

27.

EIGHT WAYS TO ASSESS A LIFTING

TOOL. J. Camp, L. Winnemuller, S. Russell, P. Johnson, University of Washington, Seattle, WA.

The purpose of this study was to evaluate lifting assistance tools for their ability to reduce musculoskeletal risk and for their usability by workers. Typically, one utility worker uses a rudimentary hook to remove a 154-pound vault lid (manhole cover). Nonfatal injury and illness cases in utility workers are 33% higher than the total recordable cases for all industry and are comparable to manufacturing and construction. Several lid-lifting tools are commercially available, but few have been evaluated for their musculoskeletal risk reduction potential. We hypothesized that a multimethod evaluation of three new lifting tools would demonstrate reduced musculoskeletal risk in comparison to the tool currently used. Four lid-lifting tools were evaluated in four areas of musculoskeletal risk: force required to operate each tool, compressive force on the spine, percentage of the population with the strength necessary to use each tool, and the amount of back bending required; two measures of productivity: task completion time using each tool, and worker self-report of fatigue; and two categories of worker usability: tool design and ease of use, and overall performance. One tool scored highest in six of the eight assessment categories. It was rated highest in objective measures such as force to operate, back compression, and percentage strength capable; and in subjective measures such as tool evaluation, tool ranking, and self-reported fatigue levels. One lid-lifting tool could be expected to reduce musculoskeletal illnesses and injuries, was favored by workers, and had several ergonomic advantages. The results provide a relative comparison between the tools and highlight the use of a variety of subjective and objective assessment methods of determining musculoskeletal risk potential. A field study of selected lifting tools, conducted with a larger number of workers and under actual work conditions, is needed.

28.

A POTENTIAL INTERVENTION FOR LOW BACK PAIN FOR FARM CHILDREN WHEN SHOVELING.

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Over one million youth work on farms performing physically demanding jobs, which may increase their risk of developing low back pain (LBP) and other musculoskeletal disorders. However, little research has been conducted on interventions to reduce the risk of injuries. Therefore, the goal of this study was to determine the effectiveness of one such intervention—add-on handles to traditional shovels, at reducing the risk of LBP in farm youth. Six different shovels were tested: plastic and aluminum traditional scoop shovels and with two different types of add-on handles on each traditional shovel. The farm children performed a shoveling task that simulated the cleaning out of a farm stall. The dependent variables were

trunk kinematics (measured by the lumbar motion monitor) and perceived exertion ratings (measured verbally) after completion of each shoveling task. No differences were observed between the plastic and aluminum scoop shovels. Maximum sagittal flexion was greatest for the traditional shovels and 8° to 10° less for the shovels with add-on handles. Similarly, maximum lateral flexion was approximately 6° less for the shovels with add-on handles as compared to the traditional scoop shovels. Trunk motions were also reduced when add-ons were used: up to 10°/s in sagittal velocity and 14°/s in lateral velocity. Interestingly, ratings of perceived exertion were lowest for the traditional shovels and almost 50% higher for the shovels with the add-on handles. This study has shown that ergonomic interventions to traditional scoop shovels may reduce the risk of LBP even though actual perceptions of the exertion level increases. Although this study has shown the utility of add-on handles on shovels for children, the results are applicable to adults that use shovels in industry. Overall, the add-ons result in more neutral posture with less motion during traditional shoveling activities.

29.

MEASURING THE CHANGE IN SPINAL

CURVATURE. M. Payton, U.S. Air Force, Edwards AFB, CA; L. Payton, Auburn University, Auburn University, AL.

A spinal curvature measuring device (SCMD) has been developed. The SCMD can be used to measure the change in the curvature of the spine from C7 to S1 in either a standing or seated position. The SCMD is described in detail with an illustrated example.

30.

WORKERS' POSTURAL BALANCE RESPONSE ON DRY SURFACE CAN PREDICT THEIR BALANCE PERFORMANCE ON SLIPPERY SURFACE.

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More than 50% of workplace falls are associated with slip events. Although frictional properties of surface should theoretically dictate slip events, there is sufficient evidence in the literature that workers' postural balance characteristics play a much more significant role in predicting slip event. There are occupations such as construction and delivery workers where work is performed under a variety of suboptimal environments. The purpose of this research was to analyze data from 40 industrial workers to determine whether the workers' postural balance during an ideal baseline condition can predict their incidence of slip events during task performance on slippery surface. The baseline condition involved the workers standing on a dry surface, with new shoes and in good lighting. A PEAK video analysis system was used to capture slip events while the workers performed simulated industrial tasks (reaching and lifting a weight and rapid bending at the waist), standing on slippery surfaces with

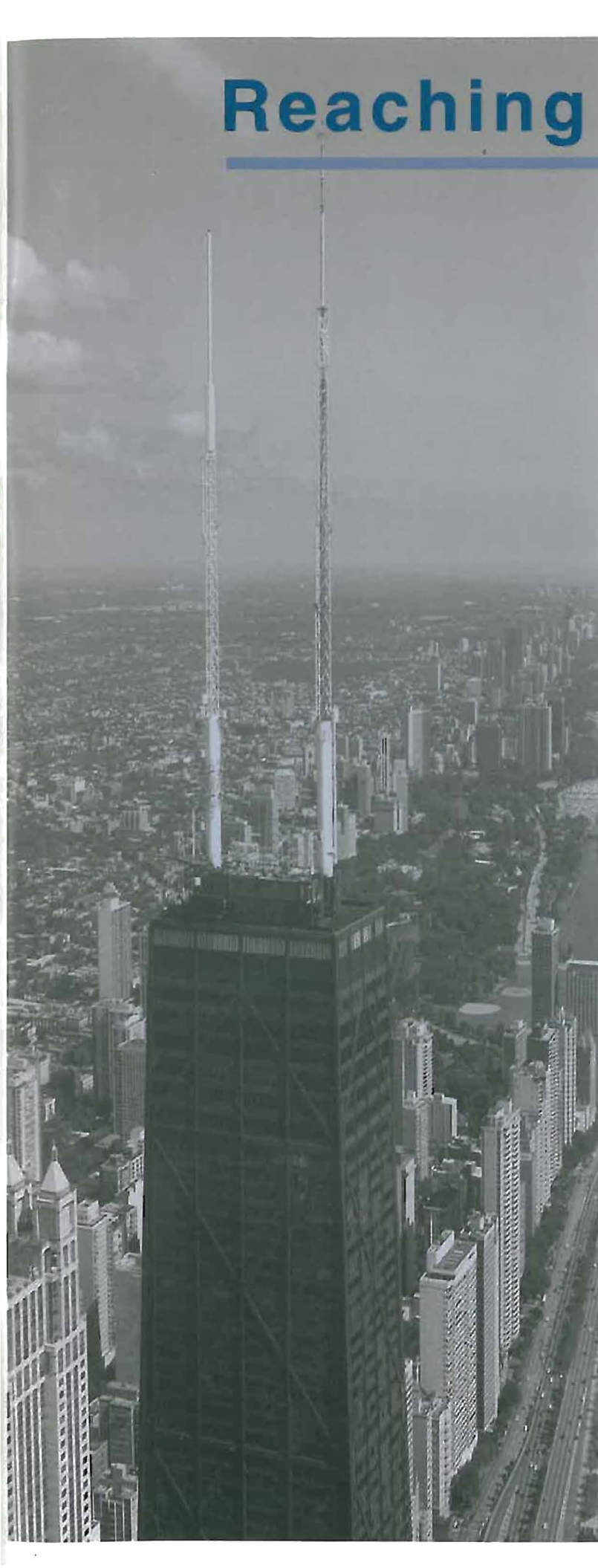
known coefficient of friction (0.35, 0.18 and 0.11). A Poisson regression analysis showed that baseline postural sway area (SA), sway length (SL) and sway excursion in the medio-lateral and anterior-posterior directions was positively associated with incidence of slip events. A logistic model fit to the data showed a statistically significant (all p-values < 0.002) association between the probability of a slip event and the workers' postural balance measures. In summary, the above findings indicate that workers who showed poorer postural balance during baseline testing actually had more slip events during task performance on a slippery surface. The results from this study will be useful in identifying workplace surface risk factors and the types of tasks that require further modification to prevent slips. Possibly specialized postural balance improvement training program for maintaining safe upright balance may yield a positive effect when carrying out tasks on slippery surfaces.

31.

LOWER EXTREMITY BALANCE DEMAND FOR CONSTRUCTION WORKERS ON STILTS.

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Falls are one of the leading causes of traumatic injuries in the construction industry, largely attributable to tasks being performed at elevations. Stilts are equipment commonly used for drywall finishing, painting, and ceiling work that create an inherent fall risk from height. Previous researchers hypothesized that stilts may place workers at increased risk for knee injuries and falls; however, the balance-control mechanism behind such a hypothesis has not been quantitatively established. This study was conducted to examine the balance demands in sagittal and frontal planes and to evaluate stresses of lower extremities during gait with stilts. Kinetic and kinematics data were collected from 20 construction workers (age: 35.8±7.7 years) while walking with stilts at different heights (24 or 40 inches). The inverse dynamics approach was used to calculate internal joint moments. Results from repeated-measure ANOVA indicated that there was a significant increase in peak hip extension (1.37 Nm/kg), knee flexion (0.68 Nm/kg), and ankle plantar flexion (0.95 Nm/kg) moments on 40-inch stilts compared with no stilts (all p-values < 0.0001). As the height of the stilt increased, lower extremity joint moments increased, suggesting more muscle activities were needed to maintain balance. In the frontal plane, the ankle joint produced a significant adduction moment (0.54 Nm/kg) on stilts during the second half of the stance phase. Hip muscles appeared to play a dominant role in progression from one step to another. Movement in the medial-lateral direction required an increased involvement of ankle muscles to maintain stability on stilts. Findings from this study indicate that stilts place the greatest increase in balance demands on the hip joints, followed by ankle and knee. To reduce the balance demands of lower extremities, it is suggested that workers avoid prolonged use of stilts, especially when stilts are elevated at high levels.



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