Reduced Exposure to Whole Body Vibration Improves Low Back Pain Among Professional Truck Drivers: A Randomized Controlled Trial Study

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Introduction

Among the work-related musculoskeletal disorders, low back pain (LBP) is the most common worker's compensation claim and the leading cause of morbidity and lost productivity in the workplace (Punnett et al., 2005). Previous epidemiological studies have shown that occupational exposure to whole body vibration (WBV) is associated with LBP (Bovenzi & Hulshof, 1999). Long-haul truck drivers in the North America are exposed to continuous and impulsive WBV exposures for prolonged periods of time, driving up to 13 hours a day and 70 hours a week. As a result, WBV exposure could be a substantial risk factor for this population. Prospective, longitudinal studies measuring WBV exposures and health outcomes are needed to further elucidate the association between WBV and LBP, and currently, Randomized Controlled Trials (RCTs) are believed to be the highest quality means to conduct such studies. Therefore, a RCT study was conducted to determine whether reducing WBV exposures can improve self-reported LBP. In this RCT study, over a one-year period, WBV exposures and changes in self-reported LBP were compared in two groups of truck drivers before and after receiving new truck seats. One group of drivers received an industry standard, passive, air-suspension seat and the other group of drivers received a newly introduced, commercially available, active-suspension seat. A previous field study has shown that these commercially available active-suspension seats reduced WBV exposures by 50% relative to the industry standard, passive, air-suspension seats (Blood et al., 2010).

Methods

Forty professional truck drivers with LBP were randomized into two groups: one group of 20 drivers received a new, industry-standard, air-suspension seat; and the other group of 20 drivers received an active-suspension seat. In addition, a group of 12 drivers with LBP who did not receive a seating intervention were also followed. WBV exposures and self-reported current LBP were collected at five specific time points over a 12-month period: one month prior to the intervention, at the intervention and 3-, 6-, 12-months post-intervention. LBP outcomes were measured using a standardized 10-point pain scale adopted from the Standard Nordic Questionnaire (Kuorinka et al., 1987). Per ISO 2631-1 standards, a tri-axial seat-pad accelerometer was mounted on the driver's seat and full shift (6-16 hours) WBV exposure data were collected at 1280 Hz using a data logger. Vehicle speed and location were simultaneously recorded at 1 Hz using a GPS logger. Using the GPS data, 15-km road segments leaving or returning to the truck terminal were identified and analyzed. These 15-km segments were chosen to best enable WBV exposure comparisons between the study groups since the trucks were travelling over the same road type at roughly the same speeds. From the 15-km road segments, the daily WBV exposures [A(8) and VDV(8)] were calculated.

Results

The results showed that daily (Mean±SE) post-intervention WBV exposures [A(8) m/s^2] were lower ($p < 0.001$) in the in the group that received and used the active-suspension seats (0.24±0.02) compared to the group that received and used the new air-suspension seats (0.33±0.02). The WBV exposures in the group that simply continued to use their existing air-suspension seats (0.34±0.02) were no different ($p = 0.99$) than the post-intervention measures from the drivers that received the new air-suspension seats. After three months, the LBP in the group that received the active-suspension seats was 30% lower from baseline measures ($p = 0.39$) compared to a 10% decrease ($p = 0.89$) in the group that received the new, air-suspension seats. In the group that continued to use their existing seats there was a 2% increase in self-reported LBP ($p = 0.96$).

Discussion

This pilot RCT study was conducted to determine whether a truck driver's seat, designed to reduce WBV exposures (an engineering intervention), improved truck driver's LBP outcomes. Typically, a Phase 1 RCT evaluates 20 subjects per arm in order to determine whether there are any measureable effects associated with the elements and outcomes being evaluated in the clinical trial. The result of this study demonstrated that active-suspension truck seat, which substantially reduced WBV exposures, was more effective in reducing LBP compared to the group of truck drivers that received the new, air-suspension seats. Although the changes in LBP were not statistically significant, previous studies have shown that a pain decrease of at least 25% from the baseline measures is thought to be clinically important/meaningful (Lauridsen et al., 2006). The small sample size in each arm likely affected the statistical power to detect differences. This study is currently being repeated in a larger RCT consisting of 140 truck drivers (n = 70 receiving industry standard, air-suspension seats, n = 70 receiving active-suspension seats). These preliminary findings indicate that reducing truck drivers' exposure to WBV can reduce the self-reported LBP and that seating interventions which reduce WBV exposures have the potential to improve self-reported truck driver LBP health outcomes.

Keywords: Trucking industry, prospective study, ergonomic intervention

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