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Recording of EEG Signals and Role in Diagnosis of Sleep Disorder

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Electroencephalogram (EEG) is a recording of the electrical movement of the brain from the scalp. For sleep disorder analysis the EEG test is done while the subject is sleeping. In this paper discuss about recording of brain signal (EEG) and how these signal play major role to finding in different brain diseases. EEG data can be different when subjects are asleep or when exhausted or when some sort of action takes place. When the patient is awake standard EEG test can be taken, but it may not demonstrate any unusual electrical action. During the sleep, brainwave patterns alter and may show more unusual electrical action.

Keywords: Electroencephalogram(EEG); Stages of sleep Montage; Electrode Positioning System(EPS); Polysomnography; Montage.

A sleep EEG test is generally done in the laboratory, using a standard machine of EEG. Before the test patients may be given a medicine to make him go to sleep. Tests usually last for 1-2 hours and the person can go to routine work normally after the test[1,2]. EEG waveforms represent the movement of the surface brain waves. This movement is subjective to the electrical action from the brain structures.

Montages

Montage is defined as the process of the placement of the electrodes over the scalp for EEG recording. The basic montage can be either bipolar or referential. The electroencephalogram (EEG) typically uses six exploring electrodes and two reference electrodes. In case of seizure it may need more electrodes to be applied. The exploring electrodes are mounted on the scalp near the frontal, central and occipital parts of the brain. The visual record of the sleep brain activity is provided by these electrodes that can be segmented into different stages of sleep (N1, N2, N3 as NREM, REM).[15,4-7] The current that is flowing throughout synaptic excitation of the dendrites of a number of pyramidal neurons in the cerebral cortex is calculated by EEG.

Since EEG is capable of reflecting regular and irregular electrical action of the brain, therefore, it is considered to be a dominant tool in the field of clinical neurophysiology and neurology.

Bipolar montage

Bipolar montage system consists of two electrodes per channel. There is a reference electrode for every channel. Bipolar Montage

is further classified into two types which are mentioned as:

a) Longitudinal Bipolar (LB)

b) Transverse Bipolar(TB)

The entire montage contains a sequence of these channels. These channels represent difference in voltages of different electrodes, such as

• "F3-C3" presents the diversity in voltage among the F3 electrode & the C3 electrode.

• "C3-P3," presents the voltage diversity between C3 and P3, and so on from side to side array of electrodes.

Referential montage

For all of the channels in the referential montage, a single generic reference electrode is used. Every channel in this system reflects the divergence between a fixed electrode and a chosen reference electrode. Due to the fact that they do not amplify the signal in only one hemisphere when compared to another, midline locations are employed as references. The location of the linked ears serves as another typical reference electrode position[27-33]. These are the electrodes of two earlobes and mastoids' physical or mathematical averages.

Average reference montage

Every amplifier's output is added together, the average of which is then taken as a reading and utilized as the general reference for every channel.

Laplacian montage

All channels show the variation between a single electrode and the weighted average of its nearby electrodes. The term source current density montage is another name for it. Its name is taken from the Laplace mathematical function. The radial current density determines the Laplace of the scalp potential.[5] The current per unit volume travelling radically into a region of scalp from the sources underneath is known as the radial current density. When there is no underlying current source, the Laplacian is zero, and when it is directed at the source, it is maximum.

Electrode positioning system

The 10-20 system is a widely used technique for placing electrodes across the scalp. It is a system that illustrates the relationship between the sites of an electrode and the critical region of the cerebral cortex. The numerals 10 and 20 indicate the separation between the neighboring electrodes. Here,[11-14] "10/20" refers to 10% to 20% of the whole front-to-back or right-to-left head detachment. The five primary places where the skull is researched are as follows:

a) Frontal Lobe

b) Temporal Lobe

c) Central Lobe

d) Parietal Lobe

e) Occipital Lobe

We divide the brain into two sections for measuring purposes. Right and left hemispheres make up the first and second parts, respectively. Each lobe in the measurement is designated with a letter. To determine the type of hemisphere, a number is also employed along with the lobe. The

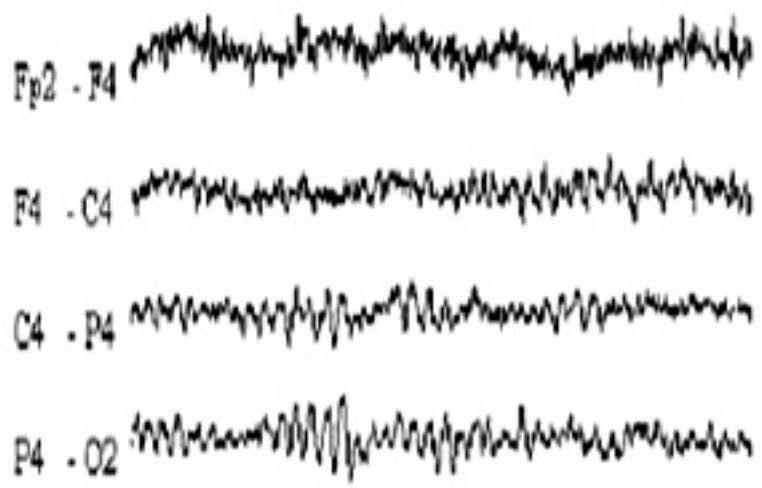

Figure 1. EEG traces [37]

quantity can be
I. Even number
II. Odd number.

Electrodes in the right hemisphere are indicated by even numbers. Examples are 2, 4, 6, 8, etc. Odd numbers indicate where the electrodes are located in the left hemisphere. Examples are 1, 3, 5, 7, etc. A "z" subscript indicates the electrodes' midline location. This system aids in the positioning of electrodes. Which are:
a) Nasion
b) Inion
c) Pre-auricular points anterior to the ear

A point between the forehead and the nose

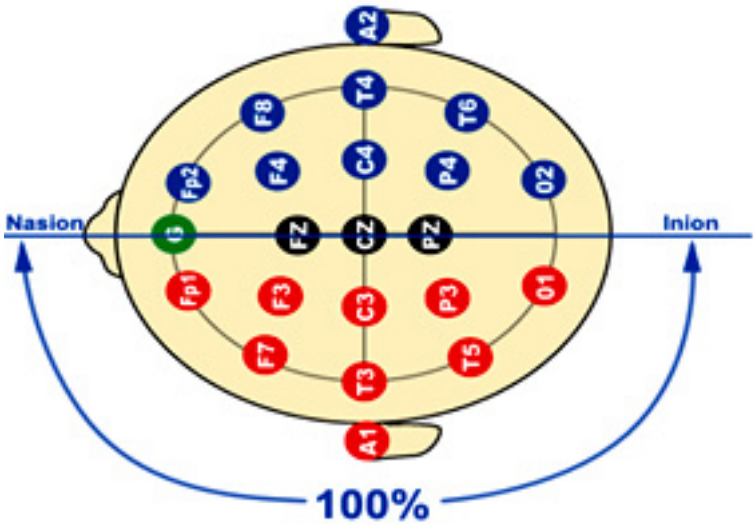

Figure 2. System of electrode placement [27]

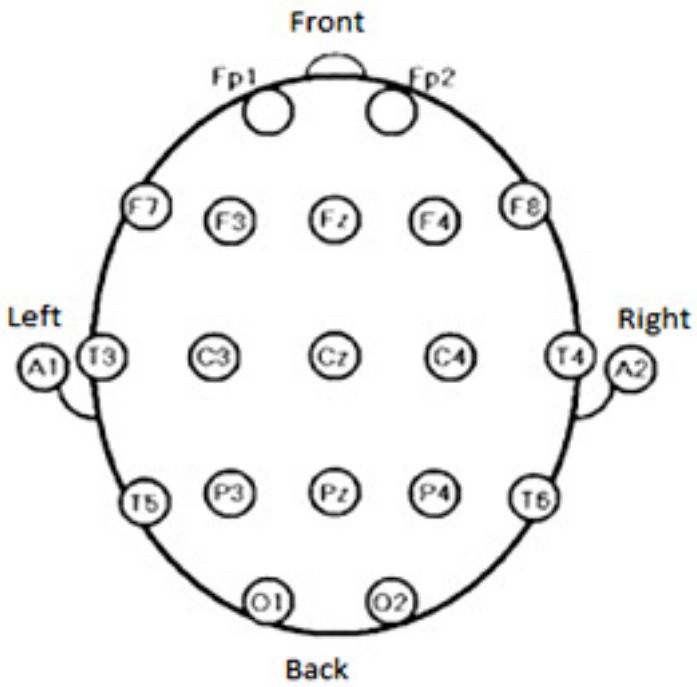

Figure 3. A standard 10/20 montage system [37]

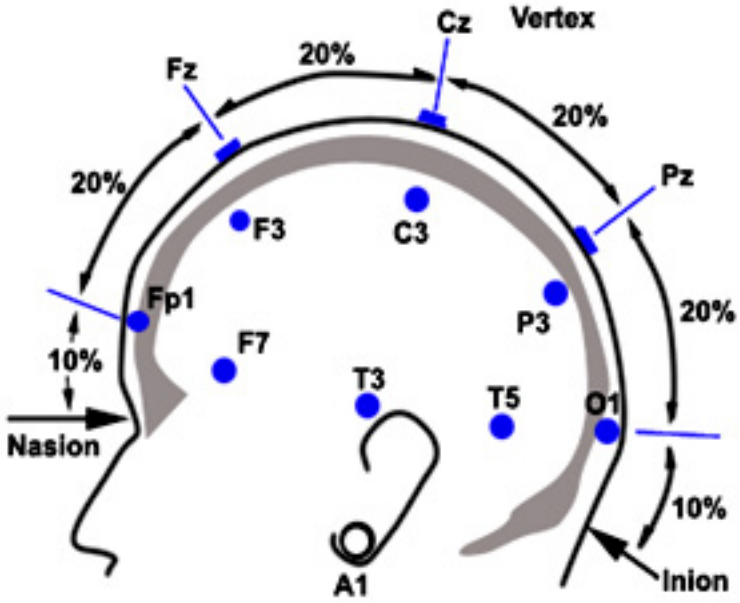

Figure 4. 10/20 System [27]

is referred to as the nasion. The term "inion" refers to a noticeable hump on the back of the head. From the rear side of the head, it is the lowest point.

Polysomnography

Polysomnography (PSG) is also called the sleep study. It is an examination used in the study of sleeps and can be helpful for diagnosis of sleep disorder. The test result obtained is called a polysomnogram abbreviated as PSG.

Polysomnography records the bio-physiological changes that occur while a person is fully asleep. This test is usually performed at night when the person suffering from the sleep disorder is sleeping. The PSG monitors and records the patient's heart rate (ECG), eye movements (EOG), brain waves (EEG), and muscle activity or skeletal muscle activation while they are sleeping at a sleep lab or hospital[15-19].

DISCUSSION AND CONCLUSION

In this paper more discuss about EEG recording and how did the recording and role of EEG signal in diagnosis of sleep disorder. Already introduce the method of diagnosis in my perivious papers**.** This study discusses the use of EEG signals to identify sleep disorders. Its goal is to foster technological innovation in order to produce a reliable and efficient result from sleep disorder diagnosis and differentiation throughout all phases of sleep disorder. I will continue to work on it and communicate with specialists in order to obtain more information that may aid in the diagnosis of sleep disorders. To completely execute the suggested vision, more research and development is required.

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