

AN ERGONOMICS INTERVENTION WITH CONSTRUCTION CONCRETE LABORERS TO DECREASE LOW BACK INJURY RISK

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INTRODUCTION

Construction workers run a significant risk of musculoskeletal injury. Laborers have the highest risk occupation for work related back pain (Guo 1995). The placement of concrete in construction poses risks of musculoskeletal injury to laborers due to the weight of materials, frequent awkward postures, schedule pressures, and harsh environmental conditions. Ergonomic tools could decrease the risk of injury. Past studies of injury risk among construction workers have focused on observational or survey data. The goals of this study were to 1) evaluate the effectiveness of an ergonomic tool called a skid plate, for decreasing exposure to low back injury among concrete laborers and 2) explore instruments that could quantify the dynamic aspects of the low back in relation to injury risk.

METHODS

This study focused on laborers manually moving the hose that delivers concrete from a pumper truck to a placement site, in a case where pouring from above was not possible. The hypothesis tested was that skid plates would prevent hose joints from catching on rebar matting and allow the hose to slide more easily, reducing the need for repetitive bending and excessive force to move the hose. Four laborers were evaluated using the Lumbar Motion Monitor (LMM) developed at Ohio State University. The LMM is a

portable tri-axial electrogoniometer that records position, velocity and acceleration in three planes of movement. The force used by workers to move the hose was measured with a dynamometer, while lifting frequency was collected by timing workers in several 10-minute increments. Workers were measured during three different but comparable concrete pours: Time 1, baseline, before introducing the skid plates, Time 2, using unmodified skid plates, and Time 3, after workers modified skid plate use by tying the concrete hose to the skid plates.

RESULTS AND DISCUSSION

Results showed that at Time 2, when skid plates were not secured, lumbar flexion and right sided bending increased significantly (Figure 1), while velocity and acceleration did not change (Figure 2). At Time 3, after workers modified skid plate use by tying the concrete hose to the skid plates, kinematic factors, including average twisting velocity and maximum lateral velocity were significantly reduced ($p < .001$).

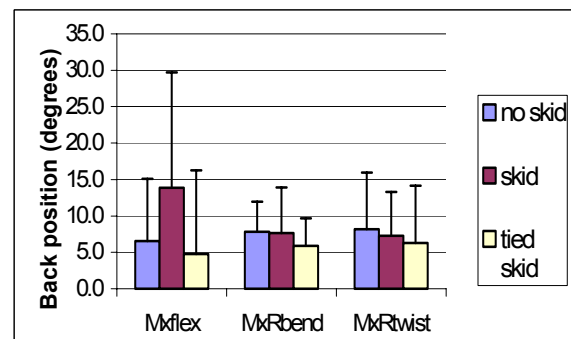


Figure 1: Low back position with skid plates

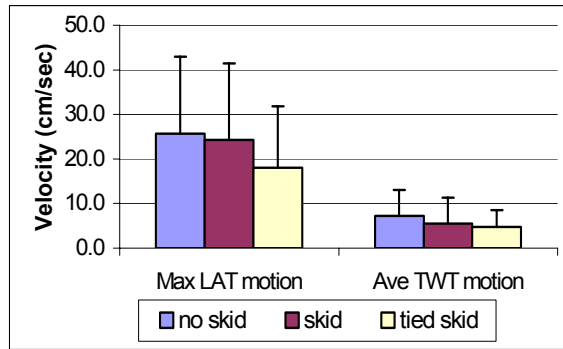


Figure 2: Low back velocity with skid plates

These are two of five factors found by Marras (1993) to be associated with risk of occupationally related low back disorder (LBD). Maximum frontal, sagittal and axial acceleration, in the lumbar region, were also significantly reduced after skid plates were secured ($p < .01$). Estimates of low back moments calculated using acceleration data, demonstrated that the maximum lumbar moment was significantly decreased in all three planes of motion when using secured skid plates ($p < .05-.001$) (Figure 3).

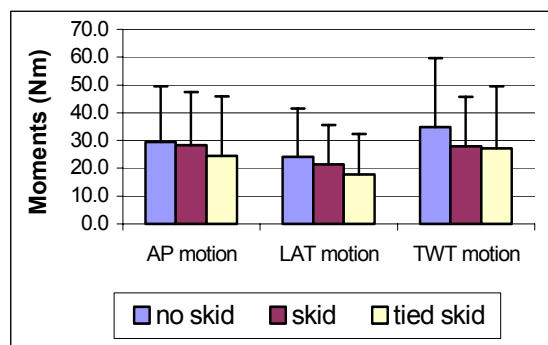


Figure 3: Low back moments

As results from biomechanical studies become available, it is evident that in addition to handling heavy loads and repetitive activities, asymmetry and kinematics such as trunk velocity and acceleration, and more importantly, the interactions among these factors are integral to understanding injury risk. Further, load moment has also been associated with the risk of LBD by Marras (1993). The findings of this study suggest

that use of secured skid plates, during horizontal concrete hose movement, decreases factors associated with exposure to low back injury group membership (Figure 4). In concrete laborers the risk of low back injury group membership decreased from 46% to 67% when using secured skid plates.

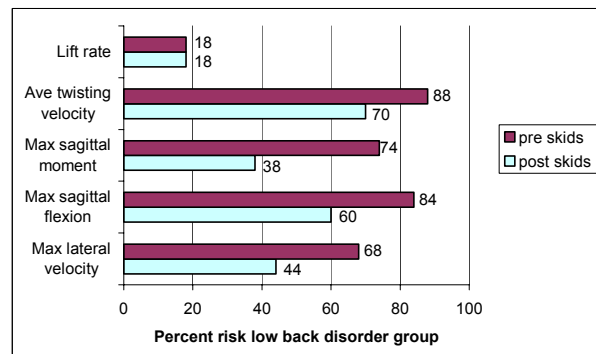


Figure 4: Risk of low back injury group risk.

SUMMARY

For laborers pulling concrete hoses, use of secured skid plates decreased awkward postures, velocity, acceleration and force in the lumbar region. Use of unsecured skid plates significantly increased flexion and right sided bending. These changes may play a part in reducing injury risk. For concrete laborers the LMM proved to be an effective field tool for evaluating dynamic lumbar spine movements during work activities.

REFERENCES

- Gou, H.R. et al (1995). *Am J Ind Med*, **28**,591-602.
 Marras, W.S. et al (1993). *Spine*, **18**, 617-628.

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