The rear impact would have resulted in Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s torso and head initially being thrown rearwards into the seatback at around 5-6 mph, and then rebounding forward into the restraining seat belt and toward the steering wheel. Ms. and Mr. Pl1LastName and Mx. Ugly Last Name would have sustained substantial complex loads on their spine in the collision, loads that include compression, rotation, and shear all occurring at the same time and to varying degrees in less time than it takes to blink an eye (around 250 msecs). The load on their left shoulder, when it was restrained by the shoulder belt, would have likely exceeded several hundred lbs. The peak cervical, thoracic, and lumbar spinal disk loads could have ranged from 150 to 400 or more lbs., respectively, more than sufficient to cause a wide range of musculoligamentous and skeletal injuries.

While a 5-6 mph rear impact collision may not sound like a very significant event, such collisions can result in surprisingly violent occupant movement. This concept is more easily understood from a series of video still shots, reproduced below, from a rear impact collision crash test conducted at 5.2 mph delta V (the same as estimated for the subject crash), and resulting in no vehicle damage. The occupant depicted in the test sustained a measured 12.5 g of peak head acceleration:

The stills were part of a peer-reviewed research publication that I co-authored, which I will make available for demonstrative purposes upon request.[[1]](#footnote-1),[[2]](#footnote-2)

The crash testing and epidemiologic literature provides good information regarding the forces associated with a 5-6 mph rear impact delta V crash, which can be quite substantial. A recently published analysis of the world literature on the topic demonstrated the distribution of body accelerations and injury risks illustrated in the charts below:

The types of shoulder and spinal injuries that Ms. and Mr. Pl1LastName and Mx. Ugly Last Name was diagnosed with (a SLAP lesion and cervical and thoracic disk derangements) are consistent with the injury mechanism of the crash. The sheer forces exerted on Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s left shoulder by the shoulder belt (or possibly transmitted by transferred forces through Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s grip on the steering wheel), would have had the potential to cause the SLAP lesion diagnosed by Dr. Cooper. This is one of the reasons that the American Academy of Orthopedic Surgeons lists traffic crashes prominently as one of the causes of SLAP lesions, along with falls, sports involving overhead movement, and dislocations. The risk of SLAP lesions is closely associated with age, and men in Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s age group are at nearly 3 times the risk of the injury as men in their 20’s, regardless of activity. This is due to the normal wear and tear-related degenerative changes that occur in the shoulder over time, which has the tendency to make the shoulder more susceptible to injury in the event of a sudden traumatic load. There is no lower threshold of crash force for causing a SLAP lesion; any force that could cause a strain could also potentially cause a SLAP lesion, as the same structures are loaded regardless of the diagnosis. A study of rear impact crashes with an average delta V of 4 mph reported that around 1 in 10 subjects had persisting symptoms and diagnosis of shoulder injury at 5 or more weeks post-crash.

The types of spinal injuries that Ms. and Mr. Pl1LastName and Mx. Ugly Last Name was diagnosed with (primarily symptomatic disk derangements in the neck and middle back) are highly consistent with the injury mechanism of the crash as well. 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. Men in their 2th decade like Ms. and Mr. Pl1LastName and Mx. Ugly Last Name typically have d age-related degenerative changes of the disks of the spine, a factor that increases the risk of injury in the event of the crash like the subject rear impact.

Although the subject crash was no mere "bumper tap", traumatic spinal disk injuries do not require excessive levels of force. 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.[[3]](#footnote-3)-[[4]](#footnote-4)[[5]](#footnote-5)[[6]](#footnote-6)[[7]](#footnote-7)[[8]](#footnote-8)[[9]](#footnote-9) It is accurate to state 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.

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 left shoulder SLAP repair surgery, etc.

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2. Croft AC, Herring P, Freeman MD, Haneline MT: The neck injury criterion (NIC): future considerations. Accid Anal Prev 2002;34(2):247-55 [↑](#footnote-ref-2)
3. 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-3)
4. 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-4)
5. 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-5)
6. Sadanand et al. Sudden quadriplegia after acute cervical disc herniation. Can J Neurol Sci 2005;32(3):356-8. [↑](#footnote-ref-6)
7. Pappas et al. Outcome analysis in 654 surgically treated lumbar disc herniations. Neurosurgery 1992;30(6):862–6. [↑](#footnote-ref-7)
8. 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-8)
9. 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-9)