

EEG Analysis for Brainwaves under Closed Eye and Open Eye

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Abstract - Non-linear dimensional complexity estimates and indicating complexity of neuronal computations during open eye and closed eye using 62-channel EEG. When compared to open eye, the closed eye was accompanied by a focused decrease of complexity estimates. Power in the theta-1 (4–6 Hz), theta-2 (6–8 Hz) and alpha-1 (8–10 Hz) frequency bands was increased over these regions. This estimates negatively correlated with theta-2 and alpha-1 and Emotional experience correlated with theta whereas internalized attention with both theta and alpha lower synchronization positively with beta-3 (22–30 Hz) band power.

Key words - EEG, Brainwaves, FFT

INTRODUCTION

In the working brain there may be not only one or two, but a much larger number of cell assemblies oscillating synchronously at different frequencies. The number of cell assemblies activated can be considered as an indicator of complexity of neuronal computations in the brain. The geometrical measure, EEG dimensional complexity, derived from non-linear system theory can calculate the overall complexity of the brain dynamics. Considering the existence of inverse co-relational relationships between complexities estimates an EEG power mainly in lower frequency bands which could predict that meditation would be accompanied by less complex dynamics. Meditation is a state called ‘thoughtless awareness’ or ‘mental silence’ in which the mediator is alert and aware but is free of any unnecessary mental activity and feeling benevolence towards oneself and others. Recent investigation says theta and alpha oscillations defined in narrow frequency bands which are of multi-functional neuronal networks activity.

LITERATURE REVIEW

A wavelet transformation is applied to electroencephalograph (EEG) records from persons under basarika. Correlation dimension, approximate entropy and coherence values are analysed. A model & software is used to keep track on the improvement of the persons mind, aging, balance, flexibility, personnel values, mental values, social values, love, sex, knowledge, weight reduction and body fitness[1]. EEG result shows alpha relative power were significantly higher during prostration in salat when compare with mimic prostration. prostration during salat has remarkable effect to human brain as compared to mimic prostration. The alpha wave indicates relaxing condition in human body though activating of parasympathetic nervous system [2]. . A standard procedure of Zen meditation requiring sustained attention and breath control was employed as the task to provoke Fm theta, and simultaneous EEG recordings were performed. Compared to the control conditions the mean value of the power showed a remarkable increase under the FM theta conditions [3]. Subjective scores Sahaj Yoga of emotional experience significantly correlated with theta whereas scores of internalized attention with both theta and alpha lower synchronization. And the result of this test shows LTM are less emotionalised and more internalised compare with STMS and LTMS are rise to more emotionally positive blissful experience [4]. Dynamically changing inner experience during meditation is better indexed by a combination of non-linear and linear EEG variables [5]. Successful BCI operation requires the user to be possessed of good skill in EEG control. Zen practitioners, well trained in mind-attentiveness focus, have quite different EEG patterns. And the mind-attentiveness focus in Zen meditation might provide a more feasible training scheme for the BCI study [6]. Individual subject experiences of inner light during Zen meditation can be recorded and analysed by using EEGs. The alpha suppressed EEGs similar with eye open pattern are observed which suggests a faster light transmission rate during Zen meditation [7]. The time-frequency analysis of EEG signals for meditation practitioners showed an event-related DE synchronization (ERD) of beta rhythm before imagination during resting state. In addition, a strong event-related synchronization (ERS) of beta rhythm was induced in frequency around 25 Hz during hand motor imagery [8]. Chain meditation practitioners exhibit

longer duration of frontal alpha event microstate, reflecting sustained stability of the brain generators [9]. Meditators have a slower mean frequencies and greater theta alpha power as well as widespread increase in theta and early alpha power and enhanced theta coherence at frontal-central region [10].

METHODOLOGY AND RESULT ANALYSIS

14 subjects were taken for the experiment of EEG test. Among the 14 subjects 8 were male and 6 were female members. Their age was between 20-30 years and average age was 25.5 years. The health condition of each subject was very good.

The subjects were instructed as follows before the EEG was performed. They were told not to consume caffeine before the test. They were told to avoid using hair styling products (hairspray or gel) on the day of the exam.

The subjects were asked to sit in a comfortable chair. To measure the electrical activity in various parts of their brain a 64 channel EEG cap electrodes were attached to their scalps. The generated electrical impulses picked up by the electrodes. To improve the conduction of those impulses to the electrodes, a gel was applied to them by which the electrodes were attached properly on their scalp.

7 subjects were in open eye and rest 7 subjects were in closed eye during the EEG test. The data were recorded for both the groups and then those data were loaded in MATLAB and the plots were found for open eye and closed eye which are shown in figure-1 and figure-2. Then the data were processed for Fast Fourier Transform (FFT) in MATLAB for frequency analysis of both the cases. The FFT of both cases are given in figure-3 and figure-4. At last the EEG signal was decomposed by using MATLAB for both the cases to analyse the waveform of brain to realise the frequency ranges like delta, theta, alpha and beta which are given in fig-5 and fig-6.

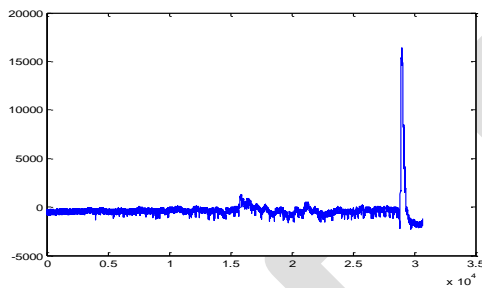


Figure-1 Open eye plot(X- in ms and Y- in mV)

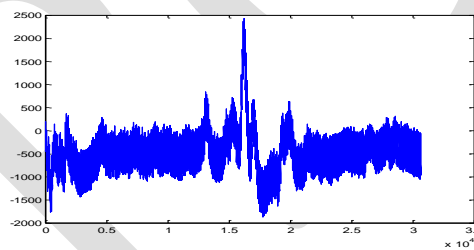


Figure-2 Closed eye plot(X-in ms and Y- in mV)

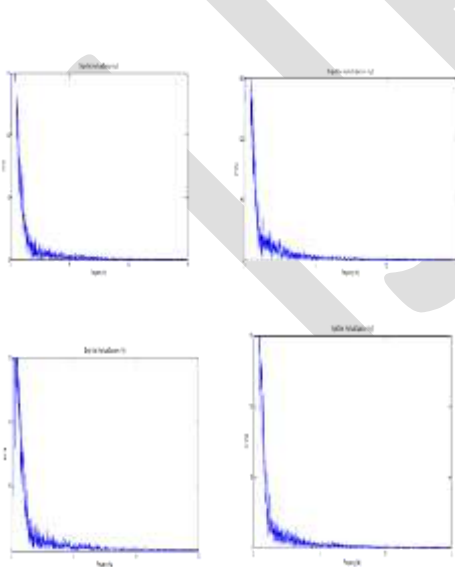


Fig-3 (FFTs of Open eye EEG)

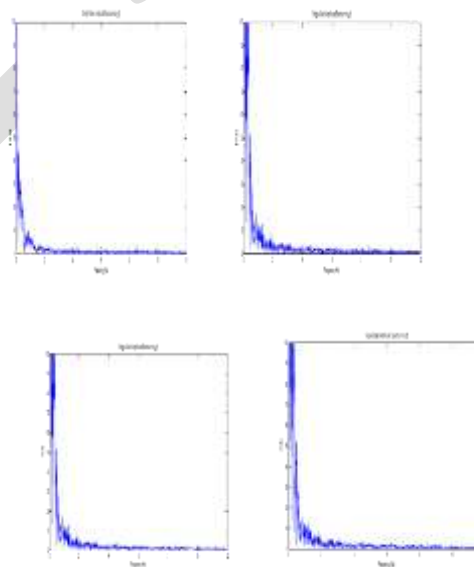


Fig-4 (FFTs of closed eye EEG)

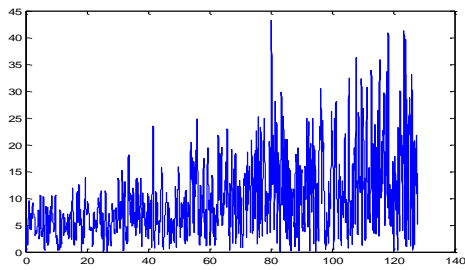


Fig-5 decomposed brain waves for open eye

(X- Frequency in Hz and Y- Time in ms)

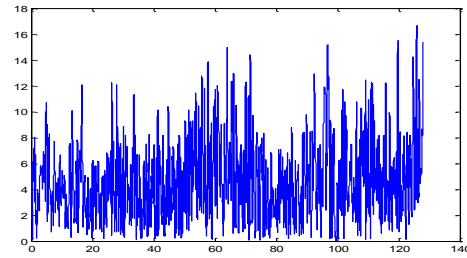


Fig-6 decomposed brain waves for closed eye

(X- Frequency in Hz and Y- Time in ms)

After getting the FFT and decomposed signals of both closed eye and open eye from the EEG data the states of theta alpha and beta for both the cases were compared. This showed more alpha suppressed and beta came in the case of subjects who were in closed eye, when they are compared with the open eye subjects. That means if one will sit in closed eye then that person will feel more happiness and those persons emotions will be more controlled by comparison with the open eye persons. For better understanding of the brain waves, the decomposed signal of both the cases were followed which are given in figure-5 and figure-6. It makes clearly understand that when someone is in closed eye ,then more theta and alpha suppressed signals are observed and the persons with closed eye are mentally more controlled and they are in better happiness in that position by compare with the open eye persons.

CONCLUSIONS

The decomposed signals taken from opened eye and closed eye EEG shows , closed eye decomposed signals are having more theta and alpha suppressed values and hence the persons under closed eye will be feel more peace and happiness and also their emotions will be more controlled by comparison with the open eye persons.

This shows when one is in mentally frustrated mood or in any kind of tension, then he should follow some meditating process by which he can recovered to its normal state soon.

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