

Relationship between Seat Belt Use and Injuries in Single-Vehicle Accidents Caused by Gear Shift Errors

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Traffic accidents caused by unintended driver operations include pedal misapplication accidents as well as accidents resulting from incorrect selector-lever operation in automatic transmission (AT) vehicles. In the previous research, the authors focused on gear-shift errors and analyzed their characteristics using traffic accident statistics. The analysis of hazard perception speed, defined as the speed immediately before a collision, showed that more than 80% of the cases occurred at speeds of 10 km/h or less, indicating that most accidents occurred at low speeds. In addition, in single-vehicle accidents caused by gear-shift errors, 45.3% of the drivers were injured. Some cases resulted in fatal or serious injuries despite the fact that a large proportion of accidents occurred at low speeds.

One possible factor contributing to the severity of drivers' injuries is the low seatbelt use rate at the time of the accident. Therefore, this research analyzed seatbelt use and injury outcomes among drivers involved in single-vehicle accidents caused by gear-shift errors using traffic accident statistics.

Among 132 single-vehicle accidents caused by gear-shift errors between 2019 and 2023, seatbelt use was observed in 92 cases, while no seatbelt use was in 40 cases, indicating a relatively low seatbelt use rate of about 70% (Fig. 1). Drivers with no seatbelt use showed a significantly higher proportion of fatal or serious injuries than drivers with seatbelt use. These results suggest that the low rate of seatbelt use may be one factor increasing injury severity among drivers in single-vehicle accidents caused by gear-shift errors.

Approximately 80% of the accidents involving no seatbelt use occurred at speeds of 10 km/h or less immediately before the collision, indicating that a large proportion of the accidents occurred at low speeds. Even under such low-speed conditions, fatal or serious injuries were observed in approximately half of the cases. Accident frequency was similar between unintended forward driving (e.g., when the vehicle was placed in D range) and unintended reverse driving (e.g., when the vehicle was placed in R range). In detailed classifications of single-vehicle accidents, "single-vehicle accidents—other" accounted for the largest proportion, showing characteristics different from those of overall single-vehicle accidents and pedal misapplication accidents (Fig. 2). In addition, chest injuries were frequently observed in accidents involving no seatbelt use. Severe injuries occurred not only through contact with in-vehicle objects such as the steering wheel but also through contact with external objects or the road surface. Notably, in "fall off" accidents, severe injuries were observed even in cases with seatbelt use.

These results suggest that single-vehicle accidents caused by gear-shift errors often occur in cases with no seatbelt use and frequently involve low speeds. Despite the fact that the speeds were low, drivers may still sustain severe injuries due to the absence of seatbelt use. In some cases, the driver may have had part of the body outside the vehicle or may have been driving with the door open, leading to contact with roadside objects or even ejection from the vehicle during the collision. These characteristics indicate that such accidents differ from other types of traffic accidents. These findings suggest that measures should be implemented to prevent gear-shift errors and seatbelt non-use.

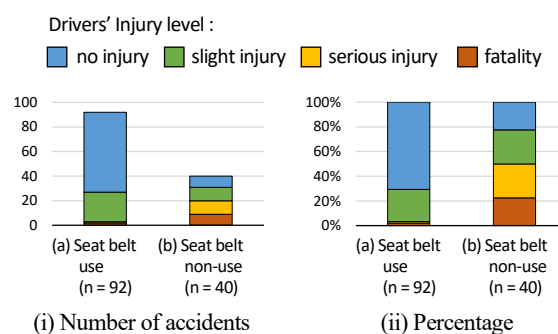


Fig.1 Distribution of single-vehicle accidents due to gear shift error by seat belt use and drivers' injury level

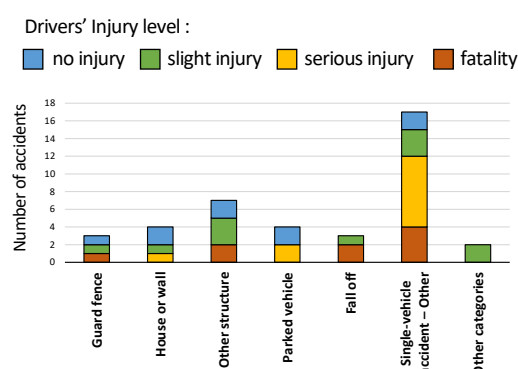


Fig.2 Number of single-vehicle accidents due to gear shift error with seat belt non-use, by accident detail type and drives' injury level (n = 40)