

# Analysis of EEG signal using MATLAB for observation PLM Sleep Disorder

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## **ABSTRACT:**

Sleep is defined as a universal activity experienced by all species. It is a natural phenomenon which consume one third of the human life .This activity demands everybody to abandon the state of consciousness and move between the states of deep sleep and dreams. Body tissues are regenerated and repaired during sleep also known as the anabolic state; it helps muscles, strengthen the immune system and the bones. As the name suggests, PLM is the periodic movement of the inferior part of leg during the sleep hours of a human being. It takes place at some definite period of time in this paper we diagnose the PLM through EEG signals. In this research article, quality and waveform of EEG Signals of human being are analyzed. The plan of this examine is to draw the consequence in the form of signal range analysis of the changes in the domain of dissimilar stages of sleep.

## **I.INTRODUCTION:**

Generally, a sleeping human being lies still with his eyes closed and breathes slowly with relaxed muscle. A sleeping person is unconscious of everything surrounding him. The stages of sleeping phase are different when compared to exhaust and hibernation, as a sleeping person can be woken by touches, a loud sound or bright light. Sleep is an important activity as breathing, eating food and drinking water for a person to live. A person cannot function properly if he does not take proper sleep. Sleep plays a vital role in maintaining memory and concentration. Sleep is essential for proper functioning of the body as it restores the energy level and refreshes a person's mood. Sleep is very important for a person's well-being. Human sleep is divided into two categories

- NREM (Non-Rapid Eye Movement sleep)
- REM (Rapid Eye Movement sleep)

## **II.FUNCTION OF SLEEP:**

Sleep is the basic activity in human life. During sleep, numerous processes occur in human body which plays important role in physical & mental growth of children and adolescents. A person would be unable to function properly if he does not take proper sleep. Sleep plays a vital role building up and maintaining memory along with improving the concentration. In addition to this, sleeping helps the body in releasing the toxins and maintaining hormonal balance. Sleep helps in making a person both psychologically and physiologically fit. Sleeping is important for:

- a) Repairing injuries and illness
- b) Growth

- c) Restoring energy
- d) Physiological wellbeing
- e) Psychological wellbeing and mood
- f) Work performance
- g) Social behavior with people around us.
- h) Proper functioning of various systems of human body

### **III.EFFECT OF LACK OF SLEEP:**

Studies suggest, an adult needs an average sleep of 7-8.5 hours in a day. It is also observed that some people feel refreshed and function properly even after a sleep of 4-5 hours a day while there are other who cannot function well even after a sleep of 9-10 hours. Lack of sleep is an alarming situation where a person can face serious medical problems in future including diabetes, obesity and other heart diseases. Lack of sleep also results in short tempers, lack of focus, tiredness, difficulty in concentration, etc. When a person fails to take a proper sleep for prolong period, he suffers from following problems:

- a) Poor attention and concentration
- b) Poor organizational skill
- c) Depression
- d) Frustration and irritation
- e) Distractibility
- f) Poor motivation
- g) Poor physical coordination (especially while driving)
- h) Mood disturbance
- i) Impaired judgment

People suffering from problems like hypoventilation, observe oxygen content reduction in blood or hypes in carbon dioxide content in the blood during sleep. These two can occur simultaneously to cause negative effect in respiration. These conditions are also observed during NREM sleep.

### **IV.STAGES OF SLEEP**

Sleep is very important for a person's well being. A whole sleep cycle takes a typical of 90 to 110 minutes, with every stage of between 5 to 15 minutes duration. The primary sleep cycles contain comparatively short REM sleeps and long periods of deep sleep. In the later part of sleep, REM periods grow longer as well as deep sleep time decreases .

Human sleep is categorized mainly into two parts which are described as under:

- a) NREM-Non-Rapid Eye Movement sleep
- b) REM-Rapid Eye Movement sleep

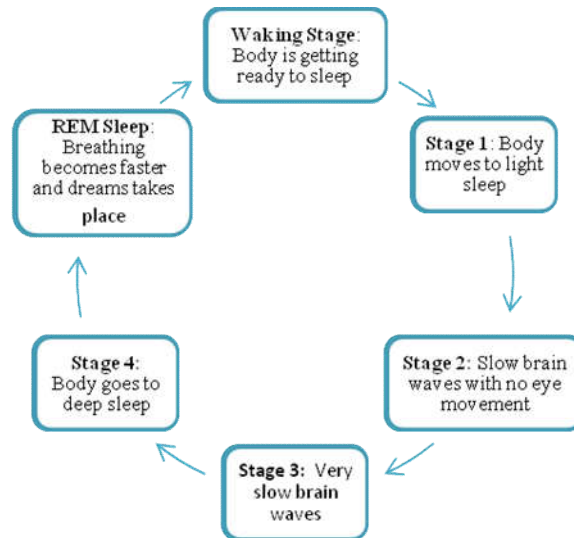


Figure 1: Sleep-Wake Cycle

The first few hours of sleep cycle comprises of short periods of REM sleep and longer period of deep sleep. In later hours of the sleep, the duration of REM period increases and that of deep sleep decreases. A normal sleep observes mainly five stages of sleep known as S1, S2, S3, S4, and REM stage.

#### V. ANALYSIS OF EEG SIGNAL

Collection of Electroencephalogram (EEG) of normal subjects & different type of sleep disordered subjects & application of signal processing on EEG data for development the algorithm for detection of sleep disorders and implementation in MATLAB R2010 Version 7.10.

After the analysis of the EEG Data (Sleep) a range of normalized power is defined for healthy subject. This value is used as reference for identification of different type of sleep disorder. The calculations of Power Spectrum Density (PSD) are done for all stages of sleep. Clipped EEG signal of duration one minute is used, that contain data from channels indicating different sleep stages. DC offset removed filtered data is passed through Hamming window with 50% overlapping & Trapezoidal method is used in calculation of average and normalized power.

#### VI. RESULT & CONCLUSION

Normalized power of normal cases having no symptoms of sleep disorder is analyzed and compared with pathological cases. Normalized power indicates the percentage of a particular EEG activity out of complete power. So it is found a better indication of measurements of detection of features instead of taking average power of particular activity. For delta, Theta, Alpha gamma activities normalized power for normal cases & PLM patient of EMG-1 & EMG2 channel comparison shown table 1 & 2.

Table 1 & 2 : For CHANNEL- EMG1 EMG2, STAGE: So Normalized Power

STAGE	S0		S0		S0	
PATIENT	PLM1		PLM2		PLM3	
SIGNAL	Plm1s0_edfm.mat		Plm2s0_edfm.mat		Plm3s0_edfm.mat	
	Avg Pow	Norm pow	Avg pow	Norm pow	Avgpow	Norm pow
P_delta	2014	0.057686	134.03	0.050345	209.26	0.037416
P_theta	8872.5	0.24984	551.14	0.27629	1109	0.25407
P_alpha	22684	0.66567	1077.4	0.57432	2466.3	0.58724
P_beta	849.19	0.026804	186.49	0.099045	493.67	0.12127

STAGE	So		So		So	
PATIENT	n1		n2		n3	
SIGNAL	n1_So_edfm.mat		n2_So_edfm.mat		n3_So_edfm.mat	
	Avg. power	Normalized power	Avg. power	Normalized power	Avg. power	Normalized power
P_delta	55.79	0.031318	1.1096e+005	0.096391	15908	0.069861
P_theta	448.05	0.259332	3.3704e+005	0.33065	45408	0.31131
P_aplha	982.3	0.58863	3.4349e+005	0.49824	62443	0.54258
P_alpha	185.68	0.12074	31652	0.074719	8717	0.076252

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