C12 Automobile Belt Fit Limitations Relative to the Pelvis – A Radiographic Study

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After attending this presentation, attendees will be shown the vulnerable position of a lap belt relative to the pelvis and abdomen. The limitations related to belt positioning are shown and the risk to female and overweight occupants demonstrated.

This presentation will impact the forensic community and/or humanity by showing the vulnerable position of a lap belt relative to the pelvis and abdomen. The limitations related to belt positioning are shown and the risk to female and overweight occupants demonstrated.

Although protection provided in frontal impacts has improved in the past ten years, abdominal injuries from the lap portion of the lap and torso restraint systems still occur. Also, the severe abdominal and spinal injuries sustained by occupants restrained by only a lap belt are well known. The recommendation has been to place the lap belt low on the pelvis. The pelvis being a strong bone could best support the belt forces. The Federal Motor Vehicle Safety Standard (FMVSS) for many years stated that the lap belt had to remain on the pelvis in a frontal crash. This study investigates whether the belt can even be positioned on the pelvis initially.

This radiographic study examines the position of an ideally positioned lap belt on a male and female. Radio-opaque pellets were attached to the seat belt webbing. The subject was seated on a flat seat with a vertical back and the belt positioned on the subject. The belt webbing was fed down through the slot between the seat back and seat bottom and the ends were anchored below the seat. Lateral x-rays were taken. The subject was then rotated 90 degrees and the lap belt was repositioned at the prior angle. In this position, frontal x-rays were taken. Because the x-ray source and film were close to the subject, the scanned image is distorted with the structures close to the x-ray source magnified. As a result complete spatial positions could not be determined from direct viewing of the scans. This phe- nomenon is described in Stewart C. Bushong's book, *Radiologic Science for Technologists*. To compensate for this problem, the scans were ana- lyzed with the aid of computer graphics and photogrammetery.

In this study the male height and weight was 68.75 inches and 168 pounds and the female height and weight was 64 inches and 160 lbs. The male height and weight closely approximates the 50th percentile male and height of the female approximates that of the 50th percentile female (although, the female weight was 8 pounds heavier than that of the average female).

The results show that, even ideally positioned, the lap belt is at, or nearly at, the top of the pelvis. Belt positioning on the male pelvis was better than for the female because the male pelvis is taller. In general male pelvises are tall and narrow, while female pelvises are short and wide. The results show the precarious positioning of the belt on the female pelvis. Small changes in the belt orientation would raise the belt above the female pelvis. This places females at greater risk of abdominal injury. Other risk factors addressed in the study are the soft tissue on the top of the thighs, which tends to raise the location of the belt, and large obese abdomens, which separate the belt from the pelvis. For some overweight individuals, even initially, the belt cannot be safely positioned over the bony pelvis.

Lap Belt, Belt Positioning, Radiology

 ** Presenting Author*