Laboratory Evaluation of Isometric Strength and Horizontal Shear Forces Associated with Typical Scaffold End Frame Disassembly Postures

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Abstract

Overexertion injuries comprise the largest category of nonfatal injuries among construction workers, whose overall injury rates rank among the highest in the U.S. These injuries typically occur when the biomechanical stresses associated with tasks such as lifting, carrying, pushing, etc. exceed the workers' strength capacity. Scaffold erectors' fall exposure is also high, and thus falls from elevation comprise a large portion of morbidity and mortality incidents in the construction industry. This study was conducted to measure the whole body isometric strength capability and horizontal shear forces of 47 male construction workers (age 18-49 years) in seven postures associated with scaffold end-frame disassembly. Required coefficient of friction values (RCOF) were also calculated from the horizontal shear forces. A computer controlled data acquisition system and custom fabricated test fixture complete with Bertec force platforms were used to quantify isometric strength and horizontal shear forces in each of the disassembly postures. An analysis of variance showed that the effect of posture on isometric strength capability was significant ($p<0.05$). The isometric forces resulting from the seven postures ranged from 334.4 N to 676.3 N. Three of the typical disassembly postures resulted in considerable biomechanical stress to workers. The study group produced sufficient isometric forces in the remaining four postures which would reduce the risk of overexertion injuries due to disassembly of scaffold end-frames. The static RCOF values resulting from the seven postures during the disassembly phase ranged from 0.11 to 0.19, thus any surface with a static COF > 0.2 would reduce the likelihood of a slip. Commonly accepted "safe" static COF values are $ 0.5.