Prehospital Emergency Removal of Football Helmets Using Two Techniques

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Context: Currently, the technique for removal of athletic helmets is to remove the helmet manually. Shock Doctor, Inc. has developed the Eject™ helmet removal system, which purportedly aids emergency responders in removing the helmet from an athlete with less motion than manual helmet removal. **Objective:** Compare the performance of the Eject™ helmet removal system for its ability to remove football helmets to manual helmet removal. **Design:** Quasi-experimental, counterbalanced. **Setting:** Controlled laboratory setting. **Participants:** Thirty certified athletic trainers (sex: 17 males and 13 females; age: 33.03±10.02 years; height: 174.53±12.04 cm; mass: 85.19±19.84 kg) taken from a sample of convenience among the local population. **Interventions:** Participants reported to the laboratory and signed an informed consent. Participants performed two football helmet removal trials under the following conditions in random order: manual helmet removal (MHR) and with the Eject™ helmet removal system (EHR). Participants practiced each removal technique and were deemed proficient in each method prior to data collection. A single investigator provided stabilization of the head and neck throughout. Removal by the EHR involved insertion of a bladder on an insertion-device between the head and the helmet to a pre-determined optimal depth. The insertion-device was then removed and inflation tubing was attached to a CO₂ cartridge to inflate the bladder and, thus, removing the helmet. A 3-point, 1-segment marker set was used to record range of motion (ROM) of the head within a six-camera, three-dimensional motion analysis system. A digital stopwatch was used to time trials. A modified Borg CR10 scale was used to rate perceived exertion (RPE). **Main Outcome Measures:** Independent variables were removal technique. Dependent variables included: removal time, ROM in 3 planes, and RPE. Two pair-wise t-tests with Bonferroni-corrected alpha levels tested for differences between time for removal and RPE. A 2x3 (technique x plane) totally within Repeated Measures ANOVA tested for differences in head ROM between the sagittal, frontal, and transverse planes. Analyses were performed in SPSS (version 18.0) (alpha = 0.05) **Results:** There was no significant difference in RPE between EHR (RPE=2.73, 95% CI 2.21-3.24) and MHR (RPE=2.55, 95% CI 2.12-2.98) (t<sub>29</sub>=0.76; P=0.45; d=0.20). Manual helmet removal (time=6.60s, 95% CI 5.68-7.51) was faster (t<sub>29</sub>=11.44; P<0.001) than EHR (35.55, 95% CI 30.06-41.05). Head ROM was greater during EHR compared to MHR in the sagittal (t<sub>29</sub>=4.57; P<0.001), frontal (t<sub>29</sub>=5.90; P<0.001), and transverse (t<sub>29</sub>=8.34; P<0.001) planes. Sagittal plane head ROM motion was greater than frontal and transverse plane movements (F<sub>2,58</sub>=241.47; P<0.001) during both EHR (ROM=11.16, 95% CI 10.30-12.03) and MHR (ROM=9.13, 95% CI 8.24-10.03). **Conclusions:** Removing a helmet manually is faster and creates slightly less motion than removing a helmet using the Eject® system. Both techniques were equally easy to use.

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