Special Warfare Combat-craft Crewman Tibial Acceleration During Open Ocean Transit in Small Boats

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Special Warfare Combat-craft Crewman (SWCC) operate heavily armed boats in a variety of special operations missions. The Rigid Hulled Inflatable Boats (RHIBs) used in a maritime environment are particularly susceptible to sea state and coastal weather due to their small size and light weight, placing a high physical demand on SWCCs. Musculoskeletal injuries are common among SWCCs, with a high incidence of low back and knee pain among coastal operators. Quantifying accelerations experienced during transit could help guide injury prevention initiatives. **PURPOSE:** To evaluate tibial accelerations experienced by Boat Captains during open ocean transit in RHIBs during Crewman Qualification Training exercises. **METHODS:** Seven SWCC Boat Captains (age: 30 ± 2.5 years, height: 179 ± 7.5 cm, weight: 82 ± 12.8 kg) participated. Boat Captains wore a tri-axial accelerometer on the right tibia just medial to the tibial tuberosity, with the x-axis in line with the long axis of the tibia. The accelerometers had static ranges of ±16g and ±18g, and collected at a sampling frequency of 1000 Hz for two hours during transits three, five, and thirty miles off shore. Peak accelerations in all three directions were averaged across each wave for each transit. **RESULTS:** Sea state during all three transits was reported as relatively calm (≤ four foot seas) and Boat Captains were able to maintain an average transit speed of 30-35 knots. The boats crossed one to two waves each second of transit. During transit in a protected bay (≤ one foot seas), average vertical acceleration (VA) was 3.81g with 1.94g and 1.76g accelerations in the horizontal axes (H1A and H2A). In two to three foot seas, average VA was 5.84g with 2.44g H1A and 2.23g H2A. In four foot seas, average VA was 7.49g with 2.92g H1A and 2.21g H2A. Maximum VA for these transits was approximately 16g, with maximum H1A and H2A of 10g and 11g. **CONCLUSION:** Boat Captains experience high accelerations at the proximal tibia, even in calm seas. The maximum accelerations observed during transit were similar to those observed during a single Military Free Fall Operation using the same accelerometer placement (VA: 24.06g, H1A: 10.32g, H2A: 4.20g). Attenuating these accelerations may cause high joint loading, which may contribute to the risk of injury development over the course of a SWCC's career. Funded by ONR Award #N000141110929.