Comparing Treatment Efficacy of Upper Airway Stimulation to CPAP for Obstructive Sleep Apnea

Colin Huntley MD1, Adam Vasconcellos MD1, Ayan Kumar2, Alec Furstenberg2, Karl Doghranji MD1, Maurits Boon MD1
1. Department of Otolaryngology-Head & Neck Surgery; Thomas Jefferson University
2. Thomas Jefferson University; Sidney Kimmel Medical College
3. Thomas Jefferson University; Jefferson Sleep Disorders Center

Introduction and Objective

Obstructive sleep apnea (OSA) is a disease state characterized by recurrent episodes of upper airway obstruction leading to a disruption in ventilation and disturbed sleep. A number of factors play a role in putting patients at risk for this disease including; BMI, upper airway anatomy, and limited dilator muscle activity (1).

Continuous positive airway pressure (CPAP) has become the primary treatment option. Since the 1980s, the technology of CPAP has come a long way and we are now able to customize mask design, humidification, level of pressure, and other variables in an effort to encourage use in our patients.

Despite our ability to customize therapy, a large number of patients are noncompliant with therapy in their review using a definition of adherence to therapy as patients who have undergone UAS implantation (UAS) and we are now able to customize mask design, humidification, level of pressure, and we are now able to customize mask design, humidification, level of pressure, and other variables in an effort to encourage use in our patients.

Upper airway stimulation (UAS) is a newer treatment option which takes advantage of selective innervation of the hypoglossal nerve. It stimulates the protractor muscles of the tongue to induce muscle tone and increase the size of the upper airway. Previously published data has shown good control of disease severity utilizing UAS with high patient tolerance and compliance (3). We aim to compare a cohort of patients treated with UAS and CPAP and evaluate therapy usage and disease control through use of the mean disease alleviation concept.

Results

At the time of this evaluation, we had performed 122 UAS at our institution. This consisted of 79 men and 43 women with a mean age, BMI, preoperative AHI, O2 nadir, and ESS of 61.27 years, 29.32 kg/m², 36.40, 80.15%, and 10.64 respectively (Table 1). 101 of these patients met inclusion criteria, had undergone postoperative titration PSG, and were included in the study. The time from surgery to first follow-up and most recent follow-up, along with treatment AHI, treatment ESS, and hours of UAS usage per day, at those time points, are shown in table 2. Treatment efficacy, adjusted compliance, mean disease alleviation, and remaining AHI are shown in table 3.

458 consecutive patients underwent a PSG or type 3 sleep study during the time period. 149 of these patients were included in this evaluation, each of which were diagnosed with moderate to severe OSA and prescribed CPAP. This consisted of 102 men and 47 women with a mean age, BMI, preoperative AHI, O2 nadir, and ESS of 55.73 years, 35.09 kg/m², 78.61%, and 9.88 respectively (Table 1). The time from the initial sleep study to first and second follow-up, along with the treatment AHI, treatment ESS, and hours of CPAP usage per day are shown in table 2. The mean time to first follow-up was 90.01 days and 89 of the 149 patients were evaluated at this point. The mean time to second follow-up was 170.52 days and 42 of the 149 patients were evaluated at this point. Treatment efficacy, adjusted compliance, mean disease alleviation, and remaining AHI are shown in table 3.

The UAS group was significantly older with a lower BMI and higher pretreatment AHI. We found the UAS group to utilize therapy for significantly more hours per night than the CPAP group at the 1st and 2nd follow-ups. Treatment efficacy at the first follow-up was significantly higher in the CPAP group at the 1st follow-up. However, at the second follow-up, the TE was higher in the UAS group. The adjusted compliance and mean disease alleviation were significantly higher in the UAS group at both follow-up time points. Lastly, the remaining AHI was significantly lower in the UAS group at both time points.

Methods

We performed a retrospective case control study of 360 patients undergoing treatment for OSA between June 2015 and June 2016 at the Thomas Jefferson University Hospital’s Sleep Disorders Center. We evaluated our cohort of patients who have undergone UAS implantation (UAS group) and used a group newly diagnosed with OSA and prescribed CPAP (CPAP group).

We recorded demographic, preoperative Epworth Sleepiness Scores (ESS), and diagnostic sleep study data in all patients. We only included UAS patients who had undergone postoperative titration polysomnograph and used this study as our determination of treatment AHI. We recorded postoperative AHI, O2 desaturation nadir, and ESS in 101 patients who met inclusion criteria. We also recorded the hours of usage per day at the time of their titration PSG and most recent follow-up visits.

We included patients in the OSA group if they were diagnosed with moderate-severe OSA (AHI > 15) and had initiated CPAP therapy. We documented ESS, number of days assessed, total hours used, hours of usage per day, treatment AHI, and with pressure percentile at their initial and second follow-up after institution of therapy.

We compared the two groups and used the mean disease alleviation (MDA) concept to assess overall control of disease. We calculated treatment efficacy, adjusted compliance, mean disease alleviation, and remaining AHI of each group at the initial and second follow-up visit. The calculation of each is detailed below.

Statistical analysis was performed using SPSS version 24 software. Continuous variables were analyzed in a nonparametric manner using a Mann-Whitney U Test. The categorical variable age was analyzed using a Fisher’s exact test.

Conclusions

• Positive airway pressure therapy remains the primary treatment modality for the treatment of OSA, with CPAP the most commonly used.

• Upper airway stimulation (inspirile medical systems, Minneapolis, MN) is a novel therapy which received FDA approval in 2014. Dozens of publications have shown the efficacy of this technology. The original clinical trial cohort, stimulation therapy for apnea reduction (STAR Trial), has been followed for five years. These studies have shown persistent benefit with significant improvements in AHI, O2 nadir, and quality of life measures (4, 5–7). The STAR results have been corroborated by single and multi-institution cohort studies (8–11).

• In addition to the significant improvement in AHI, O2 nadir, and quality of life seen with UAS, patients are able to tolerate therapy for a large portion of the night. The recently published ADHERE registry included 101 patients across 10 international centers and showed a mean usage of 6.5 hours per night. 96% of the patients were able to utilize UAS therapy for greater than 20 hours per week, the standard definition of compliance for CPAP.

• We saw significantly more usage of therapy, higher MDA, and lower remaining AHI in the UAS group.

• The second point of evaluation was a significantly longer time frame after institution of therapy in the UAS group. We again saw more usage of therapy, higher MDA, and lower remaining AHI in the UAS group.

• Although CPAP likely offers better control of apnea and hypopneic events, UAS may offer better treatment of disease, as patients tolerate and utilize therapy to a greater degree.

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References