

Titration and Technology - A Single or Multidimensional Perspective?

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Abstract

Oftentimes we look at titration as a one-way street where the techs increase pressure until the patients exhibit acceptable or normal range AHI (<5/hour). Depending on the diagnosis, CPAP is usually the first line of defense to address obstructive sleep apnea (OSA). While this the gold standard for OSA, advancement in technology continually evolve and offer more dynamic modes that can further increase adherence to therapy due to comfort and varying pressure requirements. The other related hurdle to optimized therapy is the transfer of settings from in-lab titrations to home-care devices. Settings are sometimes changed or modified per physicians' approval in order to fulfill prescription orders even if the complete settings and sub-settings that optimized the titrations in-lab (and experience of the patients) are not fully transcribed due to manufacture differences and/or the limitations of the DME inventory.

This article is of two-folds, one-to look at titration in and outside of the lab for long-term therapy adherence; and two-utilizing technology as additional standard of practice.

Keywords: Titration; Obstructive sleep apnea; CPAP devices; APAP; Adherence to therapy; Multi-dimensional approach to PAP therapy; OSA

Introduction

Is it time to consider automatic titration devices into our standards of practice? According to a study published in 2008 on Reliability of Home CPAP Titration with Different Automatic CPAP Devices "Pressure behaviour and pressure recommendation significantly differ between Auto CPAP (APAP) machines both after one night and one week of home titration" (Series, Plante & Lacasse) [1]. This study points out that pressure requirements vary either nightly, weekly, and so on. Thus, APAP should provide a more appropriate therapy for OSA patients in the long run due to varying pressure needs.

On the contrary, another study published in 2009 in Sleep Med concluded that "patients with moderate sleepiness treated with CPAP, we found no difference in effectiveness between an algorithm-based pressure and an auto-titrated pressure" (Nosedá, Andre, Portmans, Kentos, de Maertelaer & Hoffman) [2]. This study seems as a contrast to the former, and therefore begs the question as to which perspective is correct or better?

Furthermore, "Home self-titration of CPAP is as effective as in-laboratory manual titration in the management of patients with OSA" (Fitzpatrick, Alloway, Wakeford, Macl ean, Munt & Day, 2003) [3]. With this study performed two decades ago and with more recent development in automatic CPAP titration algorithms-the premise of automatic CPAP or APAP being as effective as in-lab titration should also not be ignored. Newer APAP algorithms offer more precise and highly-sensitive algorithms in detecting flow limitations, snoring and apneas. Other algorithms even offer central apnea detection where if central sleep apnea (CSA) events are identified, no additional increase in pressure will happen in order to avoid exacerbating CSA events.

On the regulatory side, the American Association of Sleep Medicine (AASM) guidelines are based on clinical studies and evidence-based medicine along with many years of experienced clinicians' input on how titrations should progress [4]. However, even with this said, we must also be reminded of each patient's physiological uniqueness and that the goal of titration should not be a one-night solution; rather, an opening experience for patients that will depend on the therapeutic settings obtained in titration on a nightly basis for the rest of their lives (for the most patients) [5].

Optimal pressure for many techs that have years of experience is typically achieved within the first 2 hours and followed by a few minor adjustments after 4 am or during the last cycles of rapid eye movement (REM) stage of sleep (4th or 5th) within a 6-7 hour titration period [6]. More challenging patients may present co-morbidity or co-morbidities (with cardiovascular disease, obesity hypoventilation syndrome, chronic obstructive pulmonary disorder or restrictive lung disease) and will be more than likely be titrated with bi-level modes eventually. Among these are spontaneous, SV (servo ventilation), volume assured with iVAPS (intelligent volume assured pressure support) or AVAPS (automatic volume assured pressure support), or with back-up rate modalities such as spontaneous-timed (S/T)-either within the first night of titration or the following scheduled titration. Most sleep labs follow this protocol if the initial titration is deemed to be a failed or unsuccessful titration where optimal pressures or settings were not achieved with the reduction of AHI to normal levels and/or arousal index as well (with REM-supine recording while on determined pressure settings and without further abnormal apneic or oxygen desaturation index) [7].

Moreover, looking deeper into the titration night-what really happens with patients during the titrations? What physiological and chemical changes occur as patients go through titrations? For one, there are various changes in hemodynamics (O₂, CO₂, bicarbonates, pH, leptin, grehlin, cortisol, etc.) when patients experience changes in their breathing patterns as well as alterations in their sleep

architectures (appropriate levels of varying sleep stages). Along these lines, there are also simpler factors such as positional or behavioral changes that are affecting the patients during titration nights. These changes are considerably important not only for the clinicians' perspectives but also the patients'. Therefore, transcribing these factors into simple prescriptions may or may not fully serve both perspectives. There should be added emphasis on how to fully translate optimal titrations into fewer settings written on prescription pads. Another option is to take all these factors in consideration and allocate future assessments and reassessments of these factors to fully obtain optimal titration-even after the fact. We also have to remember that the physiological changes experienced by the patients continue long after the one-night titration.

After understanding the standards in obtaining the optimal pressure settings for OSA patients, other factors that are affecting how OSA is managed have emerged recently. In less than a decade, two things have evolved tremendously in the sleep industry—the roles of insurance companies and technology. Strategic changes in reimbursements (insurance systems) to increase standards of practice and access to care due to the improvements and acceptance of sleep disorders have been implemented. On the other hand, manufacturers have spent enormous resources in advancing their algorithms on their PAP, bi-level and other non-invasive devices (modalities).

These two additional factors have become advantageous to clinicians and patients on the clinical and management side of patients, particularly on the home care setting where the Durable Medical Equipment (DME) clinicians who are typically respiratory therapists (RT) by training, set up patients with their devices, perform their follow up meetings with patients by downloading data from their devices and troubleshooting therapy issues from mask troubles, pressure setting changes, and many other issues with collaboration with the patients' physicians.

These changes have positive effects on patient care after the in-lab titration

The drop-off rates—the estimated number of patients that either stop their therapy completely or have become sporadic users of their devices—were once between 50-55% within the last decade. Other Durable Medical Equipment (DME) companies have claimed higher compliance rates. However, as an industry, we still have varying figures at this point and there is still no absolute numbers to figure out more accurate compliance levels due to a decentralized system of sleep patient management. Needless to say, we have plenty of room for improvement, given the technological advancements we have and the existing pressure from insurance companies as well as the government (Center for Medicare and Medicaid System) to provide better long-term services to our patients [8].

There is a possible way to obtain an accurate rate of patients who fall out of therapy, adhere to long-term compliance, and many other useful data in gauging the effects of more recent improvements in technology (PAP devices, masks, humidifiers, and accessories) by means of collecting usage from devices; however, not all devices are capable of giving the same data among manufacturers. We can only refer to the bulk of patients who are placed on data-capable devices to justify the premise on the advantages of utilizing APAP devices versus single-pressure CPAP devices in optimizing patient therapies.

Going back to titration, by looking into the existing gap between the optimal settings obtained from the in-lab experience and the devices

set in the patients' homes, we can presume that objectives vary among DMEs who set up patient devices. DMEs' PAP settings are transcribed directly from the sleep titration settings (written off as prescriptions by the sleep physicians) or slightly modified depending on what devices are available on-hand that has comparable features, settings and sub-settings with the physicians' approval [9].

Pressures (cmH₂O) are typically the main settings considered when preparing devices for home care. Whereas other settings or sub-settings are sometimes ignored that potentially have added to the optimized settings experienced by the patients during the titration in the sleep labs. This possible dilemma—actual mirroring of optimal titration to translate into prescribed device settings that will be utilized for patients at home every night should further be discussed and enforced in order to possibly increase successful adherence of OSA patients with their therapies. Pressure settings are important; however, if there are other settings/sub-settings that helped with optimizing the overall therapy for patients, then these factors must also be included and transferred over to the patients' home devices.

On a relative note, why do some patients complain of experiencing plateaus in their therapies whereas they don't feel the same way as how they did during their first time with PAP (positive airway pressure) therapy? Some complain after a month or a few months later after successful initial nights or weeks on PAP therapy. If we consider that therapy and titration is straight-forward, nevertheless, a multi-dimensional endeavor at the same time, we could conclude that these later complaints by patients are brought about by so many other factors that we have not localized yet [10].

Similarly, patients attend their titration nights with a straight-forward frame of mind that they will be exposed to air pressures until the best pressure eliminates their apneas and they sleep undisturbed. However, there are so many other variables that come to play—their discomfort and preference with masks, sleeping positions that they are used to, height and texture of pillows or blankets, the hissing sounds of mask intentional and unintentional leaks—at times called mask farts, etc. In short, the entire process and experience are again—multi-dimensional.

On this note, Automatic PAP devices (APAPs) have come a long way and established legitimacy in its performance, particularly with “patients with moderate sleepiness treated with CPAP, we found no difference in effectiveness between an algorithm-based pressure and an auto-titrated pressure” (Nosedá, André, Potmans, Kentos, de Maertelaer, & Hoffmann, 2009) [2] as published in Sleep Med.

So, the question begs—can we implement this approach and standardize APAP as the gold standard to optimally treat OSA for the long-term perspective—possibly increasing patient adherence to therapy while reducing drop-off rates and lessen troubleshooting work for clinicians in DMEs who manage these patients with physicians?

Bridging the gap between optimal titrations and device settings set for homecare with APAP configurations have been practiced by Kaiser Permanente and the VA (Veterans Admin.) hospitals by focusing on performing home sleep testing (HSTs with 3-4-channel devices) and APAPs for many years now. The other factor that the two big organizations (VA and Kaiser Permanente) add to the mix is a regimented follow up schedule with patients. In the VA, patients are usually seen 2 weeks after the initial device setup, followed by another follow at 30 days, then 6 months, and eventually yearly scheduled meetings (if adherence to therapy has been established with the patient). This method is also considered as titration—but outside of a

sleep lab—allowing for the APAP algorithm to take over and to find varying optimal pressures on a nightly basis. Some more complicated than OSA patients (with co-morbidities such as obesity hypoventilation and COPD) are treated with mechanical (non-invasive) ventilation, thus, requiring more robust follow up schedules.

In summary, titration should not only be seen as a sleep lab experience. It should not be a one-time-deal. Multi-dimensional therapeutic perspectives might prove to be more efficient (with particular patient segments) in addressing multi-dimensional patients, especially since we do have current advanced technologies to support the industry (such as APAP technology and more advanced modalities) and the need of many patients in addressing their nightly-changing optimal pressure requirements. In the meantime, there can also be reduced troubleshooting times with DME clinicians and increased adherence to therapy with properly transcribed titration settings and sub-settings.

We should think about the present and future experience of each patient. Therefore, from screening, diagnosis, treatment, and long-term management—all should be a part of the titration. The goal is to successfully make the patient experience the therapy while keeping in mind a long-term titration of the patient months and years to come otherwise, we miss out on the goal and definition of therapy. The disease we are addressing is a chronic one—not a one-night-disorder. Thus, titration can be optimized inside or outside the sleep labs and that technology as well as data can add values towards increased compliance to therapy.

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