Effects of Contact Lens on the Eyeblink Frequency during a Visual Search Task

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EFFECTS OF CONTACT LENS ON THE EYEBLINK FREQUENCY DURING A VISUAL SEARCH TASK[1]

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The effects of wearing of contact lens on the frequency of eyeblinks were investigated by two kinds of visual information processing tasks. The results revealed that the differential effects of eye movements examined in the previous experiment under no contact lens condition were almost all confirmed in the present experiment under contact lens condition. Moreover, wearing of contact lens caused the remarkable increments of eyeblink rates. However, some of contact lens group showed the extremely low frequency of eyeblinkings, compared with no contact lens group, which suggested individual differences in the remarkable diversity in the way of acceptance of this physical load, and a possibility of including voluntary eyeblinkings to some extent.

Key words: eyeblinking, contact lens, visual information processing, eye movement, Bell's phenomenon

The previous study pointed out the differential effects of eye movements on the eyeblink rates (Tada & Iwasaki, 1985). Two of 13 subjects were excluded in that experiment because of the extremely high frequency of eyeblinks of those subjects compared with the residual subjects. It was, we inferred, probably due to the wearing of contact lens. Therefore, the present experiment was conducted to investigate directly the effect of contact lens on the spontaneous eyeblink frequency. In other words, the purpose of this expreriment was to examine the effect of the direct or physical stimulation to the cornea by the contact lens, the irritative stimulation pointed out by Ponder & Kennedy (1927), rather than the other psychological factors.

Method

Subjects: Fourteen undergraduate students (6 males and 8 females) served as subjects, including 2 subjects taking part in previous experiment, and all of them wore the contact lenses. An average age was 19-year old, ranging from 18 to 21-year old,

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and they were naive to this kind of experiments of spontaneous eyeblinks.

Procedure: Tasks, apparatus and procedure were almost identical with the experiment II of the previous study (Tada & Iwasaki, 1985). Eyeblink rates (EBR) detected by the electrooculogram (EOG) were examined between the two kinds of visual information processing performances. The one of tasks was conducted under the no eye movement condition, a kind of simple reaction time paradigm and the other under the eye movement condition, which was contained the horizontal, vertical and oblique, and the upward and downward eye movements.

Results

(1) *Eye movements and EBRs*

The previous findings that was examined the relation between the eye movements and the EBR were almost perfectly confirmed in the present experiment, as shown in Fig. 1, which was illustrated the effects of various forms of eye movements on EBRs. Almost identical frequency distributions of EBRs under each condition were found, except the larger magnitudes of EBRs under contact lens condition than under no contact lens condition.

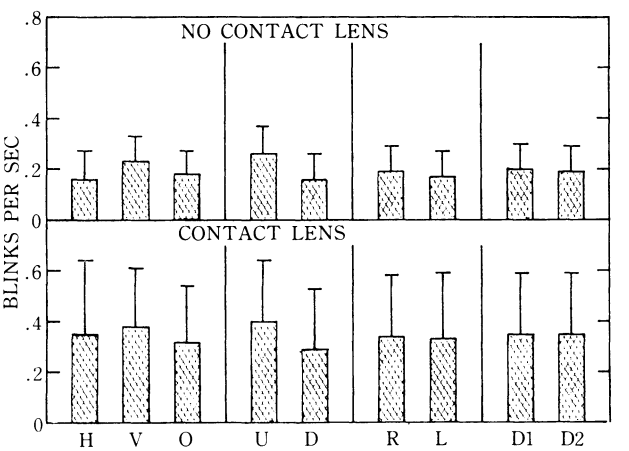

Fig. 1. Comparison of mean eye blink frequency under the various conditions of eye movements between no contact lens and contact lens conditions. Abbreviation: H; Horizontal, V; Vertical, O; Oblique, U; Upward, D; Downward, R; right direction, L; left direction eye movements, D1 and D2; the magnitude of eye movement (D1 is about 25 and D2 is about 50 degree in visual angle, respectively).

(2) *EBRs between contact lens and no contact lens conditions*

Overall mean EBRs between contact lens ($N=14$) and no contact lens conditions ($N=11$) were shown in Fig. 2, which was demonstrated the remarkable differences in EBRs under two conditions. The Cochran-Cox's t test revealed the greater EBRs under the contact lens condition than under the no contact lens condition ($t=2.146$, $df=23$, $p<.05$). It was noteworthy that the greater individual differences was found under the contact lens condition. Standard deviation of each condition was .141 and .264, respectively, and both of maximum and minimum EBRs among totalized 25 subjects were found under contact lens condition (Fig. 3). That is, EBRs under contact lens condition were extreme responses and those under no contact lens were medial responses. This may imply that the physical load of contact lens bring about the greater EBRs and the diversely individual differences in the way of acceptance of that load.

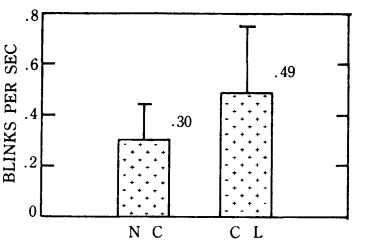

Fig. 2. Differences of mean eyeblink rates (EBR) between contact (CL) and no contact lens (NC) condition. T-shaped lines on each column indicate the standard deviation of each EBR (Blinks Per Sec).

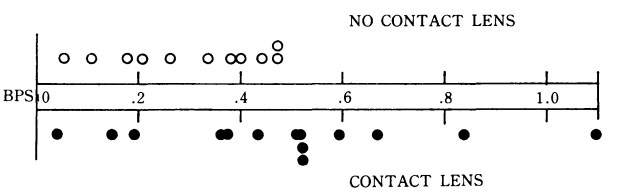

Fig. 3. Differences of scattering of mean eyblink rates (blinks per sec, BPS) between contact lens and no contact lens condition.

(3) *Periods of wearing the contact lens*

In order to examine the effect of chronological length of wearing the contact lens upon the diversely individual difference, correlation between wearing length and EBRs were calculated. However, correlation was not so high ($r=.31$) and there were not so close relation between chronological length and EBR.

(4) *Differential effects of hard and soft lens*

There are two kinds of contact lenses, hard and soft, and there is a possibility that the properties found in the differences among lenses affect the EBRs. In order to

investigate this difference, comparison of the mean EBRs between the two kinds of lenses was conducted (.510 and .424, respectively), but the significant difference between them could not demonstrate ($t = .408$, $df = 11$).

Discussion

The general effects of eye movements on the blink frequency was confirmed in the present experiment as well as the previous experiment (Tada & Iwasaki, 1985). These results will suggest the possible relation to the Bell's phenomenon, the interaction of eyelids and eyeballs.

The most striking result in the present experiment was the effect of contact lenses on blink frequency. Wearing of contact lenses caused the remarkable increments of eyeblink rates on the one hand, and the same time brought about the extremely few blinkings in some subjects on the other hand. The implication of this result will be divided into two ; (1) the diversely individual differences in the way of acceptance of, or coping with this physical load, (2) therefore, these blinkings may be contained voluntary blinkings as well as spontaneous (involuntary) blinkings. That is, subjects with contact lenses tend to facilitate or inhibit their blinkings voluntarily to some extent, on the basis of the way of their coping behavior with wearing of contact lenses. Accordingly, there was found the diversely individual differences and there was not an unitary form of tendency. It should be noteworthy that the contact lens subjects should be excluded from the experiment of this kind dealt with spontaneous blinkings.

References

Ponder, E. & Kennedy, W.P. **1927** On the act of blinking. *Quarterly Journal of Experimental Physiology*, **18**, 89-110.

Tada, H. & Iwasaki, S. **1985** Spontaneous eyeblinkings elicited by the vertical eye movements. *Perceptual and Motor Skills*, **60**, 191-200.

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