

Summary and Future Perspectives

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The Wagnerian leitmotif in this book on OSA is sleep position. OSA is a serious, highly prevalent disease with major health implications (chapters “Introduction” and “OSAS: The Magnitude of the Problem”). In the beginning of the book, the finding is highlighted that mild OSA in the majority of cases is positional (chapters “The Contribution of Head Position to the Apnea/Hypopnea Index in Patients with Position-Dependent Obstructive Sleep Apnea”, “Influence of Sleep Position on the Transition of Mild to Moderate and Severe OSA” and “Positional Therapy: Left Lateral Decubitus Position Versus Right Lateral Decubitus Position”). With progression of the disease from mild via moderate to eventually severe OSA, positional OSA progresses into non-positional severe OSA. In later chapters the observation is made that patients with insufficient response to therapy, such as can happen in palatal surgery, maxillomandibular advancement or bariatric surgery, severe non-positional OSA can reverse to less severe positional OSA (chapters “Positional OSA in the Morbidly Obese and the Effect of Weight Loss on OSA Severity”, “Positional Therapy and Tongue Base Surgery”, “Residual POSA After Maxillomandibular Advancement in Patients with Severe OSA”, “Impact of Upper Airway Surgery on Positional Change During Sleep” and “Comparison of Positional Therapy to CPAP in Patients with Positional Obstructive Sleep Apnea”). The circle is complete.

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It has become clear that sleep position deserves a larger role in the management of sleep-disordered breathing, especially habitual snoring and OSA. In the first place, polysomnography positional sensing should routinely be included. Separate positional measurements for head and trunk during polysomnography should be seriously considered (chapter “The Contribution of Head Position to the Apnea/Hypopnea Index in Patients with Position-Dependent Obstructive Sleep Apnea”). Polysomnographic observations in various populations, sleep positions and sleep stages are discussed in chapters “Prevalence of Positional Obstructive Sleep Apnea in Patients Undergoing Polysomnography and the Effect of Sleep Stage”, “Clinical Characteristics of Positional Obstructive Sleep Apnea Among Asians” and “Positional Therapy: Left Lateral Decubitus Position Versus Right Lateral Decubitus Position”. Next in order, improvement of current drug induced sedated endoscopy methods by taking sleep position into account. For example, in cases with positional OSA undergoing DISE, observations in lateral sleeping position are mandatory (chapters “Drug-Induced Sleep Endoscopy and Sleep Position” and “Changes in Site of Obstruction in Obstructive Sleep Apnea Patients According to Sleep Position”). It is a clinical reality that, as yet, this is rarely done. Perhaps, tilting of the head during DISE is sufficient (chapter “Drug-Induced Sleep Endoscopy and Sleep Position”).

Generally accepted definitions of POSA are urgently needed, as well as algorithms and formulas to predict if positional therapy might be considered as part of the overall treatment plan (chapters “Towards a Clinical Classification System (APOC) for Position-Dependent Obstructive Sleep Apnea”, “Retrospective Cohort Analysis with the APOC System” and “Correlation Between Calculated/Predicted and Actual AHI After Positional Therapy”).

It can be concluded that variations on the tennis ball technique have become obsolete since the introduction of smart positional therapy (chapters “History of Positional Therapy: Transition from Tennis Balls to New Devices”, “Long-Term Results and Compliance of a Special Vest Preventing the Supine Position”, “Results of a First-Generation New Device for Positional Therapy”, “Short-Term (4 Weeks) Results of the Sleep Position Trainer for Positional Therapy”, “Long-Term (6 Months) Effectiveness, Compliance, and Subjective Sleep Outcomes of Treatment with the Sleep Position Trainer in a Large Cohort of Position-Dependent OSA Patients”, “10 Problems and Solutions for Positional Therapy: Technical Aspects of the Sleep Position Trainer” and “Prevalence and Effect of Supine-Dependent Obstructive Sleep Apnea on Oral Appliance Therapy”). Positional therapy can be offered as single treatment or supplementary to oral device treatment or surgery (chapters “Prevalence and Effect of Supine-Dependent Obstructive Sleep Apnea on Oral Appliance Therapy”, “Positional Therapy and Palatal Surgery”, “Positional Therapy and Tongue Base Surgery”, “Residual POSA After Maxillomandibular Advancement in Patients with Severe OSA” and “Impact of Upper Airway Surgery on Positional Change During Sleep”). CPAP and positional therapy have been compared (chapter “Comparison of Positional Therapy to CPAP in Patients with Positional Obstructive Sleep Apnea”), but the value of adding positional therapy to CPAP remains to be studied.

It can be speculated that positional therapy might have a role in other populations and diseases other than obstructive sleep-disordered breathing (chapters “Clinical Characteristics of Positional Obstructive Sleep Apnea Among Asians”, “The Effect of Body Position on Sleep Apnea in Children”, “Sleep Position and Pregnancy”, “Positional OSA in Down Syndrome” and “Positional OSA in the Morbidly Obese and the Effect of Weight Loss on OSA Severity”). Rare cases of central sleep apnea have been shown to be positional as well; the pathophysiology remains unclear (chapter “Positional Central Sleep Apnea”).

Concerning future perspectives, much remains to be studied, for example, the promising potential value of positional therapy during pregnancy or patients with Down’s syndrome.

There is much debate about the postoperative care of patients with OSA. The epidemic of OSA puts serious strain on IC units. Should all patients be admitted to IC units and treated with CPAP? Relatively new is the insight that most patients sleep on their back after surgery—the worst sleeping position—more than in the normal situation. In such patients, it might be better to look at the AHI in supine position rather than at the overall AHI. Can a role for postoperative positional therapy be envisaged or is postoperative tilting of the head sufficient? There are open questions with potential new fields of research.

In case combined positional and surgical treatment (or oral device therapy) is considered, one has to consider the sequence of the treatments. Some patients will need both forms of therapy simultaneously because the combined treatment is clearly better than one of the two therapies alone. While sleep surgeons are presently often offering positional therapy in case of surgical failure because of residual positional dependency, a future development would be to offer positional therapy before surgery, upfront. In some patients who undergo maxillomandibular advancement however, the different effects of MRA on supine and lateral become apparent only after surgery. Here it would not be logical to begin with positional therapy.

Guidelines might need to be adapted (chapter “Positional Therapy, Consequences for and Implementation in OSA Guidelines”).

If one tries to define the features of the ideal treatment for OSA (or for that matter, any other disease), they would include **effectiveness, patient friendliness, good compliance, wide availability, reversibility, cost-effectiveness, absence of (major) side effects and possibility to combine with other treatments**. New forms of positional therapy have the potential to fulfil these criteria to a large degree. For this reason, positional therapy is supported by patient societies (chapter “Position Training: An Indispensable Therapy”).

With regard to **effectiveness**: By good patient selection—how to do this is discussed in chapters “Towards a Clinical Classification System (APOC) for Position-Dependent Obstructive Sleep Apnea”, “Retrospective Cohort Analysis with the APOC System”, “Correlation Between Calculated/Predicted and Actual AHI After Positional Therapy”, “Position-Dependent Sleep Apnea: Implications for Diagnosis and Management” and “Positional Therapy in Obstructive Sleep Apnea: For Whom and for Whom Not”—one can easily identify many excellent candidates for positional therapy.

With regard to **patient friendliness**: Several studies comparing positional therapy to oral device therapy are ongoing. It is yet unclear whether patients prefer positional therapy to oral devices or CPAP, in case all treatment options would be possible.

Wide availability: Presently positional therapy is rapidly becoming available in many Western European countries, while other parts of the world will hopefully follow shortly. While positional therapy presently is only commercially available, it can be envisaged that before long insurance companies will cover its acquisition. There is wide variation among countries in what and what is not insured in diagnosis and treatment of sleep-disordered breathing. For example, some countries cover CPAP, others do not; some countries cover MRA, others do not; other countries cover CPAP but not surgery. Many European countries cover DISE, while (currently) the USA does not. In many countries, only one form of treatment is covered, e.g. once a patient has a CPAP and would like a MRA (for instance, for travelling); this is often not covered. It looks as if insurance companies have to get used to the fact that multimodality treatments might do better than one treatment alone, and that they should accept the short-term financial consequences (with long-term benefit).

Reversibility: CPAP and oral device therapy are reversible; surgery is not. In case a patient cannot tolerate CPAP for one reason or another, the CPAP appliance can be returned. The same holds true for positional therapy. Oral devices, on the other hand, are custom made and can therefore not be used by another patient, if not successful. Surgeries of course are in no way reversible, and treatment outcomes as no effect, or even detrimental effect, unfortunately can happen.

Cost-effectiveness and good compliance: The costs of positional therapy are lower than that of CPAP, oral device and surgery. It is clear that devices only work when they are being used. Short-term compliance—4 weeks—of the sleep position trainer is 92–100 % (92 % when compliance is defined as use of 4 h/7 night/week, 100 % when compliance is defined as 4 h/5 nights/week) and long-term compliance—6 months—is 60 % (chapters “Short-Term (4 Weeks) Results of the Sleep Position Trainer for Positional Therapy” and “Long-Term (6 Months) Effectiveness, Compliance, and Subjective Sleep Outcomes of Treatment with the Sleep Position Trainer in a Large Cohort of Position-Dependent OSA Patients”). It is hoped that compliance can be further improved by stricter positive reinforcement, explanation, training, stimulation and motivation. Further improvement here is in reach. Technological improvements are under way. Compliance is discussed in chapter “Compliance of Various Forms of OSA Treatment”, technology in chapter “10 Problems and Solutions for Positional Therapy: Technical Aspects of the Sleep Position Trainer”.

Absence of (major) side effects: Surgery has many sometimes serious and often irreversible side effects. Side effects of CPAP comprise mask leakages, skin pressure lesions, nasal breathing problems, sinus diseases, etc. Side effects of oral device therapy include painful jaws muscles in the morning, dry mouth, hypersalivation and in the long run changes in dental occlusion. So far, no major side effects of positional therapy have been reported.

Possibility to combine with other treatments: Positional therapy can be used as stand-alone therapy or combined with surgery (chapters “Positional Therapy and Palatal Surgery”, “Positional Therapy and Tongue Base Surgery”, “Residual POSA After Maxillomandibular Advancement in Patients with Severe OSA”, “Impact of Upper Airway Surgery on Positional Change During Sleep” and “Comparison of Positional Therapy to CPAP in Patients with Positional Obstructive Sleep Apnea”) and with oral devices (chapter “Prevalence and Effect of Supine-Dependent Obstructive Sleep Apnea on Oral Appliance Therapy”). Since CPAP is most used in moderate to severe OSA—usually non-positional OSA—the possibility to combine CPAP and positional therapy is less obvious.

Preventive Medicine

Prevention is a major topic in many areas of medicine: oncology, cardiovascular diseases, etc. It is somewhat strangely underrated in OSA. Many caregivers even are of opinion that OSA should only be treated in “clinically relevant” OSA, e.g. AHI > 15. Why? Positional therapy, applied in early disease, habitual snoring and mild-to-moderate OSA, has the potential to cure or at least postpone the development of OSA. If the development of the disease is postponed long enough, it automatically becomes prevention. There is no logical reason to wait with treatment until serious comorbidities such as hypertension have appeared.