Reviewer’s report

Title: Are cervical multifidus muscles active during whiplash and startle? An initial experimental study.

Version: 3 Date: 29 February 2008

Reviewer: Paul Ivancic

Reviewer’s report:

The authors have done a nice job of addressing the reviewers comments in their revised manuscript. It is a very interesting and important study that contributes to our understanding of neck injury mechanisms during whiplash.

Major Compulsory Revisions

1. Please justify the use of a car seat from an older model, 1991. Would the authors expect similar results if they had used a modern seat, that may absorb more energy and potentially cause lower neck muscle loads?

2. Please provide greater description of the feedback controlled linear sled, or references to prior published studies in which details are provided. I have not found a detailed description of the acceleration generation system for this sled in the literature. A photograph of the sled along with the acceleration generation system would be very helpful. Are compression springs and a piston used to generate sled acceleration? If so, what are their specifications? Are bearings & linear shafts used to guide sled motion? If so, please provide specifications. What is the mass of the sled and seat? Is the seatback rigidly fixed, or is it allowed to deform during impact? How long is the track, how is the sled decelerated, and what is the amplitude and duration of the deceleration pulse?

3. Figure 2c. Deceleration of approximately 0.5 g is observed immediately following two acceleration peaks, though the deceleration is not observed in the pulse obtained from the vehicle-to-vehicle collision. What causes this immediate deceleration? Does friction play a role due to large extension torque on the seat, or does the impact cause the sled to shift upwards? It is interesting to note that deceleration pulses were also observed immediately following acceleration in both representative examples (Figure 3).

4. Discussion, pg 10, para 2. The authors note that peak capsular ligament elongation rates of approximately 50 mm/s have been observed during simulated whiplash using a computational model (ref 35). I was not able to find elongation rate data in this reference. Were these data computed from one math model, subjected to one impact energy? The reference notes average T1 acceleration of 2.3 g. At higher impact severities, up to 8 g or 10 g, peak ligament elongation rate would most likely increase, potentially causing higher subfailure load tolerance. Please discuss.
5. Figure 3, 2nd subject. In this example, multifidus activity is observed after peak head rotation and peak head retraction. Please add average occurrence times for the kinematic parameters in Table 1. Please comment on the potential role of multifidus in contributing to capsular ligament elongation in those whose multifidus onset occurs following peak head kinematics.

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:

1. I also conduct whiplash biomechanics research.
2. I know two of the authors of this manuscript.