Results: Twenty-four studies met our inclusion criteria. Engineering interventions included alternative keyboards, computer mouse designs and wrist supports, keyboard support systems, and tool re-design. Personal interventions included ergonomics training, splint wearing, electromyographic biofeedback, and on-the-job exercise programs. Multiple component interventions (e.g., ergonomic programs) included workstation redesign, establishment of an ergonomics task force, job rotation, ergonomics training, and restricted duty provisions.

Multiple component programs were associated with reduced incidence rates of CTS, but the results are inconclusive because they did not adequately control for potential confounders. Several engineering interventions positively influenced risk factors associated with CTS, but the evaluations did not measure disease incidence. None of the personal interventions alone were associated with significant changes in symptoms or risk factors. All of the studies had important methodological limitations that may affect the validity of the results.

Conclusions: While results from several studies suggest that multiple component ergonomics programs, alternative keyboard supports, and mouse and tool re-design may be beneficial, none of the studies conclusively demonstrates that the interventions would result in the primary prevention of CTS in a working population. Given the lack of demonstrated effectiveness, intervention research should prioritize randomized controlled trials that include: 1) adequate sample size; 2) adjustment for relevant confounding variables; 3) isolation of specific program elements; and 4) measurement of long-term primary outcomes such as the incidence of CTS, and secondary outcomes such as employment status and cost.

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C6.1 Visual Reference Effect on Balance Control in Roof Work—Simeonov PI, Hsiao H

Falls from roofs are the leading cause of fatal fall injuries in the construction industry. From a biomechanical and psychophysiological standpoint the majority of occupational fall incidents, including falls from roofs, can be attributed to deterioration and disruptions in worker's balance control. Identifying the critical factors that could deteriorate the control of balance during roof work can help to develop effective fall-prevention strategies.

In a laboratory study we investigated the effects of height and close visual references on workers' postural stability and their interaction effects with roof slope, and roof surface firmness. Workers performed standing tasks on inclined [(0^0), 4/12 (~18^0), 6/12 (~26^0), 8/12 (~34^0)] and compliant surfaces at height (0', 10', 30') with close visual structures included or excluded from their peripheral visual field. Workers' standing balance was determined from the movement of their center of pressure (CP) measured by a force platform.

The results from 10 subjects demonstrate that visual exposure to environments without close visual references significantly increased worker body sway parameters (velocity of sway, area of sway, RMS of ML and AP sway). These effects were compounded by surface firmness (i.e., unstable support), workplace height, and surface slope. Close visual references significantly reduced sway and restored some of the sway characteristics (AP sway and sway area) to their baseline values.

These data can assist the roofing industry in modifying the roof work environment for improving workers' posture stability. The results of this study may also be used to develop a methodology for roofers' safety training with focus on the role of visual factors.

C6.2 Computational Simulation of Electrical Arc Parameters—Capelli-Schellpfeffer M, Miller GH

There were over 540,000 electrical workers in the United States in 1992. Bureau of Labor Statistics data for 1994 show 11,153 cases of reported days away from work due to electrical burns, electrocution/electrical shock injuries, and fires and explosions. In 1994, the Census of Fatal Occupational Injuries noted 548 employees died from these exposures out a total 6,588 work-related fatalities nationwide. Electrocution is a frequent cause of construction-related fatality.

The clinical spectrum of electrical injury ranges from the absence of any external physical signs to severe multiple trauma requiring extensive surgical care. Reported neuropsychiatric sequelae can vary from vague complaints seemingly unrelated to the electrical injury event by their distance in time or apparent severity, to sequelae consistent with traumatic brain injury. In part, blast effects may explain why electrical injury patients without external signs of electrical contact may present with nervous system or hearing impairment.

Regarding arc blast to date there is no causal link that has been established to guide treatment decisions, assist in triage assessment, or serve as the basis for recommendations on future preventive measures. To investigate the possible etiologic relationships between electrical arc phenomena and electrical injury and fatality, we have pursued the development of computational models for electrical arc events including their acoustic component. Ultimately, the correlation between numerical simulations of arc forces and experimental data is expected to enhance understanding of the mechanisms of

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ABSTRACTS

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