

## 회전운동검사에서 전정안구 반사의 변동성

이정준 · 이원상 · 정운교 · 공석철 · 이주형

= Abstract =

### Plasticity of Vestibulo-ocular Reflex in Slow Harmonic Acceleration Test

Jeong Joon Lee, M.D., Won Sang Lee, M.D., Woon Kyo Chung, M.D.,  
Seok Cheol Kong, M.D., Ju Hyoung Lee, M.D.

*Department of Otorhinolaryngology, College of Medicine, Yonsei University, Seoul, Krea*

The results of rotation chair test were known to variable by many parameters such as eye opening and alertness, etc. The situational change in rotation chair test must be considered to interpretation of its result. But in Korea, there were no reports or articles about parameters which influence the result of rotation chair test. So, we assumed that eye opening and alertness were main parameters and took rotation chair test in neurologically normal subjects. For evaluation of the effect of eye-open or eye-closure and alertness on the rotational vestibular stimulation, we have taken sinusoidal harmonic acceleration test in 30 otoneurologically normal subjects. The maximal slow phase eye velocity, gain and asymmetry were obtained and compared with each other in four different conditions with properly fixed conditions such as in darkness and 0.05Hz frequency. At least five minutes interval was given between the tests and recalibrations were done before each tests.

The results of this test were as follows.

1) Vestibular-ocular reflex (VOR) changes according to eye open or closure.

In cases of examinees which were given alerting tasks, larger gain was obtained with eyes opened than with eyes closed, and that was statistically significant ( $p < 0.05$ ).

In cases of examinees which were not given alerting tasks, larger gain was obtained with eyes opened than with eyes closed, but that was not statistically significant ( $p > 0.05$ ).

2) VOR changes according to alertness.

In cases of examinees which opened their eyes, larger gain was obtained with alerting tasks than without alerting tasks, and that was statistically significant ( $p < 0.05$ ).

In cases of examinees which closed their eyes, larger gain was obtained with alerting tasks than without alerting tasks, and that was statistically significant ( $p < 0.05$ ).

3) There was no significant changes of asymmetry according to the conditions.

Therefore, from above results, we recommend the condition in which examinees open their eyes and

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: 1996 8 27  
: 1997 6 25

be given alerting tasks as one of the optimal condition in sinusoidal harmonic acceleration test. (Korean J Otolaryngol 40 : 8, 1997)

**KEY WORDS** : Vestibulo-ocular reflex · Sinusoidal harmonic acceleration test · Eye open or closure · Alertness · Gain.

### 서 론

### 재료 및 방법

#### 1. 대 상

가  
, 1907 Brny가  
1).  
가  
(horizontal semicircular canal)

, , 20 , 30  
18 , 12  
Moore ( )  
가 ) .<sup>4)</sup>

#### 2. 방 법

Mller  
가  
가

<sup>2)</sup> Mizukoshi

<sup>3)</sup>

30 °  
15  
가  
Hortmann (Neckartenzlingen, West  
Germany) PD - S7110 Rotating chair  
Nicolet (Ma-  
dison, Wisconsin, U.S.A.) Nystar Plus software  
0.05Hz (frequency) 120 ° (ampli-  
tude)

가

4가  
(sinusoidal harmonic acceleration test)

가

(calibration),

가

5 가

가 ,

(eye open with attention tasks)

(eye closure with attention tasks)

(eye open without attention tasks)

결 과

(eye closure without attention tasks)

1. 안구의 개폐에 따른 전정안구반사의 변화 (Table 1)

100 3 가 . sec , 33.6 ° /sec, 9.3 ° /  
 2 (cycle) 3 7.9 ° /sec 30.4 ° /sec,  
 (maximum 95%  
 slow phase eye velocity, Vmax), (Gain)  
 (Asy - 26.9 ° /sec, 7.0 ° /sec  
 mmetry) 25.1 ° /sec, 가 7.2 ° /sec

(rotating chair)

Fig. 1

가

(left Vmax)  
 Vmax)

(right

가

$$(Gain) = \frac{V_{max}}{\text{Maximal chair velocity}(60^\circ/\text{sec})}$$

$$(Asymmetry)(\%) =$$

$$\left| \frac{\text{left } V_{max} - \text{right } V_{max}}{\text{left } V_{max} + \text{right } V_{max}} \right| \times 100(\%)$$

0.56, 가 0.16

0.51,

가 0.13

95%

Manova test

0.45,

Pa -

가 0.12

ired t - test

P 0.05

0.42,

가 0.12

Table 1. Change of VOR according to eye open or closure

	With alertness		Without alertness	
	Eye open	Eye closure	Eye open	Eye closure
Vmax( ° /sec)	33.6 ± 9.3*	30.4 ± 7.9	26.9 ± 7.0	25.1 ± 7.2
Gain	0.56 ± 0.16*	0.51 ± 0.13	0.45 ± 0.12	0.42 ± 0.12
Asymmetry(%)	4.7 ± 3.5	5.5 ± 4.6	5.9 ± 3.8	6.0 ± 3.7

(\* : statistically significant)

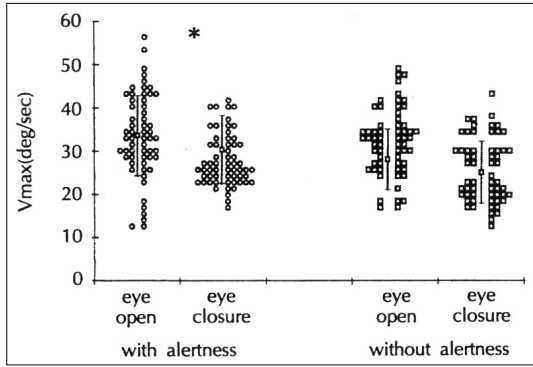


Fig. 1. Change of Vmax according to eye open or closure (\* : p<0.05).

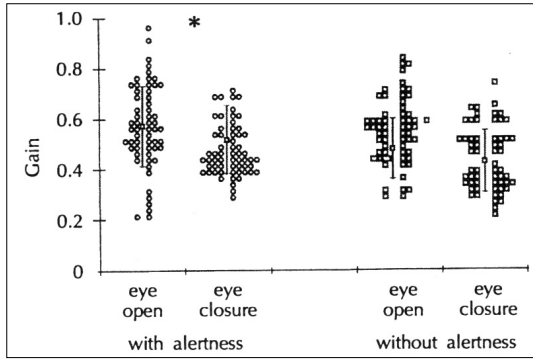


Fig. 2. Change of gain according to eye open or closure (\* : p<0.05).

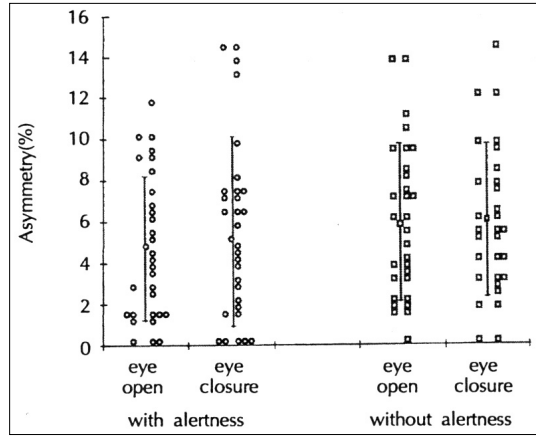


Fig. 3. Change of asymmetry according to eye open or closure (\* : p<0.05).

Fig. 3

가

가

2. 주의 집중 유무에 따른 전정안구반사의 변화 (Table 2)

Fig. 2

가

가

4.7%, 가 3.5%

5.5%, 가 4.6%

5.9%, 가 3.8%

6.0%, 가 3.7%

가

33.6 °/sec,  
 9.3 °/sec ,  
 26.9 °/sec, 7.0 °/sec  
 , 95%  
 30.4 °/sec,  
 7.9 °/sec ,  
 25.1 °/sec, 가 7.2 °/

sec

95%

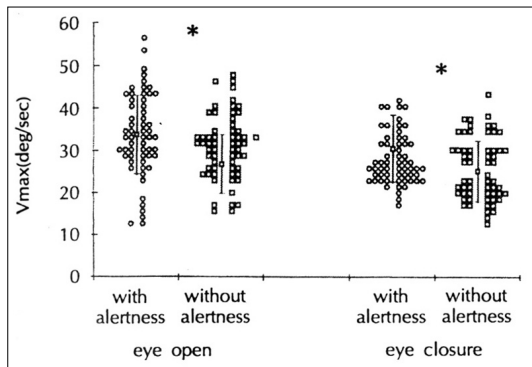
Fig. 4

가

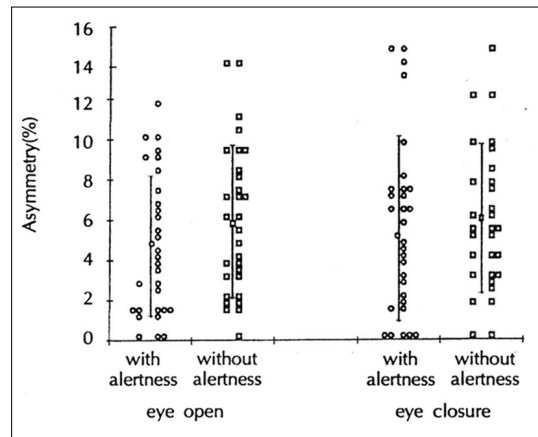
**Table 2.** Change of VOR according to alertness

	Eye open		Eye closure	
	With alertness	Without alertness	With alertness	Without alertness
Vmax (°/sec)	33.6 ± 9.3*	26.9 ± 7.0	30.4 ± 7.9*	25.1 ± 7.2
Gain	0.56 ± 0.16*	0.45 ± 0.12	0.51 ± 0.13*	0.42 ± 0.12
Asymmetry (%)	4.7 ± 3.5	5.9 ± 3.8	5.5 ± 4.6	6.0 ± 3.7

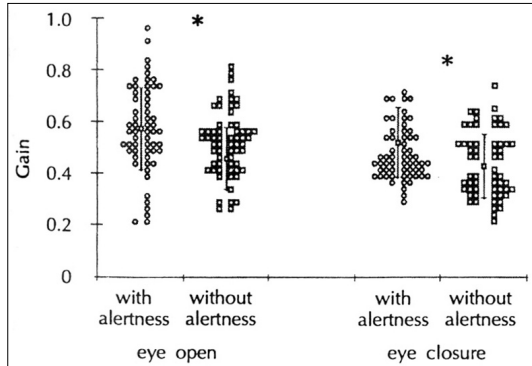
(\* : statistically significant)



**Fig. 4.** Change of Vmax according to alertness (\* : p<0.05).



**Fig. 6.** Change of asymmetry according to alertness (\* : p<0.05).



**Fig. 5.** Change of gain according to alertness (\* : p<0.05).

95%  
 0.51, 가 0.13  
 0.42, 가 0.12  
 95%

Fig. 5

가

가

0.56, 가 0.16

0.45,

4.7%,

가 0.12

가 3.5%

: 40 8 1997

5.9%, 가 3.8% . 가 가 ,  
5.5%, 가 가  
가 4.6% 가 가  
6.0%, 가 3.7% 가  
가

Fig. 6

가 가 , 가 가

### 고 찰

5).

가 가 (active rotation)  
(passive rotation)

6).

(horizontal semicircular canal)  
1Hz  
13). Brny(1907)<sup>1)</sup>가  
Brny's chair 가 가  
Cupulometry<sup>14)</sup> 가 가  
Montandon<sup>15)</sup>  
constant acceleration test

sinusoidal harmonic acceleration test(SHAT)가 가 )  
 가 가 가 23)  
 가 가 가 0.16Hz  
 가 가 가 .  
 Wall<sup>19)</sup> sinusoid, sum of sines, Pseudorandom, Velocity trapezoid 가가 phase lead  
 sinusoid phase lag  
 SHAT가 가 sinusoid phase lead가 ,  
 19) phase lag가 .  
 가 가  
 (Amplitude), 23)24)  
 (Frequency), (Duration) 가 .  
 가 .  
 50 60 ° /sec 25),  
 20), 120 ° 0.05  
 Hz 60 ° /sec 26).  
 0.2Hz  
 (low frequency) 0.2Hz (directional preponderance)  
 (high frequency) 가 가 23) 25).  
 가 가 가 23) 25).  
 1SD(standard deviation, Jenkins)  
 Baloh 17)21)22) ) 22%  
 0.05Hz , 60 ° /sec . 22% 22).  
 가 가 가 ,  
 가 가 가 ,  
 45 가 가 , 1962 Collins  
 가 가 가  
 19) 가 가 27), 1976 Barr 0.3Hz  
 (40 ) 가 가 가  
 (Gain), (Phase), (Asymmetry) 0.65,  
 0.95,  
 0.35  
 (

<sup>28)</sup> Barr  
가

가  
가

<sup>28)</sup> Miller (1990)

가

가 가

가 (pla-  
가

sticity) ,

가

(adaptation) ,

가 (habituation)

<sup>2)</sup> Wall Furman

가

가

### 결 론

가

<sup>20)</sup>

Mizukoshi (1983)

가

<sup>3)</sup>,

가

가

가

가

가

12 20 30 가 18

Miller <sup>2)</sup> Wall Furman<sup>20)</sup>

. Baloh

(SHAT)

가 (deviation)

<sup>29)</sup>,

1. 안구의 개폐에 따라

1) 가 0.56

0.51

(p<0.05).

2) 가

0.45 0.42

가 가 (p>0.05).

3)



가 .

2. 주의 집중 여부에 따라

1) 가 0.56  
0.45  
(p<0.05).

2) 가 0.51  
0.42  
(p<0.05).

3) 가

가 가 가

가

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