

Dynamic Responses of Female and Male Volunteers in Rear Impacts

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Objectives: Compared to males, females have up to twice the risk of whiplash-associated disorders (WAD) resulting from vehicle crashes. The present study focuses on the differences in the dynamic response corridors of males and females in low-severity rear impacts.

Methods: In this study, analysis of data from volunteer tests of females from previously published data has been performed. Corridors for the average female response were generated based on 12 volunteers exposed to a change of velocity of 4 km/h and 9 volunteers exposed to a change of velocity of 8 km/h. These corridors were compared to corridors for the average male response that were previously generated based on 11 male volunteers exposed to the same test conditions.
 [4 km/h X .62 = 2.5 m/h; 8 km/hr = 5 m/hr]

Results: Comparison between the male and female data showed that the maximum acceleration of the head for the females occurred on average 10 ms earlier and was 29% higher during the 4 km/h test and 12 ms earlier and 9% higher during the 8 km/h test.

THESE AUTHORS ALSO NOTE:

Whiplash "injuries most commonly occur at relatively low changes of velocity (typically <20 km/h) and in impacts from all directions, though rear impacts are the most common in the accident statistics".

"Since the end of the 1960s, epidemiological data have shown that females have a 1.4 to 3 times higher risk of sustaining whiplash injuries than males."

Also, females have 3.1 times higher risk for long-term neck injury/impairment in rear impacts compared to males.

"It is thus well established that females have a larger risk of whiplash injuries resulting from vehicle crashes compared to males."

Males dominate most human volunteer dynamic response whiplash experiments.

METHODS

The volunteers were seated in the front passenger seat of a 1990 Honda Accord LX four-door sedan. The rear of the Honda was struck by the front of a 1981 Volvo

240DL station wagon for the volunteer tests. The Volvo's impact speeds produced speed changes of about 4 and 8 km/h on the Honda. The Honda's passenger seat was locked in the full rear position and the initial seat back angle was set to about 27 degrees from the vertical for all tests. The head restraint was locked in the full-up position. The volunteers were restrained by a lap and shoulder seatbelt and instructed to sit normally in the seat, face forward with their head level, place their hands on their lap, and relax prior to impact. The volunteers knew an impact was imminent but could not predict its exact timing. Each volunteer underwent two tests: one each at a change of velocity of 4 and 8 km/h.

DISCUSSION

"The results of the volunteer tests analyzed in this study showed an earlier and higher peak head x-acceleration for the females compared to the males."

In a 1996 study, 75.6% of adjustable headrests were found to be in the lowest possible position.

This study shows that there are characteristic differences between the response of males and females in a low severity rear impact.

"Females are at higher risk of neck injuries at low-severity impact."

KEY POINTS FROM DAN MURPHY

- 1) Whiplash "injuries most commonly occur at relatively low changes of velocity (typically <20 km/h) and in impacts from all directions, though rear impacts are the most common in the accident statistics."
- 2) Whiplash studies are produced in km/hr. To convert to miles per hour, the conversion factor is .62. Consequently, 4 km/h X .62 = 2.5 m/h; 8 km/hr = 5 m/hr.
- 3) "It is thus well established that females have a larger risk of whiplash injuries resulting from vehicle crashes compared to males." Yet, males dominate most human volunteer dynamic response whiplash experiments.
- 4) "Since the end of the 1960s, epidemiological data have shown that females have a 1.4 to 3 times higher risk of sustaining whiplash injuries than males."
- 5) Comparison between the male and female data showed that the maximum acceleration of the head for the females occurred on average 10 ms earlier and was 29% higher during the 4 km/h test and 12 ms earlier and 9% higher during the 8 km/h test.
- 6) Females have 3.1 times higher risk for long-term neck injury/impairment in rear impacts compared to males.

- 7) In a 1996 study, 75.6% of adjustable headrests were found to be in the lowest possible position.
- 8) This study shows that there are characteristic differences between the response of males and females in a low severity rear impact.
- 9) "Females are at higher risk of neck injuries at low-severity impact."