

Potential Changes and Microvibration Responses in the Eyelid Elicited by Single Flash Stimulation.

Toshiyuki OZAKI* and Yoko KUDO**

*The first Department of Physiology,
Hirosaki University School of Medicine,
Hirosaki, Japan*

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The potential changes and microvibration (MV) responses caused in the upper eyelid by single flash stimulation to both eyes or a single eye were obtained with the summation technique and their physiologic properties were investigated in healthy resting subjects with eyes closed. It seems likely that the lid potentials evoked photically mainly consist of electromyographic components due to the excitation of the orbicularis oculi through photopalpebral reflex and probably electroretinographic component, because of its disappearance in the occluded eyelid. potential; microvibration response; eyelid; flash

It has been described by OZAKI et al (1966) that there are MV responses in human eyelids evoked by flash stimulation. ITOH (1967) reported that photically evoked lid MV responses were so-called retinopalpebral reflex which originated in the orbicularis oculi and appeared bilaterally. It was, furthermore, suggested that photically evoked lid MV responses reflect the activity of the reticular formation. On the other hand, INANAGA and YAMAGUCHI (1969) also reported that there were a close correlation between the potential changes caused in the eyelid as the photopalpebral responses and the level of arousal. However, so far as physiological significance of the lid potential changes portrayed as the photopalpebral reflex (PPR) is concerned, few informations are available. Therefore, the present experiments were undertaken to elucidate the physiologic properties of the lid potential changes elicited photically from standpoint of the generation of them.

The potential changes between the body surface of the right upper eyelid and inside corner of the lower eyelid were recorded by means of

* 尾崎 俊行 ** 工藤 洋子

the same one as an EMG recording technique led by surface electrodes. The microvibration (MV) of the body surface of the left eyelid was also simultaneously recorded by a MV recording technique (OZAKI et al; 1962). In addition, the average potentials and MV responses in the eyelid caused by flash stimulation to both eyes or only one eye were obtained with the digital computer for data processing, Mediac (MC-401, San-ei, Sokki Co., Tokyo), respectively.

In A of Fig. 1 were represented a case of the averaged potential

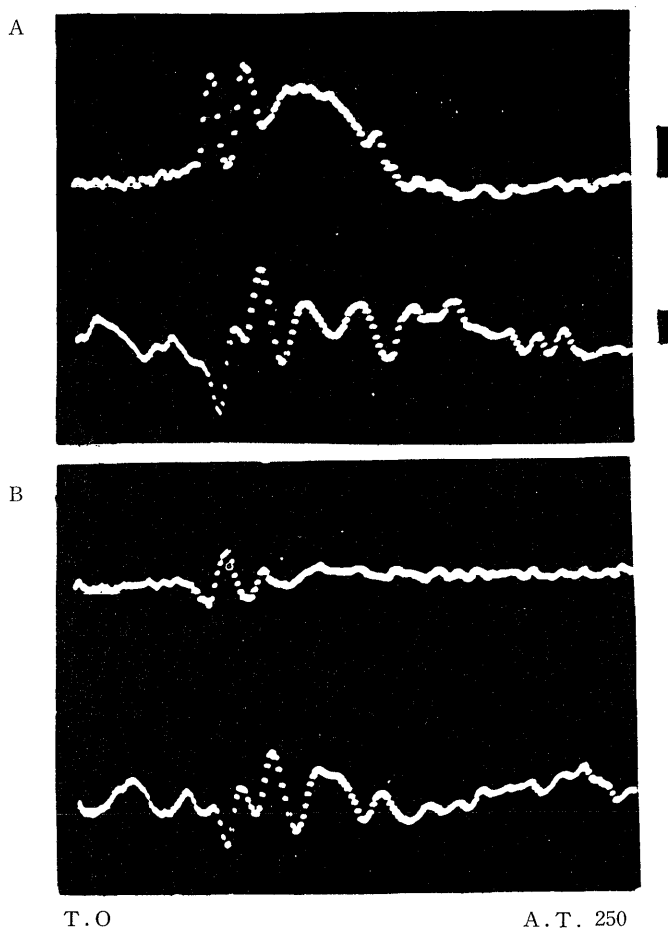


Fig. 1. From above to down: Average lid potential (right lid) and average lid MV response (left lid) caused by flash light delivered randomly to both eyes (A) or only left eye (B) by occluding light to the other eye. In the lid potential evoked photically, upward deflections are positive. Each vertical line of right angle indicates $50 \mu\text{V}$ in the lid potential and 1mV in the lid MV response.

Numbers of summation : 100.

Analysis time : 250 msec.

Note disappearance of the late component of the lid potentials evoked photically in the right eyelid, which was masked by a special occluder to avoid light into the eye.

changes (above) and MV responses (down) in the eyelid caused by flash stimulation to both eyes in waking normal subject with eyes closed. In the averaged potential changes evoked photically, the early rapid components with two peaks and late slow component were recognized markedly. On the other hand, the general properties of the averaged lid MV responses evoked photically were characterized by an initial small downward deflection, following two larger upward one and some slower vibrations, which were caused by the movements of the eyelids. In B of Fig. 1 were shown the averaged potential changes (above) and MV responses (down) in the eyelid caused by flash stimulation to only one eye. In this case the other eye was covered completely by a special occluder of black cloth to avoid light into the eye. In the lid potential changes evoked photically, the early rapid components with two peaks were considerably decreased in amplitude and the late slow component almost disappeared. On the other hand, photically evoked lid MV responses showed the same patterns as those obtained in the case of stimulation to both eyes, although the amplitude of the vibrations was decreased slightly. These results shows that the late slow component of photically evoked lid potentials is not related to the excitation of the orbicularis oculi through so-called PPR, but to probably the slow component of the electroretinogram (ERG), because it disappeared completely in the occluded eyelid.

Accordingly, it seems likely that the potential changes caused in the eyelid by flash stimulation to both eyes are mainly composed of electromyographic components related to the orbicularis oculi and electroretinographic component due to the ERG, which is inadequate as the indicator of the effector activity in the PPR.

REFERENCES

- 1) INANAGA, K. & YAMAGUCHI, E. (1969): The averaged photopalpebral reflex in man. *EEG Clin. Neurophysiol.*, 27, 665.
- 2) ITOH, H. (1967): Photically evoked lid MV response from wakefulness to sleep in man. *J. Physiol. Soc. Jap.* (Jap.), 29, 628~640.
- 3) OZAKI, T., FUJIWARA, K. & ITOH, H. (1966): On the evoked lid MT response to rhythmic flash stimulation. *J. Physiol. Soc. Japan* (Jap.), 28, 241~242.
- 4) OZAKI, T., SATO, K., AWAZU, T., MIMURA, K., HONDA, N., TERAMOTO, S. & KITAZIMA, K. (1962) Some observations on minor tremors related to heart beat. *Jap. J. Physiol.*, 12, 484~493.