Comparison of Muscular Movement following Blood Alcohol Concentrations using Low speed rear impact tests and Dynamic simulation

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Rear-end collision rarely caused fatal accidents rather than head-on collision. However rear-end collision occurred half of traffic accidents with severe injury¹. Recently, relationship between blood alcohol concentrations (BAC) and accident risk has well established in large studies²³. A BAC above 100mg/100ml leads to the risk of involvement a fatal crash by as much as 50 to 90 times³. Despite the harmful effects of alcohol on drivers, there has been little research of rear-end collision after alcohol intake. The aim of this study was to assess the effect of BAC in muscular movement during rear-end collision.

One healthy man (174cm, 75kg) performed rear-end sled test with three conditions, -; normal state (BAC-0%), BAC-0.12% and BAC-0.24%. Impact velocity of rear-end sled test was 10km/h and participant requested to took a seat belt (Fig.1). Participant’s BAC was measured by digital breathe alcohol test machine before rear impact. To measuring participant’s muscular movement, 3D Motion capture system (VICON Motion Systems Ltd, UK) was used. To quantitative analysis, the raw 3D data were imported into the model created in the MD Adams (MSC.Softwaree, USA) of computer software environment with the LifeMOD (LifeModeler, Inc., USA) (Fig.1).

There was significant difference between normal state and high BAC of human muscular movement. The torque of joint and movement of human body were increased following BAC level (Fig.2, 3). It seems to be appeared that the high BAC obstruct prompt reaction of defend movement after rear-end collision, it means that high BAC cause losing control of oneself body⁴. These results indicate that people who have high BAC might suffer more severe injured than sober people¹ at rear-end collision. Therefore we suggest that BAC-correlated is not only affect to driving ability but also affect to extent of injury.

REFERENCES


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Fig1. (a) Posture and maker set of participant. (b) After rear-end collision, analysis of 3D raw data using LifeMOD.

Fig2. Torque of each joints after rear-end collision according to three states.

Fig3. According to blood alcohol concentrations muscular movement of participant’s head at sagittal plane. X and Z means participant’s forehead marker’s coordinates from virtual stating point after rear-end collision according to three states.