Effect of Sleep Quality on Cognitive and Physiological Functions among Patients Admitted in Medical Wards

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ABSTRACT

Introduction: Sleep is crucial for the survival of a human being as food. It helps to increase physiological and cognitive functions. Sleep is defined as transformable condition, where there is a withdrawal from the extrinsic environment. Sleep permits to rejuvenate the physical and physiological function. Disrupted sleep also leads to brain dysfunction and hemodynamic alterations.

Materials and Methods: A quasi-experimental study was considered to attain the objectives of the study. On probability, convenient sampling was done. The pre-interventional data were collected on day 0. Eye mask and ear plug were given as intervention from day 1 to day 3.and data were collected on each day.

Results: The study was conducted on 60 samples. The study reveals that majority of patients were between 40 and 59 years and out of 60 patients, majority of the patients were female It was found that the patients average sleeping hours at home were 6–9 h and patients had no difficulty in initiating sleep in normal routine sleep. Patients had deprived sleep due to continuous light and sound. The sleep status is improved from day 1 to day 3. There was significant relationship between the heart rate, blood pressure, respiration, and sleep quality; there was no significant relationship between cognitive function and sleep.

Conclusion: The present study reveals that the sleep quality was enhanced by the application of eye mask and ear plug which led to changes in the physiological parameters such as blood pressure and heart rate. The blood pressure came down to normal limit with sleep quality.

Keywords: Sleep, sleep quality, eye mask and ear plug, cognitive functions, physiological parameters

INTRODUCTION

Sleep is crucial for the survival of a human being as food. It helps to increase physiological and cognitive functions. Sleep is defined as transformable condition, where there is a withdrawal from the extrinsic environment. Sleep permits to rejuvenate the physical and physiological function. Normal circadian rhythm and physiological function occurs while sleeping.[1]

The normal circadian rhythm works 24 h cycle. The biological clock determines the time of sleep and arousal. Normal physiological changes occur in our body according stages of sleep. Temperature is decreased during NREM stage. Each sleep stage has different respiratory pattern. Cardiovascular system varies in both the stages. In gastrointestinal system, the esophageal motility is diminished. The stimulation of thyroid stimulating hormone is stopped by N3 sleep and release of TSH is increased by sleep disruption.[1]

According to recent studies, disruption in sleep affects the cognitive function and it decreases the information stored in the memory and degenerate the attention process.[2] Recent

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studies reveal that disturbed sleep triggers stress response and releases large number of inflammatory markers. The negative response of immune system, release catecholamines and cortisol, the t cell and natural killer cell is decreased leading to rise in leukocytes and monocytes. These disturbances in cell causes decrease capacity to fight against infection and susceptible to infections, which eventually leads to prolonged stay in the hospital.[3]

Disruption in sleep is increased in patients admitted in wards due to the amount illumination in the ward, frequent noise, during administration of medications, activities by staff and patient. Stress and illness itself also contribute toward inadequate sleep in the hospital environment.[1]

Recent study done in ST. George's hospital suggests that 50% of patient in a study group of 100 identified noise as the disturbing factor for sleep.[3] Therefore, sleep disruption is prevalent in patients admitted in hospital.[4]

As the sleep quality is deranged mostly due to light and noises, some sleep enhancing equipments such as ear plug and eye mask will help to improve the sleep hygiene.[4]

According to recent study performed in Jorden, it reveals that experimental group who received ear plug and eye mask slept more hours and had better quality of sleep compared to the control group who received only routine care.[3]

Research conducted in the ICU to know the effect of ear plug on onset of delirium, it was found that patient with ear plug had 15% mild confusion whereas in control group 40% of patients had mild confusion.[5]

The healthcare institutions are in a run of improving the quality of care to the patients. Administration of sleep enhancing equipment's like ear plug and eye mask will increase the sleep quality, eventually preventing the patients from cognitive and physiological impairment as well as reducing the prolonged stay in the hospital. This study will inspect the improvement in sleep quality by administrating ear plug and eye masks and there by evaluating the association between the cognitive and physiological parameters with increased sleep quality. The objectives of the study are to evaluate the sleeping habits among patients admitted in medical wards to assess the perceived factors for deprived sleep among patients admitted in medical ward, to assess the sleep quality on cognitive function before and after introducing eye mask and ear plug, to assess the sleep quality on physiological parameters before and after introducing the eye mask and ear plug.

MATERIALS AND METHODS

Research design

A quasi experimental study was considered to attain the study objectives.

Sampling technique

Participants were selected using non-probability convenient sampling.

Sample size

The sample size was 60.

Variables

The dependent variable is cognitive and physiological functions of patients admitted in medical ward, the independent variable is the sleep quality given through ear plug and eye mask.

Setting

This study was conducted at the medical wards of selected hospital of Navi Mumbai.

Tool

In this study, for the data collection, the modified St. Mary's hospital sleep questionnaire to assess the sleep quality in hospital, Standardized Mini-Mental State Examination to assess the cognitive function was used.

Validity and reliability

This study content validity of the tool was done by 12 experts from varied fields. Reliability was assessed and the tool was found to be reliable.

Data collection

Pre-interventional test was conducted on day 0 and the post-interventional test data were collected in the morning after applying eye mask and ear plug from post-interventional day 1 to day 3. Data collection was done for the period of 10 days. After explaining the study, purpose consent was signed and pre-interventional test was done. The post-interventional test data were collected in the morning after applying eye mask and ear plug for 3 consecutive days.

RESULTS

The study reveals that majority of patients were between 40 and 59 years and out of 60 patients, majority of the patients were female (51.7%). The study shows that the average sleep of 6–9 h was achieved from day 1 to day 3 after applying the eye mask and ear plug and the patients sleep status improved from day 1 to the patient's frequency of waking up was decreased by post-interventional day 3. Before intervention, 40% of patients had extreme difficulty in initiating sleep which improved after the application of eye mask and ear plug.

The average sleep hours of 83.3% patients in the ward were between 0 and 6 h and 16.7% had sleep hours between 6 and 9 h on day 0. After intervention, 100% of patients had sleep hours between 6 and 9 h on day 1, 2, and 3 [Table 1].

Majority of the patients 43.3% had very light sleep on day 0 [Table 2] and 98.3 % of patients had deep sleep on day 3.

About 50 % of the patients had 3 times of wake up on day 0 and 100 % had 1-time wake up [Table 3] on day 2.

After introduction of eye mask and ear plug with regard to difficulty to sleep, 56.7% of patients had a lot of difficult [Table 4] and 70% of them had no sleep difficulty on day 3.

The mental status was normal for 95% on day 0 [Table 5] and 100% normal on day 3.

There was no significant difference in mental status before and after introducing the eye mask and ear plug [Table 6].

The systolic blood pressure was high on 96.7% of patients on day 0 and after introducing the eye mask and ear plug, 86.7% had normal SBP on day 3 [Table 7].

There was significant difference in systolic blood pressure before and after introducing eye mask and ear plug in patients [Table 8].

Table 9 depicts that there was a significant difference in systolic blood pressure between day 0 and 1 and between day 0 and 3 after introducing the eye mask and ear plug.

The diastolic blood pressure was high with 33.3% of patients on day 0 [Table 10] and 100 % of patients had normal diastolic blood pressure after introducing the eye mask and ear plug.

Table 1: Distribution of sleep hours of patients in ward before and after introducing the eye mask and ear plug (n=60)

Average sleep (h)	Frequency (%)			
	Day 0	Day 1	Day 2	Day 3
0–6	50 (83.3)	0	0	0
6–9	10 (16.7)	60 (100.0)	60 (100.0)	60 (100.0)

Table 2: Distribution of patients sleep status before and after introducing the eye mask and ear plug (n=60)

Serial number (items)	Day	Frequency (%)			
		Very deep	Deep	Light	Very light
1	Day 0	0	0	34 (56.7)	26 (43.3)
2	Day 1	19 (31.7)	41 (68.3)	0	0
3	Day 2	55 (91.7)	5 (8.3)	0	0
4	Day 3	1 (1.7)	59 (98.3)	0	0

Table 3: Distribution of number of times of wake up during sleep before and after introducing the eye mask and ear plug (n=60)

Day	Frequency (%)				
	>4 times	Three times	Two times	One time	None
Day 0	28 (46.7)	30 (50.0)	1 (1.7)	1 (1.7)	0
Day 1	0	0	17 (28.3)	43 (71.7)	0
Day 2	0	0	0	60 (100.0)	0
Day 3	0	0	0	59 (98.3)	1 (1.7)

Table 4: Distribution of difficulty to sleep off before and after introducing the eye mask and ear plug (n=60)

Day	Frequency (%)				
	Extreme difficult	A lot	Some	Little	None
Day 0	24 (40.0)	34 (56.7)	2 (3.3)	0	0
Day 1	0	0	6 (10.0)	54 (90.0)	0
Day 2	0	0	0	36 (60.0)	24 (40.0)
Day 3	0	0	0	18 (30.0)	42 (70.0)

Table 5: Distribution of mini mental status score before and after introducing the eye mask and ear plug (n=60)

Day	Frequency (%)			
	Normal (30–25)	Mild (24–21)	Moderate (21–10)	Severe (9–0)
Day 0	57 (95)	3 (5)	0	0
Day 1	58 (96.6)	2 (3.3)	0	0
Day 2	60 (100)	0	0	0
Day 3	60 (100)	0	0	0

Table 6: Comparison of standardised mini mental status examination score before and after introducing the eye mask and ear plug (n=60)

Day	MMSE				
	Mean	SD	ANOVA f-test	P-value	Significant at 5% level
Day 0	28.78	2.04	2.609	0.052	NS
Day 1	28.86	1.89			
Day 2	29.20	1.38			
Day 3	29.53	1.06			

MMSE: Mini-mental state examination, SD: Standard deviation, NS: Not significant

Table 7: Distribution of physiological parameter (systolic blood pressure) before and after introducing the eye mask and ear plug (n=60)

Day	Frequency (%)	
	Normal SBP (90–120)	High SBP (>120)
Day 0	2 (3.3)	58 (96.7)
Day 1	54 (90.0)	6 (10.0)
Day 2	52 (86.7)	8 (13.3)
Day 3	52 (86.7)	8 (13.3)

SBP: Systolic blood pressure

Table 8: Comparison of systolic blood pressure before and after introducing eye mask and ear plug in patients (n=60)

Day	Mean	SD	ANOVA f-test	P-value	Significant at 5% level
Day 0	145.78	12.97	128.263*	<0.001	Significant
Day 1	113.23	9.98			
Day 2	115.06	10.31			
Day 3	114.55	9.52			

SD: Standard deviation, *Significant

Table 9: Comparison of systolic blood pressure between days of introducing the eye mask and ear plug

Test Introducing eye mask and ear plug	Physiological parameter (SBP)					
	Day	Mean	SD	Paired t-test	P	Significant at 5% level
Before	Day 0	145.78	12.97	18.69*	<0.001	Yes
After	Day 1	113.23	9.98			
Before	Day 1	113.23	9.98	1.37	0.175	No
After	Day 2	115.06	10.31			
Before	Day 2	115.06	10.31	0.35	0.727	No
After	Day 3	114.55	9.52			
Before	Day 0	145.78	12.97	18.02*	<0.001	Yes
After	Day 3	114.55	9.52			

SBP: Systolic blood pressure, SD: Standard deviation, *Significant

There was significant difference in diastolic blood pressure before and after introducing the ear plug and eye mask in patients [Table 11].

Table 12 depicts that there was a significant difference in systolic blood pressure between day 0 and 1 and between day 0 and 3 after introducing the eye mask and ear plug.

The heart rate was high for 5% of patients on day 0 and normal for 100% of patients on day 3 [Table 13].

There was a significant difference in heart rate before and after introducing the ear plug and eye mask in patients [Table 14].

Table 15 depicts that there was a significant difference in heart rate between day 0 and 1 and between day 0 and 3 after introducing the eye mask and ear plug.

The respiratory rate was high for 40% of patients on day 0 and normal for 66.7% of patients on day 3 [Table 16].

There was no significant difference in respiratory rate before and after introducing the ear plug and eye mask in patients [Table 17].

There was no significant difference in respiratory rate before and after introducing the ear plug and eye mask in patients in between days [Table 18].

DISCUSSION

The current study reveals that the patient routine sleeping habits were normal and had difficulty to initiate sleep during

Table 10: Distribution of diastolic blood pressure before and after introducing the eye mask and ear plug (*n*=60)

Day	Frequency (%)		
	Low DBP (<60)	Normal DBP (60–90)	High DBP (>90)
Day 0	0	40 (66.7)	20 (33.3)
Day 1	0	60 (100.0)	0
Day 2	0	60 (100.0)	0
Day 3	0	60 (100.0)	0

DBP: Diastolic blood pressure

Table 11: Comparison of diastolic blood pressure before and after introducing the ear plug and eye mask in patients (*n*=60)

Physiological parameter (DBP)					
Day	Mean	SD	ANOVA *f*-test	*P*-value	Significant at 5% level
Day 0	87.06	11.91	53.870*	<0.001	Significant
Day 1	70.26	8.22			
Day 2	69.90	8.77			
Day 3	68.10	7.99			

DBP: Diastolic blood pressure, SD: Standard deviation, *Significant

Table 12: Comparison of diastolic blood pressure between days of introducing the eye mask and ear plug

Test Introducing eye mask and ear plug	Physiological parameter (DBP)					
	Day	Mean	SD	Paired *t*-test	*P*-value	Significant at 5% level
Before	Day 0	87.06	11.91	9.607*	<0.001	Yes
After	Day 1	70.26	8.22			
Before	Day 1	70.26	8.22	0.273	0.786	No
After	Day 2	69.90	8.77			
Before	Day 2	69.90	8.77	1.377	0.174	No
After	Day 3	68.10	7.99			
Before	Day 0	87.06	11.91	10.129*	<0.001	Yes
After	Day 3	68.10	7.99			

DBP: Diastolic blood pressure, SD: Standard deviation, *Significant

Table 13: Distribution of heart rate before and after introducing the eye mask and ear plug (*n*=60)

Day	Frequency (%)		
	Low heart rate (<60)	Normal heart rate (60–100)	High rate (>100)
Day 0	0	57 (95.0)	3 (5.0)
Day 1	0	60 (100.0)	0
Day 2	0	60 (100.0)	0
Day 3	0	60 (100.0)	0

Table 14: Comparison of heart rate before and after introducing the ear plug and eye mask in patients (*n*=60)

Physiological parameter (heart rate)					
Day	Mean	SD	ANOVA *f*-test	*P*-value	Significant at 5% level
Day 0	89.76	7.79	110.971*	<0.001	Significant
Day 1	74.70	5.33			
Day 2	73.70	5.30			
Day 3	74.50	3.50			

*S, SD: Standard deviation

Table 15: Comparison of heart rate between days of introducing the eye mask and ear plug (*n*=60)

Test Introducing eye mask and ear plug	Physiological parameter (heart rate)					
	Day	Mean	SD	Paired *t*-test	*P*-value	Significant at 5% level
Before	Day 0	89.76	7.79	14.326*	<0.001	Yes
After	Day 1	74.70	5.33			
Before	Day 1	74.70	5.33	1.232	0.223	No
After	Day 2	73.70	5.30			
Before	Day 2	73.70	5.30	0.951	0.346	No
After	Day 3	74.50	3.50			
Before	Day 0	89.76	7.79	15.939*	<0.001	Yes
After	Day 3	74.50	3.50			

SD: Standard deviation, *Significant

Table 16: Distribution of respiratory rate before and after introducing the eye mask and ear plug

Day	Frequency (%)		
	Low respiratory rate (<12)	Normal respiratory rate (12–20)	High respiratory rate (>20)
Day 0	0	36 (60.0)	24 (40.0)
Day 1	0	38 (63.3)	22 (36.7)
Day 2	0	39 (65.0)	21 (35.0)
Day 3	0	40 (66.7)	20 (33.3)

Table 17: Comparison of respiratory rate before and after introducing the ear plug and eye mask in patients

Day	Mean	SD	ANOVA *f*-test	*P*-value	Significant at 5% level
Day 0	20.65	7.95	0.428	0.733	NS
Day 1	19.75	2.08			
Day 2	19.65	2.07			
Day 3	20.41	7.99			

SD: Standard deviation, NS: Not significant

Table 18: Comparison of respiratory rate between days of introducing the eye mask and ear plug

Introducing eye mask and ear plug	Physiological parameter (respiration)					
	Day	Mean	SD	Paired *t*-test	*P*-value	Significant at 5% level
Before	Day 0	20.65	7.95	0.828	0.411	No
After	Day 1	19.75	2.08			
Before	Day 1	19.75	2.08	0.279	0.781	No
After	Day 2	19.65	2.07			
Before	Day 2	19.65	2.07	0.738	0.463	No
After	Day 3	20.41	7.99			
Before	Day 0	20.65	7.95	0151	0.0881	No
After	Day 3	20.41	7.99			

SD: Standard deviation

hospital stay. The average sleep hours of 93.4% patients at home were 6–9 hours whereas during hospital stay, 83.3% of patients had reduced sleep of 0–6 h before intervention. A similar study was conducted to assess the sleep quality and as well as quantity and factors causing sleep disturbances revealed that the patients had poor sleep-in hospital as compared to home. In 2205 number of patients, approximately 95% of patients had lesser sleeping hours compared to sleep at home.[6]

In the present study, the sleep quality of patient were improved in the 1st day of intervention (application eye mask and ear plug).In pre interventional day all the patients had average sleep <6 h and 56.% patients had light sleep whereas after the intervention the sleep hours increased to 6–8 and none of the patients had light sleep after introducing eye mask and ear plug. In day 1(periinterventional day), 96% of patient waked up more than 3 times and on day 3 of intervention, 98.3% of patient s woke up only once in the entire night.

A similar study was conducted by Demoule *et al*. to assess ear plug and eye mask impact on patients admitted in intensive care unit. The study reveals that the deep (N3) sleep proportion was 21% in the experimental group and the 11% in the group who does not receive the intervention the number of prolonged period awakening was less in the interventional group compared to control group.[7]

In physiological parameter, the blood pressure of patients was high and heart rate was within normal limit but there was a significant change in the heart rate with intervention. Respiration was also within the normal limit.

A meta-analysis study was conducted by Lo *et al*. to know the relation of sleep and blood pressure. It was found that the

sample who had deprived sleep had higher SBP (96%) and DBP was not significant.[8]

The present study reveals that the sleep quality was enhanced by the application of eye mask and ear plug which lead to changes in the physiological parameters such as blood pressure and heart rate. The blood pressure came down to normal limit with sleep quality. The heart rate was within normal limits but there were significant changes after the application of eye mask and ear plug.

CONCLUSION

The aim of healthcare institution is to provide a holistic care to the patients. Sleep is important factor for every being especially to the patients admitted in hospital. Ear plug and eye mask will improve the sleep hygiene of the patient and minimize the physiological effect due to decreased sleep in hospitalized patient and will improve the patients stay in hospital.

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CONFLICTS OF INTEREST

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