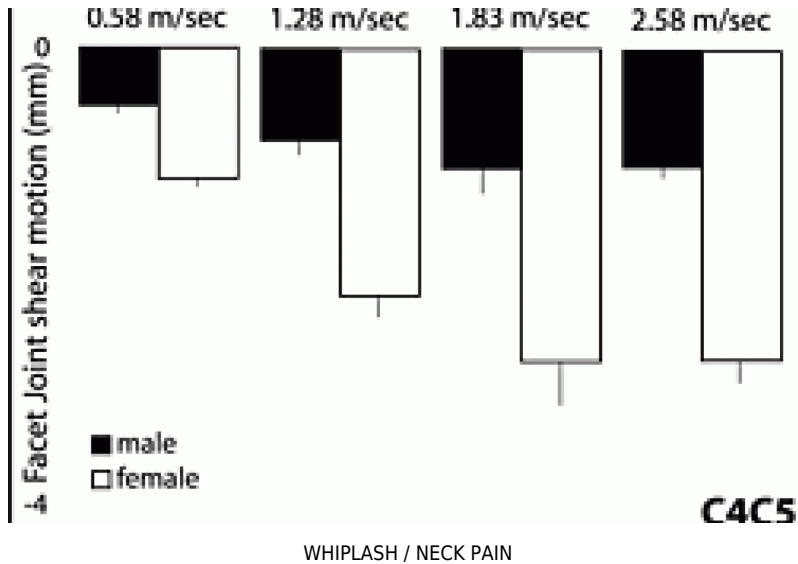
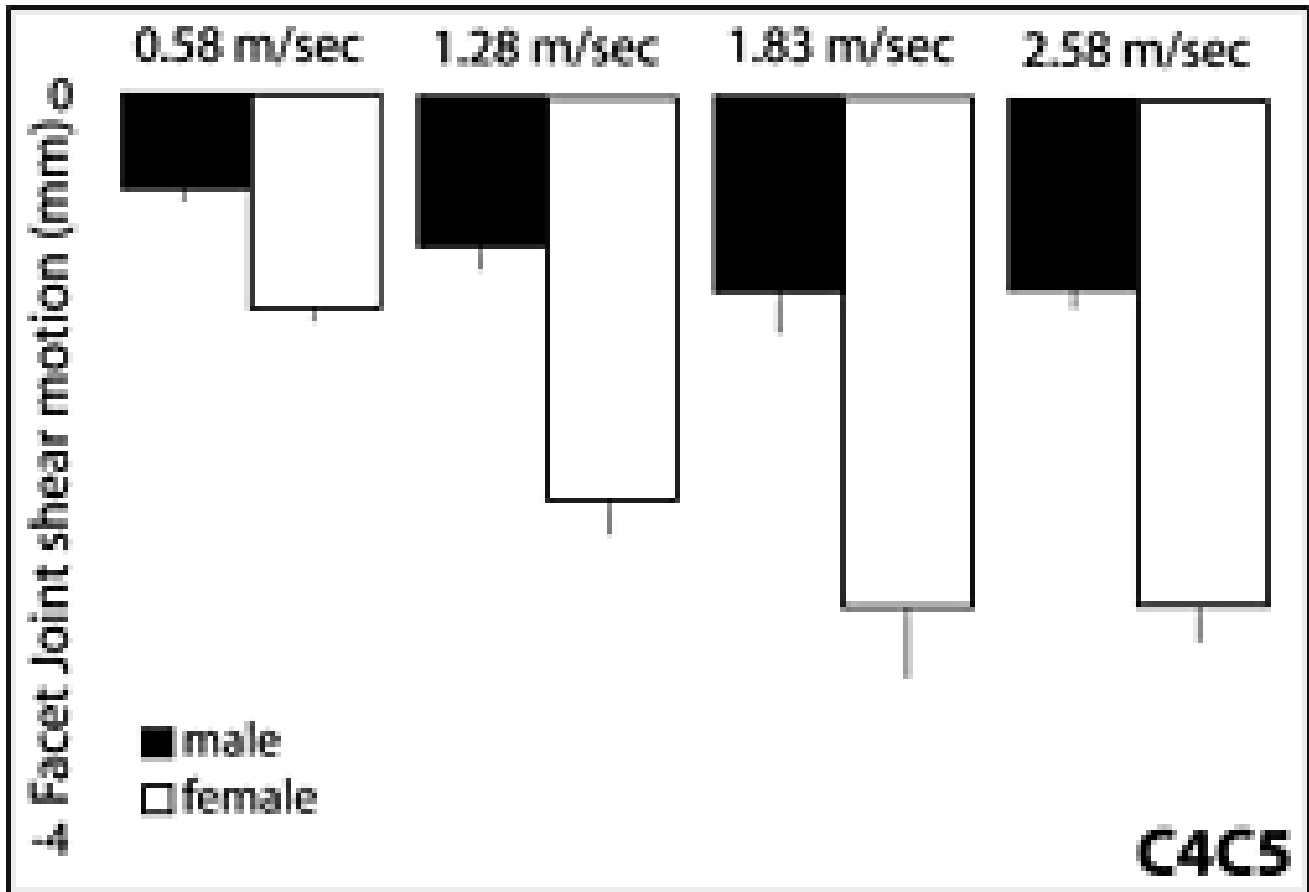


Dynamic Chiropractic



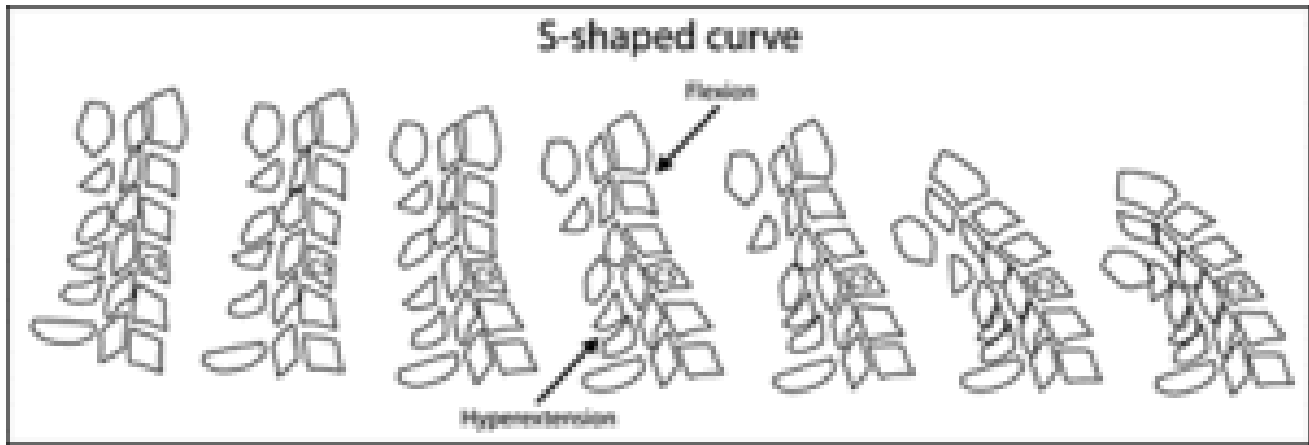
Women More at Risk for Injury and Chronicity in Low-Speed, Rear-Impact Collisions (LoSRIC)

Female occupants sustain a greater percentage of cervical acceleration-deceleration (CAD) injuries in LoSRIC than men, by a ratio of approximately 2:1. In addition, females also are more likely to suffer from chronic symptoms following a CAD injury.¹ A recent study² investigated the differences in injury risk potential to female cervical spines; the researchers found that female necks sustain greater motion in the lower cervical facet joints, and concluded, "This population is more likely to be injured under whiplash loading." Specifically, the facet joints at C4-C5 and C5-C6 experienced the greatest amount of damaging motion.



Once injured, women are between 2.0 and 2.3 times more likely than males to have chronic symptoms than men.³ Fortunately, those who visit a chiropractic physician early following an injury may have better outcomes than those who wait longer for evaluation and treatment.⁴

S-Shaped Curve: In LoSRIC collisions, it has been accepted for years^{5,6,7,8} that the cervical spine initially assumes an S-shaped configuration, with hyperextension at the lower cervical spine levels, and hyperflexion at the upper levels; followed by a C-shaped configuration with the neck in hyperflexion - what is called the rebound phase. This has been reproduced consistently in the literature, and researchers have concluded that horizontal accelerations as low as 3.5-5.0g can cause injury to the lower cervical spine.^{9,10,11}

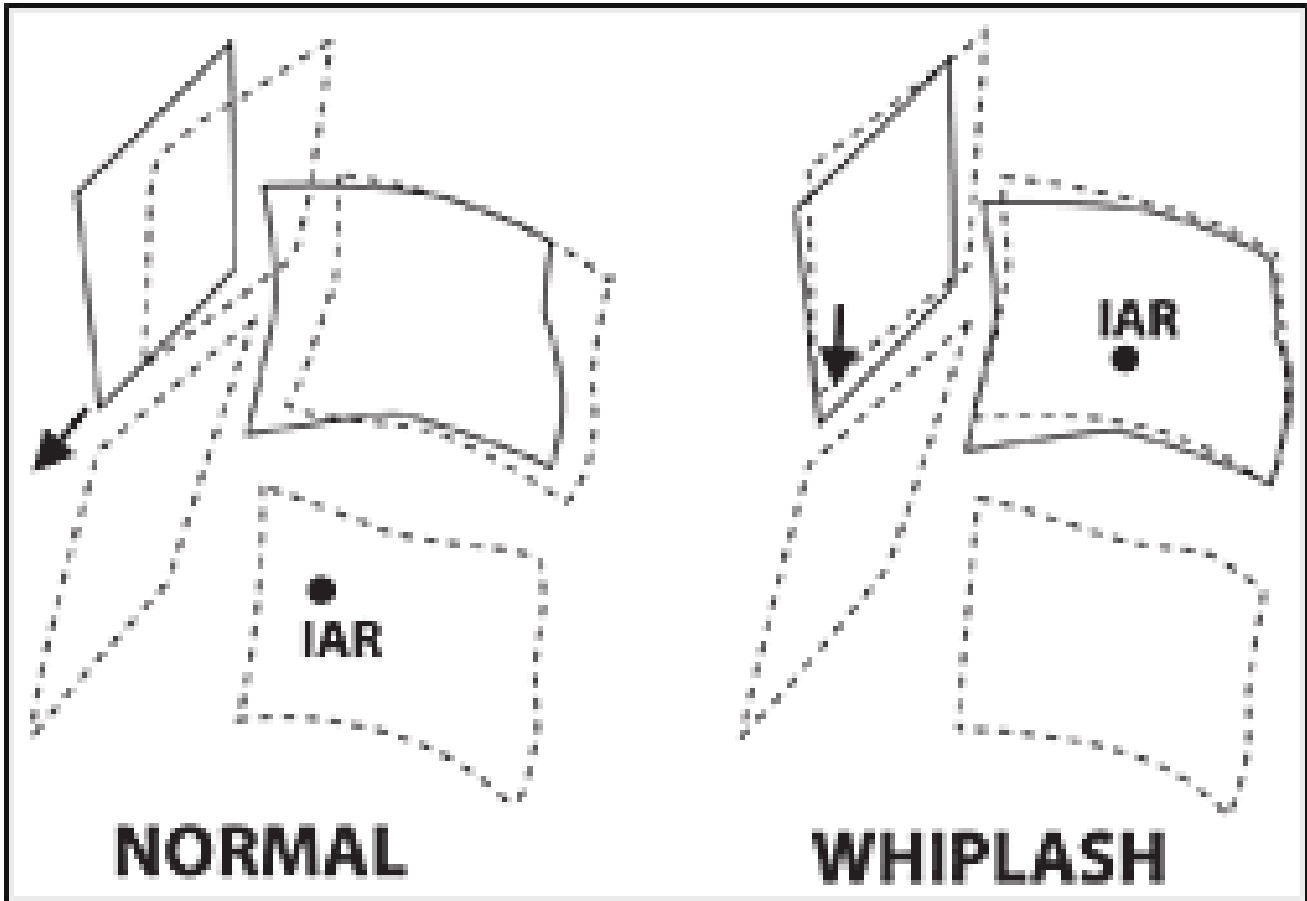


In the anterior part of the facet joint, the injury mechanism appears to be a combination of both shear and distraction, which can lead to a tensile failure of the supporting structures. In the posterior portion of the joint complex, it appears to be a combination of shear and compression.¹² This compression mechanism is likened to a chiseling of the inferior facet due to a change in the instantaneous axis of rotation.

This chiseling effect stems from a pinching of the joint capsule, synovial fold, or even bone-on-bone contusions between the facet articular processes. Females were found to be more likely to be injured due to their total motion being much greater than that of men, as well as proposed anatomic, hormonal and genetic differences. Excessive stretch leads to tissue failure, and excess intervertebral motion is clinically associated with instability, injury and chronicity of symptoms.

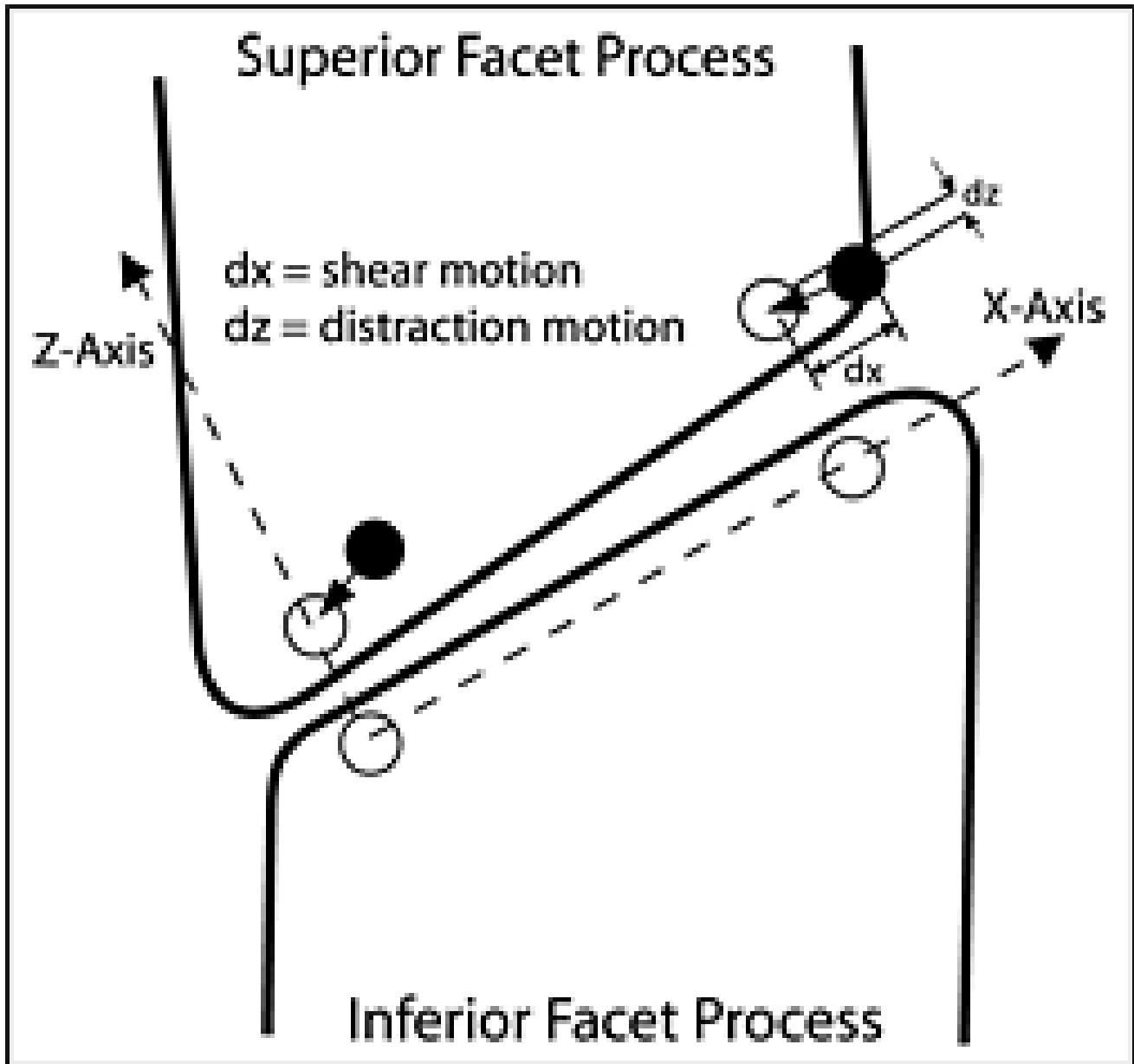
The cervical facet joints have been found to be richly innervated.¹³ Subsequent crushing of the synovial fold between the two facet processes has been proposed as one mechanism of nociceptive insult. Subcortical bone also is well-innervated, and because cartilage does not cover the entire facet joint, bone-on-bone contact between adjacent segments has been proposed as a mechanism of injury.

In females, the posterior portion of the joint, bone-on-bone contact between adjacent segments has been proposed as a mechanism of injury. In females, the posterior portion of the joint has even less protective cartilage than in men.¹⁴ Facet joint pain is the single most common basis for chronic neck pain after CAD injury.¹⁵ Injury to the lower cervical facet joints induces posterior neck and shoulder pain, which happen to be two and three most common symptoms in LoSRIC¹⁶ (headache being the other).



Researchers have hypothesized that the injury potential is highest early, during the S-shaped phase, and that the structures most likely to be injured are the anterior longitudinal ligament, intervertebral disc and facet joint in both the S-shaped and C-shaped phase. Movements exceeding physiological levels for the cervical intervertebral disc have been observed as low as 3.5g LoSRIC crashes. These proposed mechanisms are due to fiber strain, disc shear strain, and outer axial deformation.¹⁷

It is thought that because of poor blood supply to these injured tissues, they may not heal completely following injury, resulting in altered cervical spine kinematics that can lead to accelerated degenerative changes and clinical instability.¹⁸ The cervical muscles and head restraint are unlikely to prevent injury in the early phases of LoSRIC.



Surprised LoSRIC females have exhibited a 25 percent larger head retraction than aware subjects. The larger retractions likely produced larger tissue strains, and probably increased the injury potential.¹⁹

It also was proposed that sex hormones may play a part in females' greater likelihood of injury response, as well as the generation and persistence of pain. Experimental studies have shown that collagen content and quality can be dramatically reduced by the introduction of estrogen, or estrogen combined with progesterone. Since collagen reinforces the capsular ligaments, its reduction, therefore, likely increases the likelihood of injury in females.^{20,21}

Soft-tissue or ligament injury susceptibility in females is not limited to LoSRIC. Females also are two to eight times more likely than males to sustain tears in another ligament complex - the ACL in the knee.²²

Females with chronic CAD symptoms are more severely affected by their symptoms than similar

females suffering from insidious onset neck pain.²³ Segmental motion was statistically greater for females than for males at the C2/3, C4/5, C5/6 and C6/7 levels, and indicated that the female soft tissues sustain a great magnitude of stretch/strain in LoSRIC. It was hypothesized that this leads to a greater compromise of cervical segmental stability. In one study, hypermobility of the lower cervical spine segments was found in over 35 percent of females with chronic CAD symptoms.²⁴ Between 4 percent and 50 percent of people who sustain neck injuries in MVC are reported to exhibit symptoms that persist for years and can become disabling.^{25,26}

Peer Review and ACR Reports: When I review and/or rebut an ACR or IME report, one of the most common mistakes I find is that the physician or engineer neglects to take into account the individual risk factors of the person who has claimed to be injured. Not only do they continue to rely on refuted science,²⁷ usually Ferrari, Allen, Kwan or the QTF, but they also attempt to extrapolate the data that has been collected on relatively healthy, prepared males in LoSRIC and assume that the threshold of injury is the same for everyone. These recent reports continue to shed light on one of the most relevant risk factors - gender - in its direct relationship for risk of injury and chronicity in females.

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