ABSTRACT

Variation in pedestrian kinematics in motorcycle pedestrian crashes leads to a difference in kinds of injuries. The speeds of the pedestrian and motorcycle have been estimated from street cams of motorcycle-pedestrian crashes. The kinematics of the pedestrian head, chest, pelvis and knees has been extracted from the crash videos and compared with finite element simulations using THUMS HBM and model of Hero Splendor, 100cc, build up at IIT Delhi. Evaluation of the THUMS model for injury-prediction capabilities in real-life motorcycle-pedestrian cases has been assessed. This has been done in two steps; estimating pre-impact parameters and evaluating the model for injuries using these parameters. For pre-impact parameters estimation, five orientations (0, 15° CW, 15° CCW, 30° CW, 30° CCW), five positions (0, 20, 40, 60, 80 mm), and five speed variations have been simulated in MADYMO to assess the best match for the known throw distance for cases selected from a hospital database. For evaluation of THUMS-based injury estimates five real-life crashes have been selected. Fracture incidence has been estimated from simulation and compared with the clinical case report. An all-round evaluation of injuries from motorcycle-pedestrian crashes has been done by simulating injuries for five offset positions (-100mm, -50mm, 0mm, +50mm and +100 mm), five angular orientations (0-deg, 45-deg, 90-deg, 135-deg and 180-deg) and three impact speeds (30 kmph, 35 kmph and 40 kmph), resulting in a total of 75 different crash configurations. For angular variations, the maximum and the minimum number of injuries have been observed in 45-deg and 90-deg configurations, respectively. While in offset variation, the maximum and the minimum number of injuries have been observed in 0mm and +100mm configurations. For skeletal injuries corresponding to the sagittal plane, symmetric pedestrian injuries for 225-deg, 270-deg and 315-deg crash configurations have been estimated, which then predicts injuries for 120 configurations. Assuming the 120 crash configurations to be equiprobable indicates that the probability of fracture of bones is highest for the head, followed by Humerus, Ribs, Clavicle, and Tibia.