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Effect of Oropharyngeal Exercise on Obstructive Sleep Apnea

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ABSTRACT

Background

Obstructive Sleep apnea is increasing health problem seen in developed as well as developing countries. CPAP is a gold standard treatment protocol used in all over the countries. Because of its cost effectiveness and device related discomfort it is necessary to find alternative treatment regimen. Oropharyngeal exercises are the treatment which involves the correct use of the physiological structures and functions by means of functional exercises and muscular exercises with the aim of increasing the tonus and mobility of oral structures in upper airway obstruction. The purpose of the study was to evaluate the effect of Oropharyngeal exercises as a simple method for treatment of patients with obstructive sleep apnea syndrome.

Objectives

To study the effect of Oropharyngeal exercises on obstructive sleep apnea syndrome.

Subjects and methods

50 diagnosed patients with OSAS were subjected thorough calculation of PSQI index and STOP-BANG sleep apnea questioner. PEFR values and SpO_2% were noted. Informed consent was taken. 3 month supervised exercise programme was given with 5 days/week, twice daily. Pre & post outcomes were noted.

Results

There was significant decrease in severity of apnea on STOP-BANG sleep apnea questionnaire, after Oropharyngeal exercises ($p<0.0001$). Also there were significant increase in oxygen saturation and PEFR values after Oropharyngeal exercises ($p<0.0001$ and $p<0.0044$).

Conclusion

It is concluded that Oropharyngeal exercise can achieve improvement in Obstructive sleep apnea syndrome.

Keywords: Obstructive sleep apnea syndrome, Oropharyngeal Exercises

INTRODUCTION

Sleep related apnoea is a health condition characterized by recurrent episodes of upper airway occlusion during sleep associated with inadequate sleep, daytime sleeplessness, and increased cardiovascular risk and it is known as Obstructive sleep apnea syndrome [3] important cause of medical morbidity and mortality is obstructive sleep apnea. Common characteristic feature of

upper airway disorder is repetitive collapse of upper airway during sleep. There is reduction of airflow and gaseous exchange.[7] Upper airway obstruction is demonstrated by the patients with obstructive sleep apnea either at the level of the tongue or the soft palate. Both anatomic factors and neuromuscular factors are important.[8] The treatment protocol of primary snoring widely varies it includes general measurements, such as avoiding alcohol and sedatives, avoiding the supine position, weight reduction, treatment of nasal problems, palate and upper airway surgeries, and use of a mandibular advancement device. There is no single treatment for OSAS that is universally accepted and that has long-lasting effects. CPAP is considered to be a gold standard treatment option for treating sleep apnoea for moderate to severe OSAS. But a substantial proportion of patients still remain ineffectively treated by it. It is also associated with device related complications like mask discomfort, rejection of partner, and cutaneous allergies which lead to low compliance of the patients for CPAP. Weight reduction by diet or surgery does cause improvement in AHI but symptoms tend to reoccur on resumption of normal diet. Intra-oral devices like lingual retainers and jaw petitioners do improve sleep disturbances in OSAS temporarily. However, it is associated with problems like use of extensive dental prosthesis, periodontal problems, and intense temporomandibular joint dysfunction (TMJ). Various surgical procedures like septoplasty, uvulopalatopharyngoplasty (UPPP), tonsillectomy and tongue base reductions do provide benefits in OSAS but their efficiency is only 40–50 % and symptoms tend to reoccur after 1–2 years. Maxillomandibular advancement is a treatment option only for severe OSAS patients with significant retrognathia. The above mentioned treatment modality for OSAS focus on increasing the airway space or on increasing the airway pressure but they do not address the basic cause of OSAS (decreased tension of pharyngeal muscles during sleep). [4]

In patients with OSA there was a significant reduction of the muscular tonus and increase of the resistance of the upper airway during sleep. It is also believed that the dilating force of the upper airway muscles are the forces which cause collapse, represented by the negative pharyngeal transmural pressure and for the weight of the structures which form the upper airway, these facts justify the rehabilitation of the orofacial and pharyngeal musculature of these individuals. [8] Oropharyngeal exercises are a new, non-invasive, cost-effective treatment which acts by increasing the tone of pharyngeal muscles. It aims at correcting the posture adequacy, the sensibility, proprioception and the tonus and mobility of the orofacial and pharyngeal musculature. Maintenance of pharyngeal patency during breathing requires the coordinated activity of upper airway and thoracic respiratory muscles during inspiration.

METHODOLOGY

This study has been designed to find out the effect of 3 months Oropharyngeal exercise on obstructive sleep apnea.

Experimental study was carried out by doing convenient sampling in age of 30-60 years old subjects diagnosed with obstructive sleep apnea. Duration of study was 6 months inclusion criteria were males and females, people who are willing to participate, subjects diagnosed with Obstructive Sleep Apnea Syndrome and Exclusion Criteria were individuals underwent recent neck surgeries, positive history for recurrent laryngospasm, allergy, asthma, acute or chronic cardio-respiratory or neuromuscular diseases, chronic inflammatory disease major craniofacial abnormalities. Material used were Demographic data sheet, Consent form, STOP-BANG Sleep Apnea Questionnaire, Pittsburgh sleep quality index, Peak expiratory flow device , Pen.

Procedure

Approval was obtained from institution ethical committee before starting procedure and informed consent was taken. STOP-BANG Sleep Apnea Questionnaire was use for the assessment of obstructive sleep apnea. Sleep quality was asses by Pittsburgh sleep quality index. SpO_2 and PEFR value was measured.

Oropharyngeal Exercise

Phase 1 included 4 lip exercises, 5 tongue exercises, 2 jaw exercises, and 2 soft palate exercises. Phase 2 included 2 lip exercises, 2 tongue exercises, 2 jaw exercises, 5 soft palate exercises, and 2 cheek exercises. Phase 3 included 2 lip exercises, 2 tongue exercises, 1 jaw exercises and 2 soft palate exercises.

Data Analysis

The data was analyzed by using Graph Pad Instat 3.0 version. Mean and Standard deviation were found out as well paired "t" and "p" values were applied to find out the relationship between pre and post values for PEFR, SpO2, STOP BANG Questionnaire & PSQI.

RESULTS

Table1.1: Distribution of Body Mass Index (in kg/m^2)

Obese 1 (30.0-34.9)	**42**
Obese 2 (35.0-39.9)	**5**
Obese 3 (≥40)	**3**

Interpretation of Table 1.1

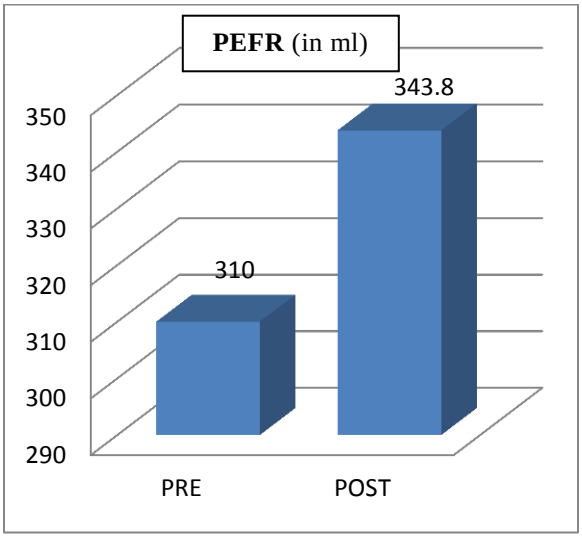
According to results shown in table 1.1 when BMI wise distribution of participants was done they were classified into three groups like obese grade 1, obese grade 2 and obese grade 3 out of 50 samples

Group 1(obese grade 1) consisted 42 participants, group2 (obese grade 2) consisted of 5 participants and group3 (obese grade 3) consisted of 3 participants.

Table 1.2: Comparison of mean of pre and post Peak Expiratory Flow Rate

Intervention	Pre	Post	p Value
Mean	**310**	**345.8**	**<0.0044**
S.D	**310±76.121**	**345.8±67.306**	

Graph 1.2: Comparison of mean of pre and post Peak Expiratory Flow Rate



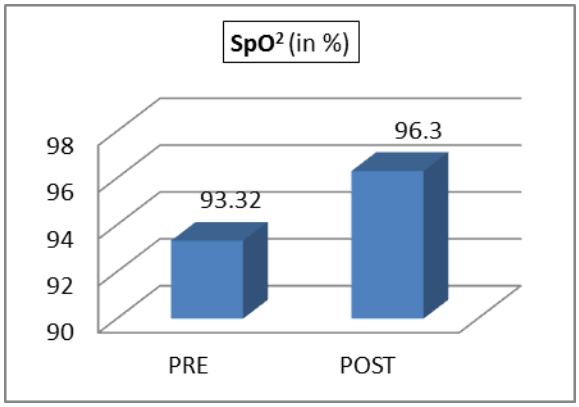
Interpretation

According to results shown in table 1.2 pre and post PEFR readings were taken and mean±S.D. of PEFR before the treatment was 310 ± 74.121and the mean ± S.D of PEFR after the treatment is 343.8 ± 67.306 (p 0.0044)

Table 1.3: Comparison of mean of pre and post SpO^2 (In %)

Intervention	Pre	Post	p Value
Mean	**93.32**	**96.3**	**<0.0001**
SD	**93.32±2.559**	**96.3±2.837**	

Graph 1.3: Comparison of mean of pre and post SpO2 (In %)



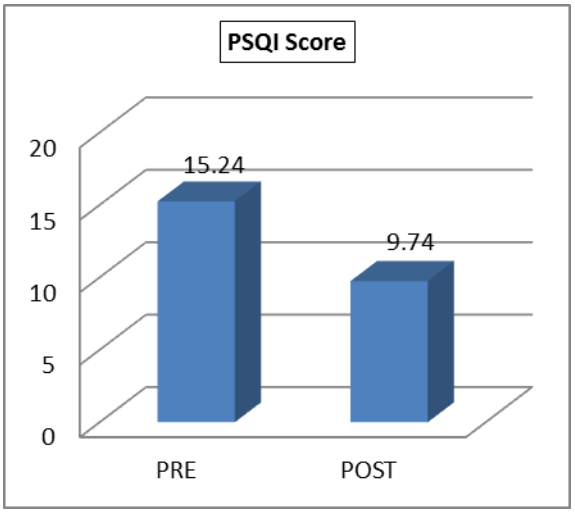
Interpretation

According to results shown in table 1.3 pre and post SpO^2 readings were taken and mean ± S.D. of SpO^2 before the treatment was 93.32 ± 2.599 and the mean ± S.D of SpO^2 after the treatment is 96.3±2.837 ($p<0.0001$)

Table 1.4: Comparison of mean of pre and post PSQI Score

Intervention	Pre	Post	p Value
Mean	15.24	9.24	<0.0001
SD	15.24±2.730	9.24±4.388	

Graph 1.4: Comparison of mean of pre and post PSQI Score



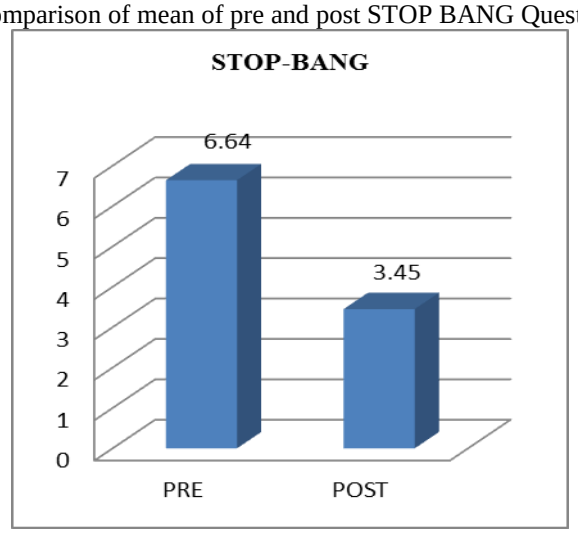
Interpretation

According to result shown in table 1.4 pre and post PSQI questionnaire was taken to assess sleep quality and pre mean±S.D values were 15.24±2.730 and after treatment mean±S.D values were 9.74±4.388 hence the graph shows improvement in sleep quality after treatment ($p<0.0001$).

Table 1.5: Comparison of mean of pre and post STOP BANG Questionnaire Score

Intervention	Pre	Post	p Value
Mean	6.64	3.54	<0.0001
SD	6.64±1.025	3.54±1.798	

Graph 1.5: Comparison of mean of pre and post STOP BANG Questionnaire Score



Interpretation

According to result shown in table 1.5 before and after treatment STOP-BANG questionnaire score was taken to assess severity of OSA and pre mean±S.D was 6.64±1.025 and post mean±S.D was 3.34±1.798 hence graph is showing improvement in patients with OSA the severity was reduced post treatment.($p<0.0001$)

DISCUSSION

Sleep related apnoea is a health condition characterized by recurrent episodes of upper airway occlusion during sleep associated with inadequate sleep, daytime sleeplessness, and increased cardiovascular risk and it is known as Obstructive sleep apnea syndrome [3] Respiratory disorders are followed by arousals. The consequence of the respiratory-induced sleep fragmentation is excessive daytime sleepiness, which is the major clinical symptom of patients with OSAS. [6] Obstructive sleep apnea (OSA) demonstrates upper airway obstruction at either the level of the soft palate or tongue. Both anatomic factors and neuromuscular factors are important to occlude the airways. [8]

Upper airway exercises are new, non-invasive, cost effective treatment modality for the treatment.

It acts by increasing the tone of pharyngeal muscles, is more physiological, and effects are long lasting. [4]

The purpose of this study was to find out the effectiveness of oropharyngeal exercise in case of obstructive sleep apnea syndrome. This experimental study is to investigate the effect of the upper airway muscle training by a series of oropharyngeal exercises in patients with OSAS. Total number of 80 subjects was assessed using STOP-BANG sleep apnea questionnaire, PSQI sleep quality index, peak expiratory flow meter and pulse oxymeter. Out of 80 patients 5 patients had history of cardiac event, 2 were having craniofacial abnormality and 23 patients discontinued.

Alan R.et.al published there article in which he found that developmental and progressive factor for sleep apnea is obesity. Sleep apnea is susceptible in relation to the distribution of adipose tissues between the central and peripheral obesity. Males are predominantly associated with central obesity as compared to females. sleep apnea susceptibility is increased by Central obesity increasing upper airway mechanical loads and or decreasing compensatory neuromuscular responses mediated by circulating adipokines, which influence fat distribution and Central nervous system activity. Severity of disease is depends upon amount and patterns of weight loss as well as relative changes in protective and pathogenic adipokines As patients with sleep apnea lose weight ,there are improvements in functioning of upper airways. [10] Results shown in table 1.1when BMI wise distribution of participants was done they were classified into three groups like Obese grade 1, obese grade 2, obese grade 3 out of 50 samples group 1(obese grade 1) consisted 42 participants , group2 (obese grade 2) consisted of 5 participants and group3 (obese grade 3) consisted of 3 participants.

In this study, pre and post PEFR readings were taken and it was statistically significant (p <0.0044) oropharyngeal exercise aims at correcting the posture adequacy, the sensibility and proprioception, and the tonus and mobility of the oro-facial and pharyngeal musculature. When the airways are constricted the peak expiratory flow rate is affected oropharyngeal exercise help to dilate the airways, it is myofunctional therapy includes the correct use of somatognatic structures and functions by means of functional exercise and muscular exercise and mobility of oral structures which can be damage in apneatic patients [8]

PEFR values, SpO^2% and height, weight for calculating BMI was taken. Oropharyngeal exercises reinforce to the Oropharyngeal muscles and increase their tone, thereby help to dilate the upper airways. Maintenance of pharyngeal activity during breathing requires the co-ordinated activity of upper airway and respiratory muscles of thorax. During inspiration pressures are produced in the upper airway as a result of inspiratory muscle contraction. [8]

Roshan k verma published there article in which they have selected 30 subjects,14 out of 16 patients (70%)who were complaining of daytime sleeplessness was relived after the intervention (p value <0.004). sensitivity of the STOP-BANG questionnaire for obstructive sleep apnea detection was 83.6%. [18]

In our study we found that STOP-BANG is indicator of poor sleep quality and upper airway breathing problems, there was significant improvement in symptoms of sleepiness, apnoea, and snoring intensity was evaluated with STOP-BANG sleep apnea questionnaire (p <0.0001). [4]

In patients with obstructive sleep apnea sleep associated upper airway respiratory disturbances can impaired clinical conditions are worsen by poor sleep quality. The impacts of poor sleep quality in prevalent diseases such as stroke is enormous. Obstructive sleep apnea is main sleep related respiratory disturbances which are characterized by repetitive disturbance of ventilation during sleep because of upper airway closure with consequent sleep fragmentation and intermittent hypoxia. Obstructive sleep apnea is associated with hypertension, diabetes, obesity, cerebrovascular attack, cardiac arrest. PSQI sleep quality index were taken and it was statistically significant (p<0.0001) [18]

Cuimaraes et al. (20) published article who found that there is significant increase in minimum SaO2 from 83 ± 6 to 85 ± 7% (p < 0.001). This indicate that only slight improvement occurred in SaO2 (about 3%) and so this method can be applied to cases of obstructive sleep apnea with slight decrease in SaO2 .in our study the oxygen saturation was also significantly improved (p<0.0001) following 3 months of Oropharyngeal exercise therapy because of Oropharyngeal exercises reinforce the Oropharyngeal muscles and increase their tone, thereby dilating the upper airways as well as it stimulates the pharyngeal receptors which helps to dilate the upper airway which helps to improve oxygenation [4]

CONCLUSION

It was concluded that Oropharyngeal exercises has significant effect on obstructive sleep apnea and helps to improves sleep quality.

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