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RESEARCH ARTICLE
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A STUDY ON EEG CHANGES BEFORE AND AFTER EXAMINATION IN MEDICAL STUDENTS OF PANIPAT, HARYANA.

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Abstract

Background: Medical education is globally recognized as highly stressful, with examination periods significantly intensifying stress levels. Stress can alter brain activity, which can be measured using electroencephalogram (EEG), a non-invasive tool that records spontaneous electrical activity of the brain from the scalp.

Objective: To evaluate the changes in EEG wave patterns in medical students before and after examinations.

Materials and Methods: The study will be conducted in the Neurophysiology laboratory, Department of Physiology, NCMCH, Panipat. A total of 20 medical students aged 18–22 years will be enrolled. EEG recordings will be obtained prior to the commencement of examinations and immediately after their completion. The variations in EEG waveforms will be analyzed to assess stress-related changes in neural activity.

Results: It is expected that EEG recordings will show distinct alterations in brain wave patterns, reflecting increased stress levels before examinations compared to after their completion.

Conclusion: Examination stress significantly affects EEG wave patterns in medical students. Recognition of such changes may help in devising strategies to reduce stress and anxiety, thereby improving academic performance and psychological well-being.

Keywords: EEG, medical students, examination stress, brain waves, academic stress.

Introduction

Electroencephalogram (EEG) is the recording of spontaneous electrical activity in brain and variation in the brain potential taken from the surface of the scalp. This study is designed to evaluate the variations in EEG waves before the commencement of examinations and after completion of the same. Stress is an emotional feeling of being overwhelmed or unable to cope up with emotional, physical, psychological, and mental strain; making you feel frustrated, nervous and angry. Our body releases certain hormones during stress. Cortisol is the primary stress hormone. Catecholamines can also be included in this category. Under normal circumstances, stress leads to activation of hypothalamus-pituitary-adrenal (HPA) axis and releases cortisol that acts on glucocorticoid receptors to exert physiological effects. In hippocampus of the brain, glucocorticoid receptor concentration is high and

it is believed that binding of cortisol to these receptors causes inhibition of HPA axis and reduced stress response. But exposure to stressful events in early life is associated with reduced number of glucocorticoid receptors. So, the feedback inhibition of HPA axis reduced and sustained stress response occurs[1]. The level of stress is getting increased in the students due to heavy syllabus to be completed in limited timeframe, substance abuse and a new environment with inadequate sleep and diet. The youth especially the students are experiencing academic stress which when perceived negatively can cause physical and psychological impairment.

Material and methods

The study was conducted in Neurophysiology lab in the department of Physiology at NCMCH, Panipat and was approved by the institutional ethical committee. The study comprised of 20 medical students from different profs between 18-22 years of age. Both male and female participants were included in the study. Written consent was taken from each subject participating in the study. EEG was done for each subject at two settings in the Neurophysiology lab. First EEG was done before the starting of examinations of the students enrolled in the study and was termed as "pre-exam stress EEG" record. Second, the EEG of each subject was done after the completion of their exams, when there was no stress of the examination and was referred as "post-exam EEG". The changes in EEG waves were analyzed. The electrodes are connected to CRO via amplifier. From higher to lower frequency, the different EEG waves are delta waves, theta waves, alpha waves and beta waves (table 1)[1].

Table 1- Different waves of EEG

EEG waves	Frequency (Hz)	Amplitude (μV)	Mental state
Alpha	8-13	Low	Quiet awake, but relaxed with eyes closed, peacefulness
Beta	13-30	Lowest	Tension, alertness, focused, thinking, sustained attention
Theta	4-7	High	Drowsy, deep, meditation, creativity, dream, feelings, insight
Delta	0.5-4	Highest	Deep sleep, coma

As shown in table 1, each EEG wave has its unique characteristic features and reflects the functions of different areas of brain and neurological system.

Result

A total of 20 students participated in the study. Pre-exam stress EEG showed beta waves in the participants whereas the EEG taken after the examinations were over, showed alpha wave activity.

Discussion

The aim of this study was to find out how stress affects the medical students. It was to emphasize how the exam stress affects their brain waves before the commencement of examination and after completion. In this research work, the changes in the neural activity was reflected by variations in the EEG waves. The results showed that the students were stressed before the starting of their exams as evident by beta wave activity in the pre-exam stress EEG. The presence of beta waves signified that the brain was active, permitting it to focus on the tasks and promote the short term memory[2]. The EEG taken after the exams depicted alpha wave activity showing that the students got relaxed once their exams were over. Students have considered studies and examinations as the key stressors[3]. Examinations have proven to be a common source of stressors among the medical students[4]. EEG monitors the brain waves and presents them in real time on a monitor that provides information about the functions of brain. A study by Jena, proved that the baseline EEG taken when there was no stress of examination showed alpha wave activity whereas the EEG taken during the examination revealed beta wave[5]. In normal day-to-day life, the EEG showed alpha wave activity, as the subjects were mentally relaxed, but when the same subjects were exposed to mild to moderate stress, their attention

was focused in the examination, their alertness improved and anxiety increased that led to the replacement of alpha waves with the beta waves[6,7,8]. Stress can have physiological, psychological and behavioral consequences such as increased risk of anxiety, depression, hypertension, loneliness, insomnia, aggressiveness, frustration, low self-esteem, headaches, cardiac diseases etc[1]. As a result, several stress management measures should be taught to the medical students so that their capacity to cope up with the difficult medical professional course can be increased[9]. In addition, the medical institutions should put efforts to improve the students' connections which may prove to be helpful in decreasing the stress induced by back-to-back examinations, loneliness, social isolation and interpersonal conflicts[10]. The significance of a stressor should be evaluated in each medical school, taking into account the effect of its unique situation[11]. To abstain from such manifestations, certain precautionary emotional well-being might be incorporated as an integral element of routine clinical amenities for the medical students, particularly in their early academic years[12].

Conclusion

Our primary aim of this study was to assess the effect of examination related stress on the EEG waves. For decades, EEG has been an imperative tool to explore the neural mechanisms underlying human psychological activities. In conjugation with above discussion, it can be concluded that during exams, the level of stress gets increased which can be observed while analyzing the changes in the wave pattern of EEG; as medical students have considerable academic stress. Once these changes in EEG waves related with exams are perceived, we can empower the students to take measures to allay the stress and anxiety at the time of examination that can improve their academic performance in future. Medical students are our budding doctors, so they are advised to remain stress-free by opting certain techniques like yoga nidra practice, mediation, exercise, yogic asanas etc.

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