A Comparison of Two Equipment Removal and Spinal Restriction Protocols on Cervical Spine and Head Motion during Football Player Stretcher Transfer

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Context: Current research suggests full spinal immobilization is not effective during management of spinal injuries. Emergency Medical Services agencies nationwide changed their spinal restriction and stretcher transfer protocols in response to these findings, however, these protocols do not account for the protective equipment worn by many athletes. Removing protective equipment from an athlete is necessary for care and treatment and causes potentially harmful motion of the head and spine. The optimal time point for removing equipment is undetermined.

Objective: To compare the differences in time and head and neck kinematics when transferring a football player with a scoop stretcher between full and minimal equipment removal.

Design: Repeated measures design with two equipment removal and stretcher transfer protocols. Setting: Exercise science laboratory.

Participants: A stratified sample of twenty students representative of a football team (20.8 ± 1.7 years; 1.71 ± 0.12 m; 84.0 ± 15.9 kg)

Intervention: Participants were fitted with football equipment and lay supine. EMS spinal restriction protocols were conducted for full helmet and shoulder pads removal (remove) and face cage removal only (keep). Participants were then transferred to an ambulance cot with a scoop stretcher. Time to completion, and linear and angular head, trunk, cervical spine, and helmet motions were measured in 3-D with an electromagnetic motion tracking system.

Main Outcome Measures: Time of task and cumulative and maximum cervical flexion and linear head motion were compared between equipment removal conditions with a repeated measures ANOVA.

Results: Time of task was twice as fast during keep versus remove (42 s vs 78 s, \( p < 0.001 \)). Cumulative cervical flexion was about 40% less \( (407° \text{ vs } 571°, \ p = 0.038) \) and cumulative cervical rotation was about 50% less \( (246° \text{ vs } 378°, \ p = 0.026) \) during keep versus remove. Cumulative linear head motion was about 1.5 times greater \( (0.15 \text{ m vs } 0.35 \text{ m}, \ p = 0.018) \) during keep versus remove. Maximum angular and linear motions were similar between conditions.

Conclusions: There was considerable head and neck motion during both removal protocols, and this was greater cumulatively during full helmet and shoulder pads removal. Coupled with the faster time of task, this suggests removing the face mask only before transferring to an ambulance cot is preferred. Maximum linear and angular head and neck motion was similar between protocols and any deviation from neutral could put pressure on the spinal cord. There could be a threshold for unsafe excursions of the head, and further analysis is needed to determine the maximum allowable linear and angular head and neck motions.

Word Count: 420.