richard et al.'s study, positional patients were significantly younger than non positional patients, while Kim et al. [26] and Mador et al. [18] did not observe any significant age effects.

Consequently, age is a weak contributing factor, but elderly OSA patients are less likely to be positional [15].

- Gender
  No gender differences have been reported in positional OSA patients.
- Obesity
  Lloyd and Cartwright [22] found that the degree of obesity correlates better with the AHI in the supine position than in the non-supine position. This finding suggests that weight loss is an effective behavioral therapy [15]. Various studies have demonstrated that obesity is highly correlated with positional OSA. In Oksenberg et al. [24], body mass index (BMI), and weight were significantly lower in positional than in non-positional patients, while weight, waist circumference, and waist-hip ratio (WHR) were significant in Kim et al.'s study [26].
- Severity
  The severity of OSA is highly associated with positional dependency.
- Snoring
  There is no objective evidence for positional effects on snoring. Braver and Block [28] reported that positional therapy was not effective for snoring. Nakano et al. [29] demonstrated not only that snorers showed decreased snoring both in duration and intensity in the non-supine position, but also that in the apneic group, the positional dependency of snoring was correlated with supine AHI. In fact, OSA patients with a higher supine AHI tended to show decreased apnea and increased snoring in the non-supine position. This phenomenon could be viewed as a predictor of disease progression. Oksenberg and Silverberg [15] reported that the supine position in habitual snorers had a general detrimental effect on snoring and on the arousals from it. Choi et al. [30] provided clinical evidence that the snoring rate was significantly lower during positional therapy than at baseline.
- Sleep Stage
  In epidemiologic studies [18, 27], the AHI during REM was found to be significant higher in non positional patients. However, the AHI during REM sleep was significantly less in the non-supine position compared to the supine position in positional patients. There has been controversy regarding the association of sleep stage and OSA. In early studies, George et al. [20] suggested that the apnea index (AI) was higher in the supine position only in the non-REM sleep stage, while the duration of apnea was longer during REM sleep regardless of the body position. However, several studies [25, 31] have demonstrated the positional effect in non REM sleep, but that some patients lose their positional susceptibility while in REM sleep [15].

6.2.4 Mechanism

The prominent pathomechanism of OSA is partial or complete obstruction of the upper airway accompanied by oxygen desaturation [32, 33]. The effect of gravity to decrease the lumen of the upper airway during supine sleep is probably the

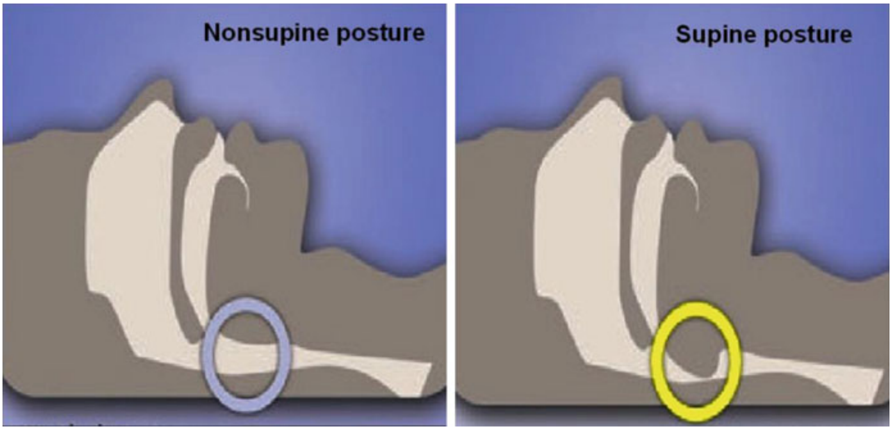

Fig. 6.3 An illustration of pharyngeal collapsibility in the nonsupine (lateral position) and supine posture

most dominant factor responsible for any physiological changes observed in this posture [15].

Sleeping in the lateral position reduces the pharyngeal collapsibility that can be caused by several mechanisms [34]. Since the tongue plays a role in upper airway obstruction, the lateral position provides a protective function by preventing the tongue from occluding the airway when the genioglossus muscle is hypertonic [32] (Fig. 6.3).

6.2.5 General Guidelines for Positional Therapy

The most recent guidelines for positional therapies was published by the Standard of Practice Committee of the American Academy of Sleep Medicine (AASM) in 2006 [9]. Although positional therapy is a simple, effective approach for position dependent patients, it is not considered a primary therapy, but is limited to secondary and supplementary treatment.

Positional Therapies

Positional therapy, consisting of a method that keeps the patient in a non-supine position, is an effective **"secondary therapy"** or can be a **"supplement to primary therapies"** for OSA in patients who have a low AHI in the non-supine versus that in the supine position.

– Standard of Practice Committee of the American Academy of Sleep Medicine

Table 6.3 PubMed search result from AASM

First author	Year	Subject	Evidence level	AASM Review criteria
Cartwright	1985	Positional therapy	III	
Cartwright	1991	Positional vs nasal therapy	II	Satisfied
Jokic	1999	Positional vs CPAP	II	Satisfied
Kushida	1999	Positional therapy	III	Satisfied
McEvoy	1986	Positional therapy	III	
Miki	1988	Positional therapy	III	
Neill	1999	Positional therapy	III	
Series	2001	Positional vs CPAP	II	

Another AASM publication provided evidence levels of clinical trials for positional therapies as in table 6.3 [52]. Unfortunately, there is no evidence level I study for positional therapies (Level I Study: Randomized well-designed trials with low-alpha & low-beta errors). In addition to PubMed searching of AASM, Skinner et al. [35] and Zuberi et al. [36] satisfied the AASM review criteria, therefore a total of five publications were considered by the Standard of Practice Committee of AASM.

6.3 Update of Clinical Evidence for Positional Therapy

6.3.1 Optimal Sleep Position

Many researchers have investigated SDB such as OSA and snoring, in which the collapse of the upper airway is the primary event [37, 38]. Numerous medical devices have been developed to eliminate SDB symptoms [14, 21, 36, 39]. Different sleeping positions have been proposed for the improvement of OSA symptoms [40, 41].

Few studies have investigated the optimal sleeping position to reduce upper airway sleep apnea andor snoring symptoms. There are several reasons why sleep position is difficult to study. In the natural sleeping position, patients unconsciously rotate approximately 90° in the lateral position without awareness of their degree of rotation during sleep. Several studies have investigated the relationship between sleep posture and the collapsibility of the upper airway. They have reported that a 20° head extension cervical support [39], a 45° incline on both sides [36], or an elevation of body position [35] are effective in reducing sleep apnea andor snoring.

However, few studies have theoretically evaluated several characteristics of body position that play key roles in determining the parameters of positional therapy. In Lee et al. [42], effective sleep positions and a combination of sleep position determinants were evaluated to examine their effect on reducing snoring and/or apnea. These parameters include cervical vertebrae support with head tilting, scapula support (SS), and being in the lateral position for sleep. The study focused on determining the potential optimal position in patients with snoring and sleep apnea. Thus, response surface analysis, a complex statistical method, was used for the following purposes: (i) to determine the factor levels that will simultaneously satisfy a set of desired specifications, (ii) to determine the optimum combination of factors that yield a desired response and describes the response near the optimum, and (iii) to achieve a quantitative understanding of snoring and sleep apnea behavior over the region evaluated.

After response surface model fitting, the data from this study demonstrated that the optimal sleeping position for eliminating snoring was not only highly associated with the lateral position, but also its interaction with cervical vertebrae support with head tilting. The results also showed that the interaction of the lateral position with cervical vertebrae support with head tilting and SS was effective in reducing sleep apnea. The principal conclusion of this study was that more than a 30° rotation and a 20 mm elevation of the upper trunk with moderate support (60–70 mm) of the cervical vertebrae were effective in reducing snoring. For sleep apnea, a >40° rotation with higher levels of cervical vertebrae support with head tilting (>70 mm) and SS (30 mm) were recommended for an AHI reduction >80%.

Based on the estimated regression equation, the optimal sleeping position ideally reduces the snoring rate to 0% during the entire sleeping period, when a 40° lateral rotation and a 60 mm cervical vertebrae elevation in mild snoring patients (i.e. a snoring rate: 20%) is employed. In addition, AHI could be decreased to <80% in the case of a 40° lateral rotation and a 30 mm SS with the appropriate cervical vertebrae support with head tilting in mild or moderate sleep apnea.

6.3.2 Intervention Studies

Until now, many studies have reported the usefulness and efficacy of positional therapy and it is summarized in Table 6.4. Various positional devices have been used including position alarms [43], tennis or soft balls [14, 16, 24], and pillows and a head support device [35, 36, 39].

There are several studies on positional therapy using specially designed pillows. One study was conducted to determine the ability of a specially designed, triangular double-inclined pillow with an arm position recess on both sides in the base under the incline to treat snoring and OSA [36]. In patients (n = 19) with mild (respiratory disturbance index [RDI] < 20) and moderate (20 < RDI < 40) OSA, the RDI decreased significantly from 17.4 to 5.1, and snoring decreased in 15 (78.9%) of the 19 patients. The effects of cervical position with neck extension on snoring and OSA were investigated using a custom-designed cervical pillow [39]. In patients

Table 6.4 Summary of intervention studies using medical devices

First author	Year	Device type	Study design
Cartwright	1985	Tennis ball technique	Pre-post
Cartwright	1991	Tennis ball with alarm	Semi-crossover
Braver	1994	Tennis ball with nasal spray	Pre-post
Jokic	1999	Tennis ball vs CPAP	Comparative: crossover
Choi	2000	Jaw and head position	Comparative
Kushida	2001	Pillow	Pre-post
Bliwise	2004	Knees-up position	Comparative: crossover
Skinner	2004	Head elevation device	Pre-post
Zuberi	2004	Pillow	Pre-post
Loord	2007	Soft vest attached to pillow	Pre-post
Choi	2009	Vest type	Pre-post
Permut	2010	Tennis ball type vs CPAP	Comparative

with mild OSA ($n = 3$), the RDI decreased significantly from 14.7 to 10.5 and the mean percentages of snoring and snoring duration were slightly reduced, though this was not statistically significant. In patients with moderate ($n = 4$) to severe OSA ($n = 5$), RDI, the mean percentages of snoring and snoring duration were not significantly decreased. However, in another study [44], the mean AHI decreased significantly during treatment from 21.8 to 14.3 in 18 patients with OSA. Thirteen (72.2%) of the 18 patients experienced decreases in AHI, but their mean percentages of snoring increased during treatment from 30 to 38%. In addition, 11 (61.1%) of the 18 patients snored without change (2/18) or more frequently (9/18) during treatment. It is thought that these different results for snoring may be due to differences in the design of the pillow, different study groups, or different indications for treatment and assessment of snoring.

Choi et al. [30] proposed a vest-type design and a connected controller with two 5-mm air tubes. Two air chambers are installed in parallel on the left and right side of the back of the vest. During sleep, one of the chambers is inflated to prevent the supine position, and then deflated after a pre-specified time and the other chamber is inflated. Using the controller, the user can select from a number of options: (1) sleep time (20, 30, or 60 min); (2) position preference (left, right, or both sides); and (3) time for maintaining inflation (60, 90, or 120 min). Based on a pre- and post- treatment comparative parallel study, both the mean total snoring rate (from $36.7 \pm 20.6\%$ to $15.7 \pm 16.2\%$) and snoring rate in the supine position (from $45.8 \pm 22.8\%$ to $25.4 \pm 20.6\%$) decreased significantly with use of the vest. The mean percent change of the total snoring rate between baseline and with the positional device was significant ($63.5 \pm 22.5\%$). Of the 17 subjects, 15 (88.2%) decreased their snoring rate more than 50% without subjective or objective adverse effects.

In a previous study of Oksenberg et al. [24] on positional therapy using a tennis ball, the usefulness the tennis ball technique (TBT) during a 6-month period in 78 consecutive positional OSA patients was examined [13]. A questionnaire was used to obtain information and 50 (64.1%) of the 78 patients returned the questionnaire. Of these patients, 19 (38%) still used the TBT, 12 (24%) used it initially and stopped within a few months, but still avoided the supine position. Nineteen (38%) stopped using the TBT within a few months without learning how to avoid the supine position during sleep. The most common reasons for stopping use of TBT were that it was uncomfortable; it kept moving; patients still slept supine with it; there was no improvement in sleep, snoring, or alertness; and it caused backache. Compared to positional therapy using a pillow or vest-type device, positional therapy using a ball or alarm may cause not only frequent arousal or disrupted sleep, but also is not effective in patients who may not feel the pressure of the ball due to obesity, or who may not hear the alarm due to loud snoring or hearing problems.

6.3.3 Comparison of CPAP Treatments

CPAP therapy has long been the primary treatment for most patients with OSA. It provides not only efficacy in sleep apnea and beneficial effects on sleep quality and daytime alertness [45], but it also improves cognitive performance [46]. There are disadvantages to CPAP treatment such as patient non-compliance and higher treatment costs. Also, many researchers have focused on improvements in the AHI with positional treatments, rather than functional outcomes such as sleep quality, daytime alertness, and cognitive performance [16].

There are only two clinical studies that compare CPAP treatment and positional therapy. Jokic et al. [16] postulated that positional treatment improved sleep quality and daytime performance, as compared to CPAP in the management of positional OSA. Based on a crossover design, 14 positional OSA patients were recruited. In this study, it was concluded that positional treatment has no clinical advantage over CPAP in the treatment of positional OSA. Positional therapy is not equivalent to CPAP treatment in reducing AHI and in improving subjective or objective sleep quality and arousal index. However, as the efficacy advantages of CPAP over positional therapy did not translate into a functional improvement with CPAP treatment, Jokic et al. (1999) emphasized that positional treatment appears to be an effective alternative treatment to CPAP, at least in the short term, in positional OSA.

Contrary to Jokic et al. [16], another comparative study demonstrated that positional therapy is equivalent to CPAP for normalizing the AHI in patients with positional OSA, with similar effects on sleep quality and nocturnal oxygenation [17]. In the study, four major findings were reported. First, in patients with positional OSA, positional therapy is equivalent to CPAP therapy in normalizing the AHI to fewer than five events per hour. In addition, the AHI was decreased by more than 50%. Second, positional therapy is similar to CPAP therapy in regard to effects on sleep quality and nocturnal oxygenation. Thirdly, there is minimal night-to-night variability in the nonsupine AHI in patients with positional OSA. The fourth finding was that positional therapy is effective at maintaining patients in the nonsupine position throughout the night [17].

Compared to Jokic et al.'s study, Permut et al.'s results emphasize that positional therapy can be a primary treatment "for positional OSA patients who have treatment effect." However, to be a primary treatment, it is necessary to confirm the equivalence or superiority of sleep quality, cognitive function, and the quality of life between CPAP and positional therapy. Superior patient compliance of positional therapy over CPAP must also be demonstrated.

6.3.4 Long-Term Follow Up Study

Positional therapy is a less frequent form of therapy than CPAP treatment, but it appears to be an adequate form of therapy for positional OSA patients [13]. In order for positioning therapy to be a primary treatment for positional OSA, it is important to evaluate long-term efficacy, safety and compliance as well as comparative studies with active controls. Since there is no accepted evidence of the efficacy of positional therapy from a long-term follow-up study, clinicians hesitate to try the positional therapy for positional OSA patients. Unfortunately, there has been no long-term study of positional therapy for 20 years since Cartwright's contribution on this topic. Oksenberg and Silverberg as far back as 1998 emphasized that well-designed, long-term evaluations of the efficacy of positional therapy in large populations were urgently needed. However, only two studies with small sample sizes have been published.

In Oksenberg et al.'s follow-up study [13], in 50 positional OSA patients after a 6 month period, 19 (38%) reported they were still using TBT. Another 12 (24%) of these patients said they stopped TBT, since they had learned to avoid the supine position during sleep. Based on these reports, the overall compliance rate of TBT was estimated to 38–62%. Patients still using the TBT showed a significant improvement in their self-reported sleep quality, daytime alertness, and a decrease in snoring loudness. Most of the patients that had stopped using the TBT after a short period of time, complained that it was "uncomfortable." Interestingly, age was the only predictor that significantly differentiated between patients who complied and who did not comply. Age was higher in two groups either "still using the TBT" group or "learned to sleep on their side without the belt" group than in any other groups.

Recently Bignoid et al. [47] reported another long-term study with a longer (mean 2.5 years) follow-up time. However, the sample size was small. Among the 62 respondents of the study, only 4 (6.0%) reported they were still using the TBT. Nine (13.4%) subjects were no longer using TBT, because they had learned to avoid the supine position during sleep. These results are similar to Oksenberg et al. [13], in that the major reason for patients stopping TBT treatment was the high degree of discomfort (63.0% of respondents).

The long-term compliance of TBT appears to be poor; as low as 19.4%, with the level of discomfort cited as a major problem. It is essential to develop alternative high-tech devices to guarantee patient comfort for positional treatment in addition to improving patient compliance with the device.

6.3.5 Combinational or Supplemental Therapy

According to the guidelines of AASM, positional therapy is a secondary and supplemental therapy for positional OSA. Recently there have been a few clinical studies to evaluate auxiliary, supplemental and combinational effects of positional therapy. Of the early studies, Cartwright et al. [43] found that adding a tongue-retaining device (TRD) to positional therapy was better than each treatment alone. Braver and Block [28] demonstrated that the combination of nasal spray and positional therapy produced a small, but significant improvement in the AHI of 20 snorers. However, Braver et al. [48] emphasized the importance and usefulness of combinational or adjunct therapy.

When patients with severe non positional OSA had a large number of apneic events in both the supine and the non-supine posture, the apneic events during the supine posture were more severe than the apneic events occurring in the non-supine posture. Penzel et al. [32] emphasized that the collapsibility of the upper airway was strongly influenced by body position and proposed that as a consequence, lower CPAP pressure was needed during lateral positions compared to supine positions. This result implies that positional therapy may contribute to a lower titration of CPAP in severe (non-) positional OSA patients to improve the acceptance and compliance of CPAP treatment.

More evidence for the importance of combination therapy was provided by Chung et al. [49], who investigated the treatment outcomes of mandibular advancement devices (MADs) for positional and non-positional obstructive sleep apnea. The percent change of AHI in non-positional patients was 46.03%, while that in non-positional patients was 74.69%.

This clinical evidence will motivate more detailed clinical evaluations to demonstrate niche effects of positional therapy, as well as its use as primary treatment for positional OSA.

6.3.6 Central Sleep Apnea

Central sleep apnea is common in patients with heart failure in which central apneas alternate with hyperpneas that have a waxing-waning pattern of tidal volume [50, 51]. A few research papers have reported that positional therapy is highly effective in attenuating the severity of central sleep apnea with Cheyne Stokes Respiration. The reader is referred to Szollosi et al. [52] and Joho et al. [53].

6.4 Concluding Remarks: Challenging Issues in Positional Therapy

Positional therapy is an effective intervention for positional OSA and SDB patients of mild or moderate severity, and is very simple, non-invasive, and inexpensive [15]. Positional therapy can be used as an auxiliary, supplemental and combinational therapy to any other form of therapy for SDB patients.

However, lack of clinical evidence means clinicians hesitate to utilize positional therapy. Patient noncompliance due to discomfort is another major obstacle. Consequently, the following are essential for positional therapy to be elevated in the SBD armamentarium.

- Long-term follow-up studies with larger sample sizes are necessary for the evaluation of efficacy, safety and compliance.
- Innovative high-tech devices should be developed to guarantee patient comfort during use.
- Comparative studies to evaluate (1) a primary therapy such as CPAP, (2) devices for position change or avoiding supine position, and (3) another therapy such as an oral device, should be performed.
- As a niche effect, combinational or auxiliary effects with any other forms of therapy should be explored.

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