CMR Comprehensive Medical Review

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CASE #96-14673-BAR

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Claimant: Sheronda Williams
Insured: Ernest Jones
Case No.: 9602329
Date of Loss: 7/16/96

CONCLUSION

Sheronda Williams, age 24, attributes head and neck pain to the subject motor vehicle accident. Assuming a "worst case" scenario, we determined that Ms. Williams was reasonably exposed to an average rearward body acceleration of 1.7 *g*, which potentially produced an average inertial head acceleration of 3.4 *g*. These minor accelerations are comparable to the accelerations which are reasonably attendant to some fairly common occurrences, and are generally considered to be well below the threshold for injury causation. Hence, from an objective biomedical perspective, the accident was not consistent with causing physical harm to Ms. Williams.

ACCIDENT DESCRIPTION

An on-site "Ohio Traffic Crash Report" indicates Ms. Williams was the unrestrained driver of a 1993 Pontiac Grand Am SE sedan that was "rear-ended" by a 1996 Jeep Grand Cherokee 4-door wagon. The mishap occurred when the Grand Am stopped suddenly for a traffic signal. The police officer noted that neither vehicle had sustained any damage. Several color photographs show extremely minor cosmetic damage to the Grand Am's rear bumper cover; a repair estimate totaled $221.76, with the entire balance allocated for the labor and paint materials that were necessary to repair and refinish the rear bumper cover. Other photographs depict minor damage to the Cherokee's front bumper assembly. A repair estimate for the Cherokee totaled $149.26; again, the entire

balance was for labor and materials. The accident report indicates that Ms. Williams complained of "head and neck pain" at the scene and was transported by ambulance to an emergency room.

COLLISION ANALYSIS

A collision analysis was performed in accordance with a "worst case" scenario that incorporated the following relevant causation variables and reasonable assumptions specific to this type of accident:

- The curb weight of the 1993 Pontiac Grand Am SE sedan was approxiniately 2,777 pounds.

- The curb weight of the 1996 Jeep Grand Cherokee 4-door wagon was approximately 3,675 pounds.

- According to the on-site accident report, it was clear and the road surface was dry when the mishap occurred at approximately 9:25 a.m.

- The extremely minor cosmetic damage to the Grand Am's rear bumper cover and the slight misalignment of the Cherokee's front bumper assembly correlate with an impact at a very low velocity.

- In accordance with Federal Motor Vehicle Safety Standards, all passenger vehicles that were manufactured after 1982 must be equipped with bumpers which can sustain barrier impacts of 2.5 mph without incurring structural damage. Sport utility vehicles, such as the Jeep Grand Cherokee, are not required to meet these Federal bumper standards.

- The Grand Am's rear bumper assembly contains a plastic honey-comb mesh which dissipates crash energy through deformation of the plastic impact absorber.

- The Cherokee's front bumper assembly is rigidly mounted to the vehicle frame and does not have energy absorbers to dissipate crash energy. As a consequence, this type of bumper typically buckles, fractures, or sustains other deformation from even low velocity impacts.

- When a low velocity impact occurs between an energy absorbing bumper and one that is rigidly mounted, the vehicles lose up to 45% of their kinetic energy (the energy which is available to accelerate the vehicles).

- Based on the vehicle weights, the extremely minor vehicular damage, and data which has been extrapolated from empirical crash tests, we calculated that the Cherokee's closing velocity was 5.5 mph. This parameter is a relative velocity which is defined as the difference between each vehicle's velocity.

- Based on empirical crash test data, we determined that the coefficient of restitution (rebound) was 0.32. In other words, the vehicles separated after the impact at a rate which was approximately equal to 0.32 times the Cherokee's pre-impact velocity.

- We further calculated that the Grand Am underwent an impact-related acceleration of 55 ft/sec^2, which corresponds to a force of approxiniately 1.7 g.

- Studies of rear-end automobile collisions have demonstrated that the interaction between a compliant human body and a semi-rigid seat may cause an occupant of the target vehicle to experience an average inertial head acceleration that is double the vehicle's acceleration. Accordingly, the average acceleration of Ms. Williams' head could have reached **3.4** g.

DISCUSSION AND CONCLUSIONS

Ms. Williams claimed head and neck pain at the scene of her mishap on 7/16/96. The on-site accident report indicates that she was transported by ambulance to an emergency room. Nevertheless, we did not review any medical records and there are no indications that her alleged accident-related symptoms have resolved. In the absence of *objective* evidence that Ms. Williams traumatically contacted a hardened surface or object, we must evaluate whether the injuries she claims were possible from exposure to the g forces which the accident reasonably generated. A g force is an acceleration or deceleration force that acts on a body due to a change in velocity. Variables such as direction, magnitude, duration, rate of onset, and manner of application influence the effect that g forces have upon a vehicle and its occupants. The area over which the forces act and the physical characteristics of the involved tissues are also important in the analysis of motion and injury.

The loading on the human spine from external forces during an automobile accident is usually a Combination of one or more of the following: axial compression, tension, shear, bending, or rotation. Bending loads are almost always present, while the degree of axial, shear, or rotational forces is dependent upon the location and direction of the contact force. 'The potential for spinal injury is proportional to the difference between the relative motions of each section of the neck and spine. When the individual body

components move at different rates, the connecting ligaments and musculature must compensate for the inertial loading differences.

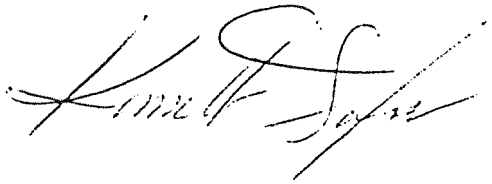
The occupant kinematics of low velocity rear-end impacts are defined by the fundamental laws of physics. Based on Newton's first law of motion that "a body will remain in a state of rest unless an unbalanced external force acts on it," Ms. Williams initially would have been induced backward toward the point of impact initially with respect to her vehicle's interior. Approximately 60 msec after the impact, her body would have had increased contact with her seatback. This contact would have continued to increase for about 260 msec; subsequently, she may have experienced some *minimal* forward rebound away from her compressed seatback. Although Ms. Williams may have been unrestrained at the moment of impact, it is extremely unlikely that she would have experienced significant forward movement after the initial rearward acceleration of 1.7 g. Further, if we assume that she was properly restrained, then any such motion, however unlikely, would have been arrested by her safety belts.

The scientific literature contains numerous studies which can be analogized to the occupant kinematics of this accident. For instance, experimental rear-end crashes at 10 mph with restrained human test subjects produced average resultant rearward and subsequent average forward shoulder excursions of 135 mm (5.31 inches) and 56 mm (2.19 inches), respectively. In some cases, the subjects' shoulders did not move forward past their initial pre-impact positions. These data and the kinematics of the subject accident indicate that Ms. Williams' torso would not have experienced significant rearward or forward accelerations.

When the human torso does move at a different rate than the head, the neck must compensate for the difference in inertial loading. Accordingly, the likelihood of a cervical injury was proportional to the difference between the acceleration of Ms. Williams' head and the acceleration of her torso. Based on the occupant kinematics, we calculated that her head could have experienced an average inertial acceleration of **3.4** g. A g force of this magnitude is comparable to the inertial head loads that are reasonably consistent with some fairly common occurrences. Please refer to the appendix to this report. Reliable scientific research has demonstrated that load levels of much higher magnitude can be experienced without any adverse effects. Thus, we conclude that there was essentially no potential for a cervical injury. Moreover, without significant head accelerations or a direct compartmental impact, there is no reasonable basis by which Ms. Williams can attribute persistent headaches to the mishap on 7/16/96.

In summary, from an objective biomedical perspective, the accident on 7/16/96 was not consistent with harming Ms. Williams.

We reserve the right to reevaluate these conclusions upon receiving any additional information relative to the accident. Thank you for allowing us to be of assistance.



Kenneth Salzer, M.S.B.M.E.
Biomedical Research Analyst

CASE No.: 96-14673-BAR

APPENDIX: ANALYTICAL FRAMEWORK

The purpose of a biomechanical analysis is threefold: First, to reconstruct the vehicle dynamics by conservatively applying the principles of physics and published empirical data to calculate velocity changes, accelerations, and accident-generated forces. Second, to use, this outcome to predict occupant motion and the resultant inertial *g* forces. Third, to assess the likelihood of consequential injury by comparing the *g* forces which were reasonably produced to the injury causing forces that are reported in the literature including those which are generated by normal daily activities.

In a multi-jointed body such as the human skeleton, *g* forces give rise to relative motion between independent body **parts.** If the motion is large or abrupt, conditions such as muscle or ligament tears, spinal cord damage, disc herniations: or significant sprain/strains can occur. Body components experience *g* forces in the course of normal daily activities. **A** comparison of the *g* forces that accompany such activities to those which were reasonably generated by the accident can provide a reliable indication of the likelihood of consequential physical injury.

The successful analysis of a particular accident depends on the availability of useful information (causation variables). When precise quantitative information is unavailable regarding a specific situation, reasonable assumptions must be made. These assumptions generally result in the estimation of a higher *g* load, and facilitate the analysis of a "worst case" scenario.