

Comparing Spine Immobilization with Spinal Motion Restriction during Transport of Suspected Spine-Injured Patients

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Context: Many emergency medical service (EMS) agencies have recently changed protocols for care of patients with suspected spine injuries by eliminating the use of long backboards traditionally employed to achieve spinal immobilization (SI). In its place, spinal motion restriction (SMR) employs cervical collars and the EMS stretcher alone to improve patient comfort, enhance respiratory status, and reduce on-scene times. However, no research has evaluated SMR efficacy to limit spine motion compared to SI during transport. **Objective:** To compare spine motion and self-reported pain prevalence in healthy subjects between SI and SMR during ground transport in the pre-hospital setting. **Design:** Counterbalanced crossover. **Setting:** Controlled laboratory and ambulance. **Participants:** Twenty males without previous history of destabilizing cervical spine injury (age=20.9±2.2 yrs, height=178.6±7.6 cm, mass=83.4±12.6 kg). **Interventions:** Participants were first fitted with a cervical collar. Inertial measurement unit sensors (MyoMotion IMS system, Noraxon USA, Inc, Scottsdale, Arizona) were then placed on the center of the forehead at the brow line and on the sternum 2.54 cm inferior to the base of the cervical collar. Trials began with the participant secured to an EMS stretcher inside the laboratory at its maximum height. The participant was then wheeled outside to an ambulance, loaded inside and driven on a standardized route (approximately 9.6 km) for 15 minutes, returning to the laboratory. Upon return, the participant was unloaded from the ambulance, wheeled into the simulated hospital setting and transferred to a hospital bed, concluding the trial. Participants completed one trial of each condition (SI and SMR) in a randomized, counter-balanced, order. Participant self-reported pain was recorded using a standard numeric pain scale at 7 time-points between the beginning and end of the trial. A two-factor repeated measures ANOVA compared spine motion in each plane ($P \leq .05$). Prevalence of pain is described. **Main Outcome Measures:** Dependent variables included cumulative integrated motion (CIM) and peak range of motion (ROM) of the cervical spine in the sagittal, frontal, and transverse planes and pain prevalence. The independent variable was condition (SI, SMR). **Results:** Transverse ROM was less ($F_{1,19}=7.47$, $p=0.013$) for SI ($6.99 \pm 3.09^\circ$) compared to SMR trials ($8.27 \pm 3.39^\circ$). No other statistically significant differences were observed ($P > 0.05$). During SI trials, 26.4% of participants reported pain while only 13.6% of participants reported pain in SMR trials. **Conclusions:** While SMR resulted in greater transverse ROM during ground transportation compared to SI, the clinical relevance of this approximate 1.25° difference is unknown. The lack of difference between SI and SMR ROM in the other two planes, combined with no difference in CIM in any plane of motion supports elimination of the traditional use of a long backboard for SI. SMR is further supported by the potential for adverse effects, like pain, associated with using SI. **Word Count:** 448