January 1, 2021

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RE: *Pl1FirstName Pl1LastName; Pl2FirstName Pl1LastName; The Ugly One Ugly Last Name et al. v SampleCaseDefendantName et al., Case No: CaseNoSample, SampleCourtName*

Date of Crash: January 1, 2020

Date of Birth: *Pl1FirstName Pl1LastName:* January 1, 1999 [20 years old at time of crash]

*Pl2FirstName Pl1LastName:* January 2, 1990 [29 years old at time of crash]

*The Ugly One Ugly Last Name:* January 4, 1994 [25 years old at time of crash]

At the time of the crash,

The driver’s-side impact would have resulted in the PlCarMake’s occupants to initially move to the left and somewhat forward at 10 mph, until Ms. and Mr. Pl1LastName and Mx. Ugly Last Name struck the center console and passenger door with their lower extremities and were restrained by their seatbelts which would have caused their heads to continue to accelerate left and forward and create high bending loads on the joints and disks of their necks, combined with sudden muscular protective forces which would have produced high levels of compression on the spinal disks in the neck and back.[[1]](#footnote-1) Per their description, Ms. and Mr. Pl1LastName and Mx. Ugly Last Name then rebounded back to their right and struck the passenger side door and window. This all would have taken less time than it takes to blink an eye (around 250 msecs).

Although a 10 mph side impact collision does not sound like a particularly severe crash, such collisions have the potential to produce relatively violent occupant movements. This fact is illustrated in the photographic stills on the following pages, which show the sequential occupant kinematics of a healthy crash test volunteer undergoing a 3.1 mph far-side impact delta V, with forces that are around 40% of the subject crash.[[2]](#footnote-2)



Figure 1: The bullet vehicle is approaching at 7.5 mph.



Figure 3: The target vehicle is starting to rotate, and the center of mass of the vehicle is accelerated to 3.1 mph (this is the delta V). The occupant begins to move to the right, relative to the vehicle interior.



Figure 4: The occupant’s head and torso flexes violently to the right as the vehicle continues to rotate from under her.



Figure 5: Inertial forces on the occupant’s head and torso continue to cause flexion to the right as the vehicle continues to rotate, with the impact to final frame above occurring over approximately 1/5th of a second. The subject experiences compression, rotation, and shear in the low back and neck.

*Discussion*

The types of spinal injuries that Ms. and Mr. Pl1LastName and Mx. Ugly Last Name was diagnosed with (primarily symptomatic disk derangements and associated sequelae) are highly consistent with the injury mechanism of the crash. Traumatic loading of the spine that results in axial (up and down) compression, particularly in combination with the other load types occurring with the subject collision, has the potential to damage the peripheral disk annulus, which surrounds and holds in the disk nucleus. Women in their early 3rd decade, like Ms. and Mr. Pl1LastName and Mx. Ugly Last Name (who was 12 at the time of the crash) typically have d age-related degenerative changes of the disks of the spine, a fact that makes the collision more likely to have "converted" at least some asymptomatic disk degeneration to a symptomatic state, rather than being the sole cause of all of the pathology identified in the post-crash imaging.

The symptoms of spinal disk injury may, in some cases, be instantly recognizable after a traffic crash because of the sudden onset of radiculopathy, but recent research has demonstrated that only about 1 in 17 cervical disk injuries are recognized as such in the ED after a crash.[[3]](#footnote-3) By far, the majority (94%) of what are later determined to be spinal disk injuries are initially diagnosed as in the ED as spinal strains.

Although the subject crash was no "bumper tap" it is well established in biomechanics, medicine, and epidemiology that an excessive level of force is not required to cause symptomatic injury to a spinal disk with any degree of degeneration, and that in most cases, the diagnostic imaging of the disk will not reveal whether related symptoms are of a traumatic origin or not, in the absence of fracture.[[4]](#footnote-4) Traumatic disk injuries have been described in the peer-reviewed literature as resulting from low to moderate force events, including minimal or no damage traffic crashes, roller coaster rides, and even more mild forces such as sneezing.[[5]](#footnote-5)-[[6]](#footnote-6)[[7]](#footnote-7)[[8]](#footnote-8)[[9]](#footnote-9)[[10]](#footnote-10)[[11]](#footnote-11) It is accurate to state, both from a biomechanical and epidemiological perspective, that there is no established or generally accepted lower force threshold at which it can be said that an acute intervertebral disk injury in any part of the spine cannot occur, and that the load threshold at which individual’s disk may injured is only known after the injury has occurred, and the external load has been estimated. it is impossible to estimate the additional compression due to internal forces, however, and the precise load associated with a temporally proximate spinal disk injury is often impossible to accurately determine after the fact.

Based on the preceding discussion there was ample and biomechanically appropriate force exerted on Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s body in the subject collision to have caused their medically documented injuries, and associated need for evaluation and treatment, including their spinal pain management procedures and cervical spine surgery.

1. Adams M et al. Biomechanics of back pain. London, UK, Churchill Livingstone, 2012. [↑](#footnote-ref-1)
2. I was involved with the experimental protocols associated with the crash testing depicted in the proceding stills and can authenticate the results. [↑](#footnote-ref-2)
3. Freeman MD, Leith WM. Estimating the number of traffic crash-related cervical spine injuries in the United States; an analysis and comparison of national crash and hospital data. Accident Analysis and Prevention 2020: doi:https://doi.org/10.1016/j.aap.2020.105571. [↑](#footnote-ref-3)
4. Fardon et al. Lumbar disc nomenclature: version 2.0: Recommendations of the combined task forces of the North American Spine Society, the American Society of Spine Radiology and the American Society of Neuroradiology. Spine J. 2014;14(11):2525-45. [↑](#footnote-ref-4)
5. Giuliano et al. The use of flexion and extension MR in the evaluation of cervical spine trauma: initial experience in 100 trauma patients compared with 100 normal subjects. Emerg Radiol. 2002;9(5):249-53. [↑](#footnote-ref-5)
6. Freeman et al. Significant spinal injury resulting from low-level accelerations: A case series of roller coaster injuries. Arch Phys Med Rehab 2005;86:2126-30. [↑](#footnote-ref-6)
7. Lutz et al. CT myelography of a fragment of a lumbar disk sequestered posterior to the thecal sac. Am J Neuroradiol 1990;11(3):610-1. [↑](#footnote-ref-7)
8. Sadanand et al. Sudden quadriplegia after acute cervical disc herniation. Can J Neurol Sci 2005;32(3):356-8. [↑](#footnote-ref-8)
9. Pappas et al. Outcome analysis in 654 surgically treated lumbar disc herniations. Neurosurgery 1992;30(6):862–6. [↑](#footnote-ref-9)
10. Smith J. An analysis of 72 real world impacts - an initial investigation into injury and complaint factors. SAE Technical Paper 1999-01-0640. [↑](#footnote-ref-10)
11. Freeman MD. Medicolegal causation analysis of a lumbar spine fracture following a low speed rear impact traffic crash. J Case Rep Prac 2015; 3(2): 23-9. [↑](#footnote-ref-11)