



**Figure 1** An example of one of the datasets. A similar pattern was seen in all of the volunteers.

#### [O40]

##### Does the low back displace significantly in low velocity rear impact shunts?

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The neck is at more risk in a rear shunt accident due to the relative displacement of the body and head. The low back is more restrained and theoretically at less risk. We aimed to assess the displacement of the low back in a low speed collision. A series of controlled low speed crash simulations were undertaken during 2005. Accelerometers were applied to the head, chest and low back of six volunteers. Acceleration at each of these sites was recorded throughout the duration of the crash. This was compared with video footage of the crash simulation.

The lowest accelerations and displacements were noted in the low back (Fig. 1).

Whilst much has been published on “whiplash” in relation to low speed collisions, the scientific literature contains little in relation to low back injury. In this study the results clearly demonstrate that the lower back experiences the least acceleration of the back/chest/head components. It is generally accepted that in order for injury to occur then there must be sufficient displacement/acceleration for the injury mechanism to be triggered. These results clearly raise the question of whether the low back can be injured in such impacts and highlight the need for further research in this area.

**Keywords:** Low back; Rear impact; Low velocity

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#### [O41]

##### Is the threshold for injury in whiplash really a delta-v of 3 mph?

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The Quebec Task Force defined whiplash as “an acceleration–deceleration mechanism of energy transfer to the neck”. The incidence of whiplash-associated disorders in the UK is approximately 250,000 and rising. It is logical that the lower the velocity change following impact, the lower the risk of injury. The accepted velocity change

(delta-v) for whiplash injuries following rear impact has been quoted as 5 mph. There is some debate as whether this is valid in the clinical setting. We aimed to investigate this further.

Between 2003 and 2005 a series of low speed controlled crash simulations were undertaken. There were a total of 27 runs on 23 individuals. In each case, accelerometers were placed on the head and chest of the volunteers. In addition, video recordings were analysed to assess displacement of the head and chest. The presence of symptoms was documented over a period of 7 days. The volunteers consisted of 23 males and 1 female with an average age of 38 (range 20–56). The average delta-v achieved was 2.3 mph (range 1.8–3.1 mph). The average maximum accelerations recorded were 3.46g at the chest and 2.93g at the head. The average difference was 0.53g. There was no significant displacement between the head and body. No symptoms were reported beyond 1 h.

Whiplash is triggered if the disparity between movements of the head and neck is of sufficient magnitude. It seems logical that there is a threshold below which whiplash will not occur. Our results have shown that below a delta-v of 3 mph there is little difference in the magnitude and timing of the movements of the head and chest.

Therefore the whiplash mechanism of injury does not occur at these changes of velocity.

**Keywords:** Whiplash; Delta-v; Threshold

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#### [O42]

##### Temporal geometric changes in the post-traumatic thoracic and lumbar spine

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**Background:** Thoraco-lumbar fractures without a neurological deficit are usually suitable for non-operative treatment. The main area of clinical interest is the progression of the deformity at the injured levels.

**Objective:** Accurate assessment of the temporal behaviour in the geometry (progression of deformity) of the injured segments in non-operatively treated thoraco-lumbar fractures with normal neurology.

**Materials and methods:** One hundred and three patients with thoraco-lumbar fractures without a neurological deficit were treated non-operatively at our unit between June 2003 and May 2006. The mean age of our patient cohort was 47 years (16–90 years) and 54% of the cohort was male. Strict criteria were followed to determine suitability for non-operative treatment. Supine radiographs were performed at the initial assessment. Erect radiographs were performed when trunk control was achieved and at follow-up assessments thereafter. Quality Motion Analysis software (Medical Metrics Inc., Houston, TX) was used to measure angular changes between the end plates and changes in anterior and posterior vertebral body heights using a validated protocol. The radiographs were standardised for magnification and contrast and were superimposed from different time points.