

HEAD ACCELERATION MEASUREMENTS DURING VEHICLE DRIVING TASKS AND LATERAL IMPACTS RELATIVE TO HEAD ACCELERATIONS DURING DAILY AND DYNAMIC ACTIVITIES

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ABSTRACT

The reporting of head acceleration data for volunteers exposed to lateral low speed vehicular impacts is limited. Even more limited is head acceleration data in the literature of volunteers that are exposed to lateral vehicular impacts, daily driving tasks, and activities of daily living. The novelty of this study is that the nine subjects underwent a battery of tests that included all three categories. Subjects performed a variety of daily and dynamic activities (DDA) ranging from walking, to jumping up and to the side, to shuffling side to side. The tasks of daily driving (TDD) involved the subjects getting into and out of a sedan and being a restrained front seat passenger while the vehicle was driven through a pre-determined course. All subjects were also exposed to multiple low speed, far side vehicle-to-vehicle lateral impacts (LVI) in a laboratory setting. The subjects were seated in the driver seat of the target vehicle. The bullet vehicle struck the front passenger door of the target vehicle at pre-impact speeds ranging from 2.5 to 5.5 mph. A tri-axial gravity sensing accelerometer was affixed at the head to directly measure accelerations; vehicle accelerations were also recorded when applicable. Peak lateral and resultant head accelerations were determined for all trials. Head acceleration results for DDA movements were comparable to those that have been reported in the literature for similar DDAs. Peak lateral head accelerations for the DDAs, TDDs, and LVIs reached up to 1.92 g, 1.15 g, and 2.52 g, respectively. Peak resultant head accelerations for the DDAs, TDDs, and LVIs were measured to be up to 8.54 g, 3.10 g, and 4.57 g, respectively. All reported accelerations include the effect of gravity.

Keywords: volunteer testing, head, linear acceleration, vehicle impact, driving tasks, daily activities

INTRODUCTION

While occupant head acceleration data in low speed vehicle impacts has been studied, the primary focus of the research has not been lateral low speed impacts. A key factor to understanding an occupant's experience in such an impact is the ability to compare occupant head accelerations during these lateral low speed vehicle impacts with those head accelerations experienced during non-injurious daily and dynamic activities (DDA) and tasks of daily driving (TDD).

Several previous studies have measured the head accelerations of volunteers while they underwent DDAs consisting of mostly motion in the anterior-posterior or vertical directions, including plopping into a chair, jumping or hopping off a platform or step, being dropped supine onto a mattress, walking, running, and jumping jacks [1],[2],[3],[4]. Scher, et al. did measure head accelerations of lateral-directed head motions of shaking water from one's ears and swatting an insect [5], and Hanlon and Bir measured accelerations during some impacts to the side of the head during soccer play [6]. The authors' previous work has measured the head accelerations experienced by vehicle occupants during TDD non-impact driving activities with primarily longitudinal components, such as heavy braking [7]. Another study submitted occupants to aggressive lane changes and vehicle turns, but this reported head excursion and not