Electromyographic Activity and Electro-oculogram Related to Spontaneous Blinks in Patients with Parkinson’s Disease

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Introduction
Spontaneous blinks is occurred by involuntary contraction of m. orbicularis oculi. Although it has been an object of study for a long time to elucidate the relationship between Parkinson’s disease and the frequency of spontaneous blinks, the activities about electromyographic (EMG) of m. orbicularis oculi and electro-oculogram (EOG) related to eyelid movements have not known. In this study of spontaneous blinks, both EMG activities from m. orbicularis oculi which is responsible for initiating closure of the eyelid and EOG activity of vertical direction to the movement of the eyelid are measured in ten patients with Parkinson’s disease and in thirty normal subjects. The aim of this study is to evaluate the generative mechanism of the spontaneous blinks by comparison of both the EMG and the EOG waveforms in the patients with Parkinson’s disease and those in the normal subjects.

Methods
Subjects: The study was carried out on ten patients with Parkinson’s disease and on thirty normal subjects as a control. The patients consisted of four males and six females, of which the youngest was 59 years old and the oldest 74 years old (mean 68 years old). All the patients belonged to stages 1, 3, or 4 in the H-Y grade (Hoehen & Yahr, 1967). Among the ten patients, one patient belonged to stage 1, four patients to stage 3, and five patient to stage 4. The duration of the disease varied from 2 to 34 years (mean 11.9 years). All the patients were treated by antiparkinsonian drugs and physical therapy. The normal subjects consisted of 29 males and one female, aged 22-61 years. The mean and SD of the age of the normal subjects was 30.5±8.3 years old. All subjects had no visual extinction. Glasses or contact lenses were removed during the examination.

Measurement and Analysis: The EMG activity of m. orbicularis oculi was recorded by means of Ag-AgCl surface electrodes with 5 mm in diameter using a bipolar lead system (Kaneko & Sakamoto, 1999). Two electrodes were fixed at 10 mm below the lower eyelid on the left side of m. orbicularis oculi. The inter-distance of the electrodes was 15 mm. The EOG signals were measured to observe movement of the eyelid. For EOG recording, a pair of electrodes was placed at 40 mm below the

Figure 1: Waveforms of EMG and EOG for spontaneous blinks. Five quantities are defined for estimation of spontaneous blinks.
center of the lower eyelid of the left eye and at 35mm above the upper eyelid. The subjects were seated on a chair for the diagnosis and gazed at a fixed point set at 1.5m in front of them in a dimly lit examination room. Spontaneous blinks were recorded for 5 min. The mean duration and the amplitude of both the EMG and the EOG (D1 and A1; D2 and A2) were evaluated by the averaging of ten waveforms for the spontaneous blinks (Figure 1). The time lag (T) between the onset of the generation of the EMG and the onset of the EOG signal was analyzed. The five quantities between the patients and the control were compared.

Results & Discussion
The results are presented in Figure 2. The mean duration of the EMG and the mean amplitude of both the EMG and the EOG in the patients with Parkinson’s disease were shorter and smaller than those in the normal subjects by the significant level of 1%, respectively. There was no difference of the time lag between the subject groups. These results suggest that the function of m. orbicularis oculi for the spontaneous blinks is reduced in patients with Parkinson’s disease. The responsible lesion of the Parkinson’s disease is degenerative changes of the dopaminergic neurons in the substantia nigra pars compacta. Therefore, the abnormal activity of the basal ganglia which consisted of the substantia nigra pars compacta, the striatum, and the globus pallidus caused hypoactive of the motoneurones of the facial nucleus innervating the orbicularis oculi. The reduced values of the amplitude of the EOG indicated that the movement of the eyelid become abnormal in Parkinson’s disease patients. It was considered by our results that the decreased EMG activity of m. orbicularis oculi as a driving force of the closure of eyelid caused the abnormal movement of the eyelid during the spontaneous blinks. Three quantities proposed in the study, which were the duration and the amplitude of the EMG and the EOG were effective indices in the discrimination of Parkinson’s disease patients from normal subjects.

![Figure 2](image)

Figure 2: Mean amplitude and duration (+SD) of EMG and EOG of spontaneous blinks for normal subject (Normal) and Parkinson’s disease patients (PD). ** denote 1% significance, respectively.

References