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QUANTITATIVE EVALUATION OF EYE OPENING AND CLOSURE WITH TIME VARIATION IN ROUTINE EEG EXAMINATIONS

Tadanori Fukami[1], Takamasa Shimada[2], Fumito Ishikawa[3]
Bunnoshin Ishikawa[3] and Yoichi Saito[4]

[1]Department of Informatics
Yamagata University
4-3-16 Jonan, Yonezawa, Yamagata 992-8510, Japan
fukami@yz.yamagata-u.ac.jp

[2]Department of Information Environment Integration and Design
Tokyo Denki University
2-1200 Muzai-Gakuendai, Inzai, Chiba 270-1355, Japan
shimada@sie.dendai.ac.jp

[3]Hotokukai Utsunomiya Hospital
4-6-34 Yonan, Utsunomiya, Tochigi 320-8521, Japan

[4]The Institute for the EEG Analysis
1-9-1 Nakazato, Kita-ku, Tokyo 114-0015, Japan

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Abstract. *Routine electroencephalography (EEG) is useful for diagnosing and following patients, but individual differences and extraneous factors such as arousal level can complicate the interpretation of EEG data. This study aimed to quantitatively evaluate the degree of enhancement and suppression of alpha waves in the eye opening and closure test. EEG was measured with eyes open and shut three times at 10-second intervals. Frequency analysis of the EEG was performed by Fourier transform, and the amplitude at the alpha peak frequency (8 ∼ 13Hz) was obtained. We calculated a relative statistical value (Z-value) for the two states, allowing normalization of the data to the individual. We then introduced a simple evaluation index derived from the average and standard deviation of Z-values and evaluated our method in data from 120 healthy subjects and 59 patients that were divided into four groups: awake/drowsy and patients/healthy subjects. By using two indices, we recognized a statistically significant difference between the average of the healthy awake group and other groups. We also recognized a significant difference between the standard deviation of the healthy drowsy group and other groups. Therefore, these indices can be used to quantitatively evaluate eye opening and closure in routine EEG examinations.*

Keywords: EEG, Routine examination, Eye opening and closure, Z-value

1. **Introduction.** The acquisition and analysis of electroencephalography (EEG) during photic stimulation, eye opening and closure, hyperventilation, and while the subject is awake or sleeping is routinely done clinically. These EEGs are usually assessed qualitatively and examined by a medical doctor. If no disease is detected, then these data are not examined again. However, the EEG data may contain more information on the state of the subject such as their arousal level, which is not related to a disease. Identifying characteristic parameters can potentially provide new information from routine EEGs. For example, a method for the analysis of EEG photic stimulation response has been proposed [1]. The EEG amplitude incorporates individual differences because it is not a normalized value. The Z-value is obtained by the comparison of EEG signals and