

= Abstract =

The Effects of Alcohol on Eye Movement

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This is a study to determine if there is a significant relationship between eye movement and alcohol intake at and below the legal limit of 0.05% blood alcohol concentration(BAC), and to identify the minimal BAC that causes significant change in eye movement.

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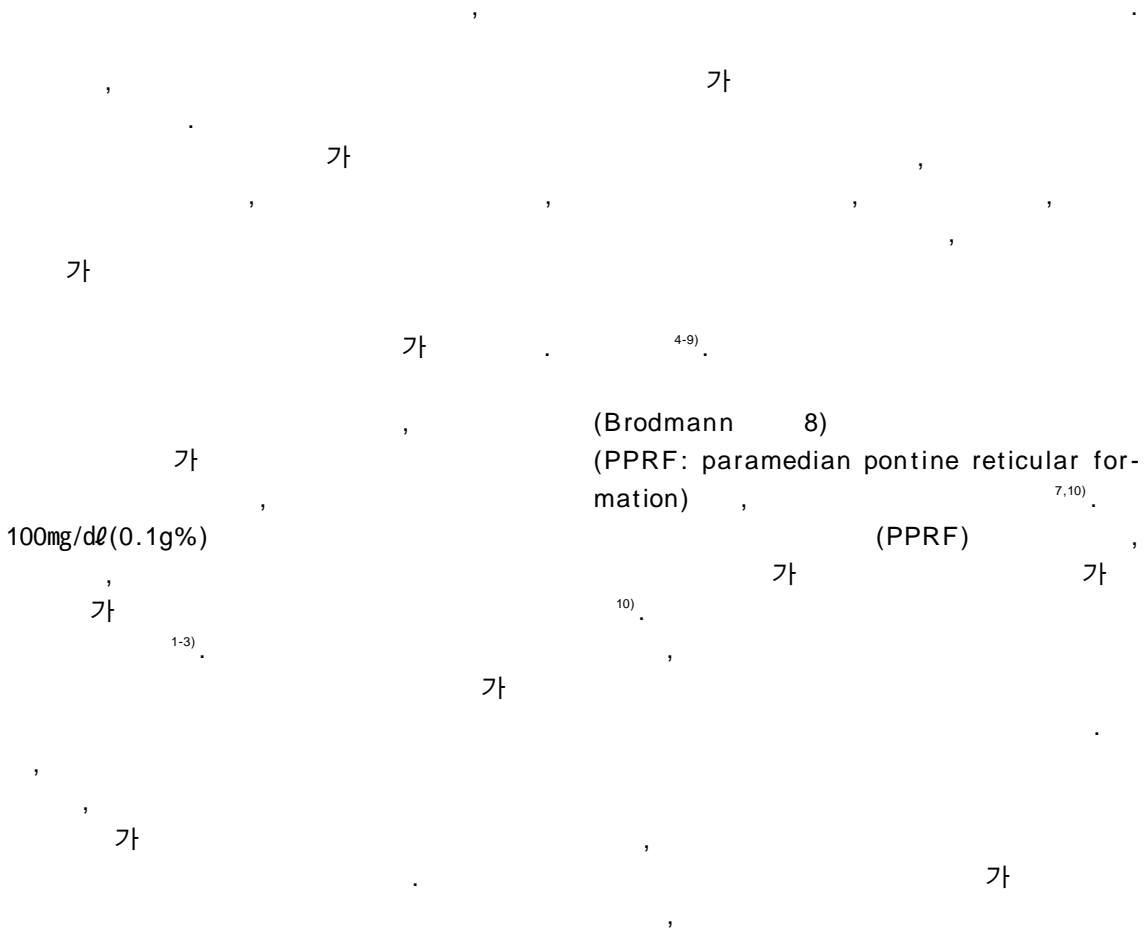
* 1999 82

Twenty healthy males were orally given 0.57g/kg alcohol. After the alcohol intake, the BAC was measured at 10 minute intervals along with measurements of saccadic velocity, latency, and gain of pursuit movement of the eye.

Linear regression analysis between BAC 0.05% and saccadic velocity and latency resulted in correlation coefficients of 0.258 and 0.306 respectively($p < 0.005$), while gain of pursuit movement had no relation to BAC. The latency at 0.05~0.06% BAC interval increased compared with the values before alcohol intake, with statistical significance($p < 0.05$).

Although there existed variations among subjects, a significant functional change of eye movement developed at 0.05% BAC, the legal limit of alcohol. Eye movement is thought to be a valuable indicator of CNS depression by alcohol and prolonged latency of saccadic eye movement by alcohol may be the explanation for increased risk of traffic accidents after alcohol intake(J Korean Ophthalmol Soc 41:215~224, 2000).

Key Words : Alcohol, Blood alcohol concentration, Latency, Pursuit eye movement, Saccadic eye movement



가
가
1.0g/kg
30
가
가
11), 0.1%
가
1.8),
5
가
20
가
26.7±2.5
70.3±4.3kg, 174.2±2.7cm
2.
0.05%
(
가
)
가
가 0.06%
가

가
Widmark
(modified Widmark
equation)^{9,12)}
0.06%
1.
(g) TBW(2.447-0.09516 × +0.1074 ×
+0.3362 ×)/1.052가 , 0.57g/kg
가 0.06% 20
48 , 4
(100% ethanol) 0.57g/kg
(160.6±5.8Ml)
60~80kg, 160~180cm
30 6
3.
가
가

Lion Alcolmeter SD-400(Lion, Barry, Eng-land)

(linearity=0.998, measurement errors compared to a reference signal <0.03%¹⁴⁾; 3%¹⁵⁾).

1000%

4.

25×120cm (light bar)
91cm

ground(common) silver/silver-chloride electrode
skin silver/silver-chloride electrode

2-channel amplifier
(Nicolet Nystar plus system,
Madison, Wisconsin, USA)

(light emitting diode)
0.1×0.25mm

1.0Lux

10.

2.5

40

0.4Hz 20.

40deg/sec

20

200% caliper

1/20mm vernier

40

7

Nystar plus 486 system

(ratio of eye velocity to target velocity: gain)

가 16-18), 20 gain

5.

10

(P20) 20 :

30 60

8,13)

가

30

60 (90)

6.

0.05%

0.01%

(ANOVA: Tukey's Studentized Range(HSD) Test)

가

30 (± : 30.5±10.3)

Table 1. Serial mean blood alcohol concentration, velocity, latency and gain with standard deviation before and after alcohol intake.

Time	Pre*	P20 [#]	After alcohol intake (min)						
			0	10	20	30	40	50	60
BAC (%)	0.000 ±0.000	0.015 ±0.009	0.027 ±0.012	0.038 ±0.013	0.045 ±0.010	0.050 ±0.007	0.049 ±0.007	0.046 ±0.008	0.041 ±0.008
Velocity (deg/sec)	227.0 ±19.7	227.1 ±18.1	216.2 ±20.5	212.8 ±25.7	206.1 ±20.9	208.2 ±25.7	207.4 ±25.6	207.4 ±24.1	209.3 ±28.5
Latency (msec)	184.1 ±25.8	193.0 ±24.9	202.7 ±30.9	208.9 ±34.1	217.0 ±33.0	218.2 ±32.5	208.3 ±26.1	201.4 ±25.7	096.9 ±28.7
Gain	0.92 ±0.18	0.84 ±0.20	0.80 ±0.19	0.77 ±0.22	0.72 ±0.19	0.71 ±0.21	0.72 ±0.19	0.75 ±0.18	0.76 ±0.17

* Pre : pre-alcohol intake state

[#] P20 : 20 min from start of drinking

BAC : Blood alcohol concentration

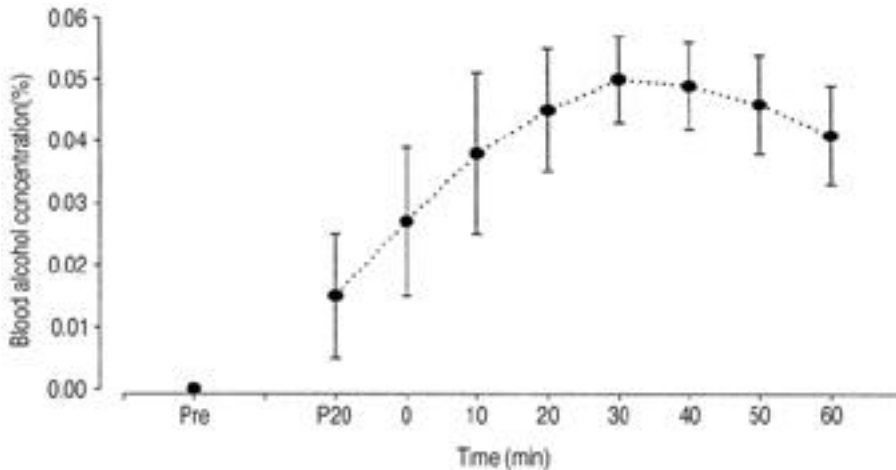


Figure 1. Mean blood alcohol concentration with standard deviation at each test session after oral administration of 0.57g/kg alcohol consumed over 30 min in 20 volunteers. "Pre" and "P20" represent pre-alcohol intake state and 20 min from start of drinking, respectively.

가 30 ((218.2 ± 32.5msec). 가
 60) (0.71 ± 0.21) 가
 0.050 ± 0.007(±)% (Table 30 (Table 1, Fig. 2).
 1, Fig. 1). 가
 0.05%
 , 20 가 0.05%
 (206.1 ± 20.9deg/sec),

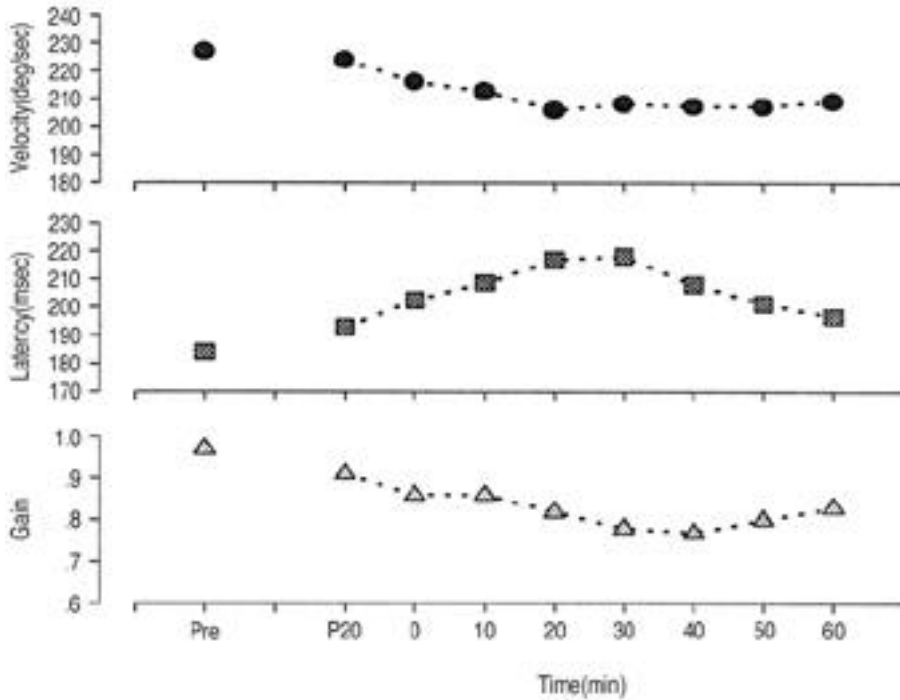


Figure 2. Mean-time course of eye movements after alcohol intake. Each curve represents saccadic velocity, latency and pursuit gain, respectively.

(Fig. 3). , 가
 , 가 0.05~0.06%
 18.4±15.5% 가
 (ANOVA: Tukeys
 Studentized Range(HSD) Test, p=0.014).
 (r) (p)
 r=0.258, p=0.002; r=0.306, p<0.001
 가
 0.01% 0.06
 % 6 ,
 가
 . 0.06% ,
 가
 (3 , 6 , 0.060~0.063%), 가
 (Table 2, Fig. 4).
 가 20
 0.05~0.06%
 8.8±8.4% 가
 (p=0.106).

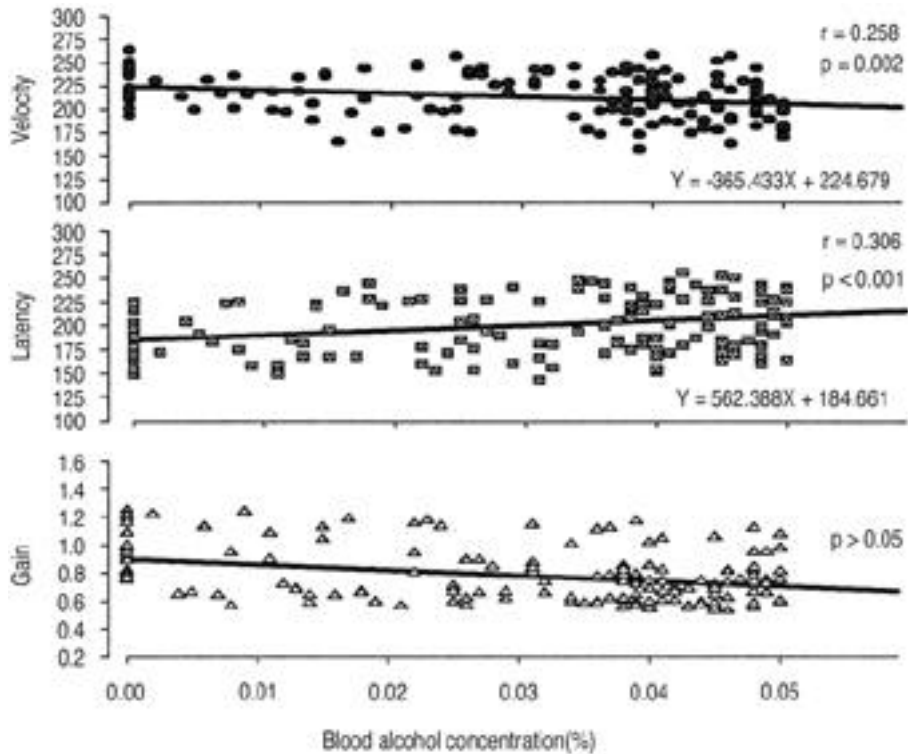


Figure 3. The scatters of velocity, latency and gain, as a function of BAC 0.05% plotted for 20 subjects. Regression line and its equation and correlation coefficient are also shown in the inset.

Table 2. Mean changes of eye movements according to the corresponding BAC.

Eye movement	Blood alcohol concentration(%)												
	0.00	0.00<	<0.01	0.01	<0.02	0.02	<0.03	0.03	<0.04	0.04	<0.05	0.05	<0.06
Velocity (deg/sec)	227.0 ±19.7	218.3 ±13.8	209.4 ±24.0	217.6 ±26.4	215.5 ±20.7	210.9 ±23.0	203.2 ±24.8						
Latency (msec)	184.1 ±25.8	191.8 ±24.4	196.7 ±32.1	197.3 ±30.0	204.8 ±33.8	209.8 ±32.9	213.4* ±26.7						
Gain	0.92 ±0.18	0.88 ±0.28	0.80 ±0.22	0.78 ±0.21	0.78 ±0.20	0.72 ±0.15	0.71 ±0.20						

* : $p < 0.05$

4
48

가

가

2%³⁾,

가

(160Mℓ) 4.5% 1000cc
 6% 800cc, 40% 90Mℓ()

가

가

0.046%

0.063%

가

20 6

REFERENCES

가

가

0.10% 0.08%

16~18%

²¹⁾

National Highway

Traffic Safety Administration

walk-and-turn, one-

leg-stand, walking a straight line, finger to nose test

가

⁹⁾

^{22,23)}

가

가

, 0.05%

가

가

0.05~0.06%

가

0.05%

가

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