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Original Research Article

Effectiveness of Oropharyngeal Exercises on Daytime Sleepiness, Snoring and Risk of Obstructive Sleep Apnea among Adults

Jaspreet Kaur[1], Ms. Kanika Rai[2], Ms. Vinay Kumari[3], Dr. (Mrs) Jyoti Sarin[4]

[1]M.Sc. Department of Medical Surgical Nursing, M.M College of Nursing, Maharishi Markandeshwar (Deemed to be University) Mullana, Ambala, Haryana, India
[2]Assistant Professor, Department of Medical Surgical Nursing, M.M College of Nursing, Maharishi Markandeshwar (Deemed to be University) Mullana, Ambala, Haryana, India
[3]Professor, Department of Medical Surgical Nursing, M.M College of Nursing, Maharishi Markandeshwar (Deemed to be University) Mullana, Ambala, Haryana, India
[4]Principal cum Professor, M.M. College of Nursing, Maharishi Markandeshwar (Deemed to be University) Mullana, Ambala, Haryana, India

Corresponding Author: Ms. Kanika Rai

ABSTRACT

The field of "oropharyngeal" exercises is a new treatment but it's a field that causes good prognosis for snoring, daytime sleepiness and obstructive sleep apnea (OSA) sufferers. Quasi experimental study using non equivalent control group pretest-posttest design was used. Pretest was taken of comparison group by anthropometric parameter, Epworth sleepiness scale, Snoring scale and STOP BANG sleep apnea questionnaire and no intervention was given. On 15th and 30th day post-test was taken. Then, experimental group was completed and oropharyngeal exercises demonstrated to the adults individually, performed by them for 20 minutes and then pamphlet given to them for motivation. The findings of the study showed that mean daytime sleepiness score in experimental and comparison group at day 15 was 6.87±3.56, 10.90±2.2 and at day 30, was 6.23±3.29, 10.80±2.2 respectively was significantly lower than before intervention i.e. 10.0±2.2, 11.20±2.2 respectively. The mean snoring score in experimental and comparison group at day 15 was 12.37±5.60, 15.80±5.61 and at day 30 was 11.43±5.42, 15.13±5.16 respectively was significantly lower than before intervention i.e. 18.30±4.97, 16.13±5.81 respectively. The mean risk of obstructive sleep apnea score in experimental and comparison group at day 15 was and 1.80±1.21, 2.83±1.02 and at day 30 was 1.73±1.25, 2.67±1.09 respectively was significantly lower than before intervention i.e. 2.80±1.44, 2.93±0.98 respectively. There was also significant positive correlation between them. Hence, oropharyngeal exercises are effective in reducing the daytime sleepiness, snoring and risk of obstructive sleep apnea among adults having snoring.

Key words: oropharyngeal exercises, daytime sleepiness, snoring, risk of obstructive sleep apnea

INTRODUCTION

Snoring was once considered as harmless, but now is suggested to be indicative of a significant clinical problem such as obstructive sleep apnea. [1] It can be defined as an inspiratory noise produced by the vibration of the soft parts of the oropharyngeal walls. Snoring is common in the general population, with up to 25% of women and 45% of men reporting habitual snoring in the world. [2] Health survey conducted in India states that around 22.0% of total population self reported about snoring disorder. [3]

Recent epidemiological study was done to assess the prevalence of snoring and high risk of obstructive sleep apnea syndrome in young male soldiers in Korea.

A total of 665 participants (aged 20-23 yr) who visited the Armed forces-II dong hospital. They all completed Berlin questionnaire, Epworth sleepiness scale and underwent physical examination. The prevalence of snoring and high risk of OSAS was 13.5% and 8.1% respectively. [4] There are several factors which influences the snoring like anatomical factors in which there is narrowing of upper airway results in snoring. Gender is also influencing snoring, it is more prevalent in men as compared to women. Sleep deprivation also induces or aggravates snoring by increasing muscular hypotonia. Alcohol and smoking may induce snoring by raising upper airway resistance. Increased weight, enlarged neck circumference and airway abnormalities may be identified among adults who snore. [5] There are harmful effects of snoring as it can decreases alveolar ventilation more in snorers than in non-snorers, also pulmonary arterial pressure and systemic pressure increases. Obstructive sleep apnea syndrome is a well-known cause of daytime sleepiness that is often associated with snoring. OSA associated with excessive daytime sleepiness (EDS) is commonly called obstructive sleep apnea syndrome. [6]

Excessive daytime sleepiness can be considered as a broad condition encompassing several sleep disorders like narcolepsy, sleep apnea or a circadian rhythm sleep disorder. [7] About 20 percent of adults in the United States report a level of daytime sleepiness sufficient to interfere with daily activities, and excessive daytime sleepiness are the leading symptom of patients presenting to sleep clinics. [8]

Obstructive sleep apnea is a repetitive complete or partial obstruction of the upper airway. It is occurring in 70% to 95% of patients. OSA affects 2-4% of the middle-aged male population and 2% of children aged 8 to 11 years in the USA. [5] Untreated obstructive sleep apnea has been linked to systemic complications such as coronary artery disease, heart failure, impaired glucose tolerance, insulin resistance and alterations in lipids. [9]

Oropharyngeal exercises are new, non-invasive, cost effective treatment modality for the treatment of mild to moderate obstructive sleep apnea or snoring. It acts by increasing the tone of pharyngeal muscles, is more physiological, and effects are long lasting. It aims at correcting the posture adequacy, the sensibility and proprioception, and the tonus and mobility of the orofacial and pharyngeal musculature. [10]

The field of "oropharyngeal" exercises is a new treatment but it's a field that causes good prognosis for snoring, daytime sleepiness and obstructive sleep apnea (OSA) sufferers who are tired of dealing with CPAP or dental devices, and who don't want to undergo surgery."Oropharyngeal exercise" is basically an exercise that helps to strengthen the muscles in and around the throat. [11]

MATERIALS AND METHODS

A quasi-experimental study was done and total 60 adults were selected from M.M (Deemed to be University) by convenience sampling technique and divided into experimental (n=30) and comparison group (n=30) by computer generated code.

Hypotheses

Following hypotheses were tested at 0.05 level of significance.

H_1: There will be a significant difference in mean post-test score of daytime sleepiness in the experimental and comparison group after the implementation of oropharyngeal exercises at day 15 and day 30.

H_2: There will be a significant difference in mean post-test score of snoring in the experimental and comparison group after the implementation of oropharyngeal exercises at day 15 and day 30.

H_3: There will be a significant difference in mean post-test score of risk of obstructive sleep apnea in the experimental and comparison group after the implementation of oropharyngeal exercises at day 15 and day 30.

H_4: There will be a significant relationship between daytime sleepiness, snoring and risk of obstructive sleep apnea score in the experimental and comparison group after the implementation of oropharyngeal exercises at 30.

Operational definitions

1. **Effectiveness**- It means the extent to which oropharyngeal exercises will bring significant reduction in the daytime sleepiness, snoring and risk of obstructive sleep apnea.
2. **Oropharyngeal exercises**- It refers to 12 exercises of the 20 minutes duration involving tongue (4 exercises), soft palate (2 exercises), jaw (2 exercises) and lateral pharyngeal wall (4 exercises) to be performed twice a day for 1 month. The exercises were taught individually and were supplemented with a pamphlet for reinforcement.
3. **Daytime sleepiness**- It is characterized by persistent sleepiness and often lack of energy during the day as self reported by adults on Epworth sleepiness scale and categorized as sleep disorder with score equal to or >10 and normal with score of <10.

Snoring- Snoring is defined as a low frequency sound produced from partial obstruction of upper respiratory airways due to vibration of airway wall structures as self reported by adults on snoring scale in terms of frequency, impact, pattern, intensity and duration. Score between 0-5 indicates absence of snoring whereas score between 5-34 indicates increase severity of snoring.

Risk of obstructive sleep apnea- It is characterized by chance of having closure of the upper airway, resulting in the cessation of airflow as self reported by adults on STOP BANG sleep apnea questionnaire and categorized as-

High risk of OSA (5-8)
Intermediate risk of OSA (3-4)
Low risk of OSA (0-2)

Adults- Males and females in the age group of 18-60 years either pursuing professional education or working as a teaching faculty.

Sample Size

Sample size was calculated by taking infinite population:

SS= $Z^2 x (p) x (1-p)/ C^2$
Where SS= Sample size
Z^2= standard normal score (1.96)
P= % of population
C= Confidence interval (95%)

Period of Investigation

The study was conducted in the month of October to December 2017.

Inclusion Criteria

- It included the adults between 18-60 years of age and who reported to have history of snoring.

Exclusion Criteria

- It excluded the adults who were having having craniofacial malformation, physical obstruction in nose or throat, abnormally large tonsils, having mouth ulcers, uncorrected deviated septum, taking treatment for snoring,
- Living alone and not present at the time of data collection and not performing or missed oropharyngeal exercises for more than 15 days.

Ethical Clearance

Ethical approval for the study was taken from the institutional ethical committee (IEC-959) of Maharishi Markandeshwar (Deemed to be University) Mullana, Ambala. Written informed consent was taken from each subject after explaining the purpose of research project.

Tools and Techniques

Self report technique was used to collect data on demographic and sleep related variables, Epworth sleepiness scale, snoring scale (includes frequency, impact, pattern and intensity) and STOP BANG sleep apnea questionnaire and measurement technique used for anthropometric parameter. The content validity was between 0.87-1. Inter-rater and intra-rater reliability using Pearson coefficient formula was been used for anthropometric parameters and the reliability found to be between 0.97-0.99 and 0.99-1.0 respectively. Internal consistency using Cronbach alpha and test-retest reliability

using spearman correlation formula was determined for Epworth sleepiness scale and reliability found to be 0.87 and 0.94 respectively. Internal consistency using Cronbach alpha and test-retest reliability using Pearson coefficient formula was calculated for snoring scale and was found to be 0.70 and 0.77 respectively. Test-retest reliability of STOP BANG sleep apnea questionnaire was calculated using Kendall tau formula and found to be 0.806.

The oropharyngeal exercises was performed by experimental group and consists of group of exercises involving four tongue exercises which includes tongue brushing, tongue slide, tongue workout, tongue clench, two soft palate exercises which includes soft palate blowing, vowel pronunciation, two jaw exercises which includes chewing, jaw resist and four lateral pharyngeal wall exercises which includes throat and neck exercises, reaching for the ceiling, ceiling swallow and finger in cheek and each exercise to be performed 10 times in one cycle and repeated 2 cycles within a day in morning and evening respectively for 1 month.

STATISTICAL ANALYSIS

The analysis of the obtained data was performed using SPSS (version 20) software. The significance level was considered as p-value ≤0.05. Data analyzed by descriptive and inferential statistics i.e. mean, median, standard deviation, chi-square and t-test.

RESULTS

Demographic and sleep related variables

Out of 60 adults, majority of the adults in comparison group (90%) and half of the adults in experimental group (53.3%) belonged to age group of 18-28 years. More than half of adults were males (66.7%) in both comparison and experimental group. Majority (90%) of adults were student in comparison group and more than half (53%) of adults were teaching faculty in experimental group. Majority of adults in comparison group (66.7%) and experimental group (70%) sleep for about 6-8 hours in night. More than half of the adults in comparison group (60%) take daytime nap and majority of adults in experimental group (70%) do not take daytime nap. More than half of adults in comparison group (56.7%) and almost one-third in experimental group (26.7%) perform one hour of physical activity daily. Majority of adults in comparison group (96.7%) and all of the adults in experimental group (100%) are not diagnosed with sleep disorder. One third of adults in comparison group (38.3%) and majority of adults in experimental group (76.7%) did not practice any relaxation therapy. Majority of adults in comparison group (83.3%) and in experimental group (70%) were non-alcoholics. Majority of adults in comparison group (73.3%) in comparison group and in experimental group (93.3%) never smoked cigarette.

Chi square was applied and findings shows that both the groups were homogenous with respect to gender, duration of sleep in night, physical activity, sleep disorder diagnosed, relaxation therapy, alcohol intake and smoke cigarette and heterogeneous in terms of age, occupation and daytime nap.

Table 1: Comparison of experimental and comparison group in terms of Anthropometric parameters before administration of Oropharyngeal Exercises N=60

Anthropometric parameters	Comp. group (n=30)	Exp Group (n=30)	M_D	SE_{MD}	t value	df	p value
	Mean ± SD	Mean ± SD					
Height (cm)	166.90±8.81	165.90±7.85	1.00	2.15	0.46	58	0.64^{NS}
Weight (kg)	69.53±10.13	75.17±10.77	5.63	2.70	2.08	58	0.04*
BMI	24.87±3.52	27.20±3.50	-2.33	0.90	-2.57	58	0.01*
Neck circumference (cm)	39.17±3.21	39.87±2.43	-0.70	0.73	-0.95	58	0.34^{NS}
Abdominal circumference (cm)	96.10±20.86	99.77±12.19	-3.66	4.41	-0.83	58	0.40^{NS}

*Significant (p≤0.05) ^{NS} Not Significant (p>0.05), 't'(58)=2.00

Data related to anthropometric parameters in Table 1 showed that comparison and experimental group were homogenous and comparable with respect to height, neck circumference and abdominal circumference before the intervention at 0.05 level of significance and significant difference found with respect to BMI and abdominal circumference in comparison and experimental group before administering intervention. Then after giving intervention no significant difference found with respect to neck circumference ($p>0.34^{NS}$) it means no change has occurred.

Table 2: Comparison of experimental and comparison group in terms of Daytime Sleepiness after administration of Oropharyngeal Exercises at Day 15 and Day 30 N=60

Group	Day	Mean ± SD	M_D	SE_{MD}	t value	df	p value
Experimental group (n=30)	15	6.87±3.56	-4.03	21.28	5.27	58	0.001*
Comparison group (n=30)		10.90±2.20					
Experimental group (n=30)	30	6.23±3.29	-4.56	28.49	6.23	58	0.001*
Comparison group (n=30)		10.80±2.28					

***Significant (p≤0.05) ^{NS} Not Significant (p>0.05) t (58)=2.00**

The data related to daytime sleepiness reveals that the mean daytime sleepiness score in experimental group and comparison group was 10.0±2.26 and 11.20±2.26 respectively with a mean difference of -1.20. Therefore, it is inferred that the adults in the experimental and comparison group were homogenous and comparable in terms of daytime sleepiness score before administration of oropharyngeal exercises ($p>0.08^{NS}$). But after giving intervention significant difference found in daytime sleepiness score of adults in experimental and comparison group at day 15 and 30 ($p<0.001^*$) in Table 2.

Table 3: Comparison of experimental and comparison group in terms of Snoring after administration of Oropharyngeal Exercises at Day 15 and Day 30 N=60

Group	Day	Mean ± SD	M_D	SE_{MD}	t value	df	p value
Experimental group (n=30)	15	12.37±5.60	-3.43	8.13	2.37	58	0.02*
Comparison group (n=30)		15.80±5.61					
Experimental group (n=30)	30	11.43±5.42	-3.70	10.01	2.70	58	0.01*
Comparison group (n=30)		15.13±5.61					

***Significant (p≤0.05) ^{NS} Not Significant (p>0.05) t (58)=2.00**

Data related to snoring before giving intervention reveals that mean snoring score in experimental and comparison group was 18.30±4.97 and 16.13±5.81 with a mean difference of 2.16. The obtained t value (1.55) was found to be non significant ($p>0.12^{NS}$). Significant difference found in snoring score of adults after giving intervention as shown in Table 3 at day 15 ($p<0.02^*$) and 30 ($p<0.01^*$).

Table 4: Comparison of experimental and comparison group in terms of Risk of obstructive sleep apnea after administration of Oropharyngeal Exercises at Day 15 and Day 30 N=60

Group	Day	Mean ± SD	M_D	SE_{MD}	t value	df	p value
Experimental group (n=30)	15	1.80±1.21	-1.03	0.29	3.56	58	0.001*
Comparison group (n=30)		2.83±1.02					
Experimental group (n=30)	30	1.73±1.25	-0.93	0.304	3.06	58	0.003*
Comparison group (n=30)		2.67±1.09					

***Significant (p≤0.05) ^{NS} Not Significant (p>0.05) t (58)=2.00**

The data further reveals that the mean risk of OSA score in experimental and comparison group was 2.80±1.44 and 2.93±0.98 with a mean difference of 0.13. The difference in scores was compared using independent 't' test and was found to be non-significant ('t'=0.418, p>0.67) before giving intervention. Further in Table 4 shows significant difference found after giving intervention in risk of obstructive sleep apnea score of adults at day 15 (p<0.001) and at day 30 (p<0.003).

Table 5: Coefficient of correlation between Daytime sleepiness, Snoring and Risk of obstructive Sleep Apnea of adults in Experimental Group at Day 30

Correlation (post-test)	Daytime sleepiness r(pvalue)	Snoring r(p value)	Risk of obstructive sleep apnea r(p value)
Daytime sleepiness	------	0.71(0.00)*	-------
Snoring	------	-------	0.50(0.00)*
Risk of obstructive sleep apnea	0.41(0.02)*	-------	-------

***Significant (p≤0.05) ^{NS} Not Significant (p>0.05) r(27)=0.47**

The data presented in Table 5 reveals that daytime sleepiness is positively correlated with snoring, risk of obstructive sleep apnea and vice-versa.

Table 6: Coefficient of correlation between Daytime sleepiness, Snoring and Risk of obstructive Sleep Apnea of adults in Comparison Group at Day 30

Correlation (post-test)	Daytime sleepiness r(p value)	Snoring r(p value)	Risk of obstructive sleep apnea r(p value)
Daytime sleepiness	------	0.35(0.05)*	-------
Snoring	------	-------	0.49(0.05)*
Risk of obstructive sleep apnea	0.08(0.66)^{NS}	-------	-------

***Significant (p≤0.05) ^{NS} Not Significant (p>0.05) r(27)=0.47**

The data presented in Table 6 reveals that daytime sleepiness is positively correlated with snoring. Similarly snoring is correlated with risk of obstructive sleep apnea but daytime sleepiness is not correlated with risk of obstructive sleep apnea and vice-versa.

DISCUSSION

The present study show the overall mean age of adults was 26.85±7.6 years. In the present study, 66.6% of adults (40/60) were males and 33.3% (20/60) were females. In the present study, one third of adults i.e. 31.6% belonged to teaching faculty whereas 68.3% were students.

In the present study the mean neck circumference of adults was 39.17±3.21 cm in comparison group and 39.87±2.43 cm in experimental group which was consistent with the findings of Katie C Guimares et.al which showed the neck circumference in control group was 40.9±3.5 cm and 39.6±3.7 cm in experimental group before intervention. [12]

In the present study, the mean daytime sleepiness score of adults on day 30 in experimental and comparison group before intervention was 10.0±2.99 and 11.20±2.26 respectively which is significantly higher than after giving intervention 6.23± 3.29 and 10.80± 2.28 respectively (p=0.001). The result is consistent with the findings of Guimaraes who reported the mean daytime sleepiness score in experimental and control group before intervention was 14±5, 14±7 respectively which is significantly higher than after giving intervention 8±6,12±6 respectively (p<0.005). Thus oropharyngeal exercises were effective in reducing daytime sleepiness. [12]

In the present study, the mean snoring score of adults in experimental and comparison group was 11.43±5.42 and 15.13±5.16 respectively (p=0.01). The findings were consistent with Shadman nemati et.al. who reported the mean snoring scale score after the intervention in control and experimental group was 7.01±1.72,

3.09±2.7 respectively (p=0.000). This implies that oropharyngeal exercises are effective to improve the severity of snoring. Hence oropharyngeal exercises was effective in decreasing the snoring. [2] The result is consistent because oropharyngeal exercises helps in reducing increased mass present in larynx.

In the present study, the mean risk of obstructive sleep apnea score of adults in experimental and comparison group was 2.67±1.09 and 1.73±1.25 respectively (p=0.003).The findings were inconsistent with the Gumaires et.al. which showed significant decrease of apnea hypopnea index in comparison and experimental group was 9.6±6 and 3.3±3.2 respectively. [12] The findings were inconsistent because according to Gumaires he assessed the moderate obstructive sleep apnea on patients and the present study assessed the risk of obstructive sleep apnea.

In the present study there is strong positive correlation between the daytime sleepiness with snoring, snoring and risk of obstructive sleep apnea and the risk of obstructive sleep apnea with daytime sleepiness in experimental group (r=0.71, 0.50 and 0.41) and (r=0.35, 0.49 and 0.08) in comparison group which indicates mild positive correlation. The findings were consistent with the Nimrod et al. who conducted a study to assess the correlation between snoring intensity with the severity of obstructive sleep apnea which shows there was a positive correlation between the intensity of snoring and the AHI ($r = 0.66$, $p < 0.01$). [3]

CONCLUSION

Oropharyngeal exercises are effective in reducing the daytime sleepiness, snoring and risk of obstructive sleep apnea among adults having snoring. The nurses along with the pharmacological therapy they can teach oropharyngeal exercises as an adjuvant therapy in improving sleep quality of patient. Also as a nurse educator teach students about assessment of sleep related problems like snoring, obstructive sleep apnea among patients admitted in hospital. The protocol should be made in the ward to identify the patients having snoring and to teach the oropharyngeal exercises to them. Researches can be conducted regarding different modalities on pharmacological therapy and non-pharmacological treatment also to reduce daytime sleepiness, snoring and risk of obstructive sleep apnea.

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