THE EFFECT OF CPAP TREATMENT ON SLEEP FRAGMENTATION

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SUMMARY: Traditional therapy for obstructive sleep apnea includes nightly use of continuous positive airway pressure (CPAP) and it has been the most common form of therapy for sleep apnea since 1981. In this study, we aimed to show that sleep stage percentage alteration is an indication of the severity of the disease and, impairment of the sleep stage percentage can be restored by CPAP treatment.

In our sleep laboratory we evaluated 63 obstructive sleep apnea patients, 14 women and 49 men, during a one-year period. Of these patients the youngest was 15 and the oldest was 71 years old and the mean of age was 44. Of these 33 had Respiratory Disturbance Index (RDI) greater than 20 and were administered CPAP therapy.

We compared some sleep parameters of these patients with and without CPAP treatment. These sleep parameters were: sleep stage percentage alteration, obstructive apnea count, the longest apnea duration, mean apnea duration and RDI. We found that obstructive apnea count is 133.06 before CPAP treatment and 26.43 with CPAP treatment. The longest apnea duration was measured as 64.87 seconds before CPAP treatment and 30.20 seconds with CPAP treatment. We measured the mean apnea duration as 19.83 seconds before CPAP treatment and 17.76 seconds with CPAP treatment. We also measured the RDI as 55.65 before CPAP and 16.04 with CPAP treatment.

According to our data, CPAP treatment corrects REM sleep percentage effectively although it does not correct completely. Our data also shows that obstructive apnea count and its reflection, RDI, were reduced significantly by CPAP treatment. In summary, our data confirm that CPAP therapy is effective in obstructive apnea patients by means of RDI reduction and sleep stage percentage correction.

Key Words: Sleep Fragmentation, CPAP, Sleep Apnea.

INTRODUCTION

Twenty-four percent of adult men and nine percent of adult women, that is, more than 20 million Americans, are estimated to have some degree of obstructive sleep apnea (1,2). Of these, six million are estimated to have cases severe enough to warrant immediate therapeutic intervention. While obstructive sleep apnea is commonly associated with obesity and male gender, it affects a

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Table 1: Sleep Stage Percentages.

	Without CPAP (%)	With CPAP (%)	Significance (P)
Stage I	27.21	19.99	<0.05
Stage II	60.73	50.46	>0.05
Stage III	6.43	14.14	<0.05
Stage IV	4.25	10.30	<0.05
Stage REM	1.30	9.28	<0.05

broad cross-section of the population (3,4). Traditional therapy for obstructive sleep apnea includes nightly use of continuous positive airway pressure (CPAP) and it has been the most common form of therapy for sleep apnea since 1981 (5,6).

Sleep deprivation and sleep apnea have similar characteristics, furthermore, sleep apnea per se a kind of sleep deprivation. Many studies have shown that brief arousals during sleep systematically reduced daytime alertness. It is known that many of the older individuals have frequent arousals that occur during sleep because of apnea. The number of these arousals is correlated with the magnitude of daytime sleepiness in these patients (7-9).

Rechtschaffen *et al.* showed that prolonged sleep deprivation would lead to death in rats (10-12). Sleep apnea, also, is a debilitating disorder, which can be fatal if not treated (13,14). In addition, recovery from sleep deprivation and treatment of sleep apnea have common characteristics. One of these is alteration of sleep stage percentage. Both in recovery sleep of sleep deprivation and in CPAP treatment, subjects show a REM sleep percentage increase.

In this study, we aimed to show that sleep stage percentage alteration is an indication of the severity of the disease and, impairment of the sleep stage percentage can be restored by CPAP treatment.

Table 2: Obstructive apnea count, longest apnea duration, mean apnea duration and RDI values.

	Without CPAP	With CPAP	Significance (P)
Obstructive apnea count	133.06	26.43	<0.001
The longest apnea duration (in seconds)	64.87	30.20	<0.05
Mean apnea duration (in seconds)	19.83	17.76	>0.05
RDI	55.65	16.04	<0.001

MATERIALS AND METHODS

In our sleep laboratory we evaluated 63 obstructive sleep apnea patients, 14 women and 49 men, during a one-year period. Of these patients the youngest was 15 and the oldest was 71 years old and the mean of age was 44. Of these 33 had Respiratory Disturbance Index (RDI) greater than 20 and were administered CPAP therapy. Sleep parameters were recorded by Medilog SAC SRI (Oxford Instruments (UK) Limited) model polisomnography.

We compared some sleep parameters of these patients with and without CPAP treatment. These sleep parameters were: sleep stage percentage alteration, obstructive apnea count, the longest apnea duration, mean apnea duration and RDI. Statistical analysis was performed using student's t-test, after normal distribution was determined by Kolmogorov-Smirnov test performed statistical analysis. Data was expressed as the mean.

RESULTS AND DISCUSSION

Sleep stage percentage alteration values are shown in Table 1. Before CPAP treatment, we found that Stage I constituted 27.21 %, Stage II 60.73 %, Stage III 6.43 %, Stage IV 4.25 % and REM sleep 1.30 % of the total sleep time. With CPAP treatment we found these values as 19.99, 50.46, 14.14, 10.30, and 9.28 respectively.

We measured the obstructive apnea count, the longest apnea duration and mean apnea duration with and without CPAP treatment, these values are shown in Table 2. We found that obstructive apnea count is 133.06 before CPAP treatment and 26.43 with CPAP treatment. The longest apnea duration was measured as 64.87 seconds before CPAP treatment and 30.20 seconds with CPAP treatment. We measured the mean apnea duration as 19.83 seconds before CPAP treatment and 17.76 seconds with CPAP treatment. We also measured the RDI as 55.65 before CPAP and 16.04 with CPAP treatment.

According to our data, CPAP treatment corrects REM sleep percentage effectively although it does not correct completely. It also corrects slow wave sleep (Stage III and IV) percentage. Correction of these parameters was consistent with the subjective expression of well being of the patients. Our data also shows that obstructive apnea count and its reflection, RDI, were reduced significantly by CPAP treatment. In addition to this finding, we found that the longest apnea duration reduced more than 50%, although the mean apnea duration was not reduced significantly. In conclusion, this study indicates that CPAP therapy is effective in obstructive apnea patients by means of RDI reduction and sleep stage percentage correction.

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