

## The Role of Gender in Injury Potential

After a brief diversion back to the AMA Guides, I am now on track with my goal to share some of the interesting scientific literature from 2008. This newsletter will review the paper Dynamic Responses of Female and Male Volunteers in Rear Impacts published in the journal Traffic Injury Prevention (December, 2008, Vol. 9, No. 6, pp. 592-599).

In this study, the authors look to identify the mechanism by which woman have twice the risk of men in developing whiplash associated disorder (WAD); a fact that is well established in the published literature. The study focuses on the differences in the dynamic response corridors of males and females in low-severity rear impacts. The authors define low-severity as 2.5-5 mph collisions. This study looked at data from previously published studies and included 21 female subjects (12 @2.5mph, 9 @ 5mph) and 11 males exposed to the same test conditions. Head-to-head restraint contact for the females occurred 14 ms earlier at 2.5mph and 11 ms earlier at 5 mph compared to the males. For the same initial head-to-head restraint distance, head restraint contact occurred 11 and 7 ms earlier for the females than the males at 2.5mph and 5mph, respectively. Furthermore, the calculated Neck Injury Criteria (NIC) values were similar for males and females at 2.5mph, whereas they were lower for females compared to the males at 5mph (3.2 and 4.0  $m^2/s^2$ , respectively). RESULTS: Comparison between the male and female data indicate that the maximum acceleration of the head for the females occurred on average 10 ms earlier and was 29% higher during the 2.5mph test and 12 ms earlier and 9% higher during the 5mph test.

The authors make some other interesting comments:

- “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.”
- 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.”

This study shows that there are characteristic differences between the mechanical response of males and females in a low severity rear impact. The authors make this observation but do not elaborate on possible explanations for this phenomenon. Therefore, I will take the liberty of presenting some thoughts that are considered to be factors when comparing injury potential between the genders. My first thought is that it really has nothing to do with gender at all but with the girth of the neck. Generally speaking, men are larger than woman. As a result, the supportive tissues surrounding the cervical spine are larger as well. This added musculature and tissue thickness add to the overall resistance to external forces.

Another is the general conditioning of men versus women. Despite trends that blur the occupations in which men and woman are employed, the truth is that most heavy labor jobs are still performed by a greater number of men than woman. This occupational tendency for men to have more physically demanding jobs is related to the first point I made about the size of men versus woman. However, the fact that men are potentially more physically fit than woman (from a strength perspective) suggests that the supportive musculature is less vulnerable to injury. This opinion is supported by many papers, one of which was also published last year (The effect of pre-injury physical fitness on the initial severity and recovery from whiplash injury, at six-month follow-up Clinical Rehabilitation April 2008; 22: pp. 364–376).

Of course, the mass of the body is the key factor that I surmise from this paper. Since woman generally have a smaller mass, it takes less force to overcome the bodies stationary momentum. If we recall that Acceleration equals Force divided by Mass it is easy to understand why equal forces acting on a smaller mass will result in greater accelerations. Thus the finding that accelerations and head impact occur earlier and at a greater magnitude is not surprising.

Reviewing literature is exciting for physicians. I have no idea if my literature summaries are appreciated by attorneys. Unless I hear otherwise, I will do a few more literature review newsletters. Please let me know if they interest you and I'll stay on the same path. Otherwise, there are many other non-literature based topics that I think you will find interesting. I can be reached at 860-538-2347 or by email at [Dr.Shaw@ShawChiropractic.com](mailto:Dr.Shaw@ShawChiropractic.com) .