Biomechanical benefits of a mobile lift in reducing mechanical loads at the lower back during transfers

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Purpose Musculoskeletal injuries at the lower back are common in caregivers, and largely attributed to mechanical loads occurring at the back during repositioning or transferring individuals from one to another place (Schoenfisch et al., 2013). While education and training on safe transfer strategies are implemented, research evidence suggests that it is insufficient to effectively reduce the risk of musculoskeletal injuries (Lavender et al., 2007). To complement, a mobile lift is used to help reduce the injury risk during transfers, and physically deconditioned people (i.e., older adults) benefit most from the device. However, no studies examined its biomechanical benefits, particularly reduction of mechanical loads at the lower back. We have estimated mechanical loads at the lower back during transferring, and examined how the loads were affected by the mobile lift. **Method** Sixteen young individuals simulated patient transfers from bed to wheelchair. Trials were acquired with two different patient body weights (70 versus 75 kg). Trials were also acquired with and without a mobile lift (Solar-185, Winncare Nordic ApS, Korsoer, Denmark). During trials, we recorded kinematics of an upper body using reflective markers attached to the wrists, elbows, shoulders, forearm, C7, L5, anterior superior iliac spines and posterior superior iliac spines through a motion capture system (Vero v2.2, VICON, Oxford, UK). The kinematic data were then used to calculate the centre of gravity of body segments and joint centres based on the anthropometric data and 6-segment model (Vaughan, 1992). We then used static equilibrium equations (i.e., $\Sigma F = 0$; $\Sigma M = 0$) to estimate a compressive force at a disc between L5 and S1. Repeated measures ANOVA was used to test if the peak compressive force was associated with patient body weight and transfer method (manual transfer versus a mobile lift) with a significance level of alpha = 0.05. **Results and Discussion** The peak compressive force ranged from 1,489 N to 4,404 N, indicating that transferring activities involved dangerous moments where the compressive force exceeded a safety criterion (3,400 N) that the National Institute of Occupational Safety and Health (NIOSH) suggested (Winter, 2009). Furthermore, ANOVA indicated that the compressive force was associated with transfer method ($F=46.46$, $p<0.0005$), and the compressive force decreased by 26% with use of a mobile lift, when compared to the manual transfer (2,230 (SD=433) N versus 3011 (SD=700) N).

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