Title: Interpretation of the causes of instability of flash visual evoked potential in intra-operative monitoring and proposal of a recording method for reliable functional monitoring of visual evoked potential using a light-emitting device

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Objective: Effective monitoring and application of visual evoked potential (VEP) during neurosurgery is a major challenge. While many monitoring methods have been effectively utilized, the use of VEP as an objective determination method has not been established. The purpose of this report was to present a method for overcoming this limitation according to the use of a specific stimulus.

Methods: Data analysis was performed in 26 cases of brain surgery, in which two responses were observed by extension of light emission. The waves from the visual cortex were selected from each reaction following the start (termed the on-response) to the end of emission (termed the off-response) with consideration for the characteristics of the potential distribution. The waves were observed to characterize changes resulting from variations in light emission duration and quantity. The results of the analysis were used to determine the optimal emission time and the amount of light for effective use of wave components during monitoring.

Results: Stable and recordable waves were observed by monitoring the off-response consisting of the P1-N1-P2 component, with a wave latency of approximately 100 ms. Since the off-response was correlated with the input, the stable wave derived from the off-response could be adjusted by changing the emission time and light intensity.

Individual differences in the latency of the off-response were decreased by extending the light emission time and reducing the quantity of light. However, it was difficult to achieve stability by adjusting the light intensity and emission time using the on-response. The off-response was confirmed to be sufficiently stable for intra-operative monitoring. Moreover, reduction in the off-response was found to match the optic nerve manipulation during operation. Waves could be used to confirm the recovery with discontinuation of manipulation, and the waves showed a decrease in amplitude and extension of latency due to the artificial limitation of input.

Conclusions: Based on the instability of VEP depending on the emitting stimulus, the off-response was shown to have the capacity to function as a monitoring tool. Recording conditions could be adjusted to achieve a light-emitting time of 500 ms and a light quantity of 8000 Lx. Stable monitoring of VEP using light-emitting stimuli can contribute towards improving surgical outcomes.