Effect of hand elevation and wrist position on mean arterial pressure measured in the hand: implications for overhead work

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Abstract

Workers in certain trades cannot avoid postures with hands overhead. The effect of overhead tasks on the hand is unclear. The purpose of this study was to compare effects of hand elevation and wrist position on pulse rate and long finger mean arterial pressure (MAP) and thus tissue perfusion of the hand. MAP was sampled at each of five right hand elevations relative to heart level (0, ±20, ±40 cm) with two wrist positions (neutral and flexed) in 20 healthy subjects. Analysis of variance and post hoc pair wise comparisons were performed. Digital artery MAP was inversely proportional to hand elevation across an 80 cm range regardless of wrist position ($R^2=0.979$, $F=758.65$, $p<0.0001$). Compensatory pulse rate changes were absent. Post-test MAP exceeded pre-test values. This model of MAP demonstrated 0.73 mm Hg/cm elevation. Position-induced hand ischemia implications exist.

Introduction

Background

Musculoskeletal disorders (MSDs) to the wrist and hand are common among workers, and are associated with working conditions that use forceful, repetitive and extreme joint postures (NIOSH, 1997). Wrist flexion is identified as a posture associated with MSD (Estill & Kroemer, 1998), discomfort (Lin & Radwin, 1998), and confirmed by other investigators (Kim & Fernandez, 1993, Snook et al., 1995, Harber et al., 1994, Franzblau et al., 1997). Flexed wrist postures were avoided when self-selected postures were permitted while completing a drilling task (Davis & Fernandez, 1994).

The equipment and technology utilised often determine work postures that workers cannot avoid. Workers in construction trades that reported performing overhead work for more than two hours per day were found to be three times more susceptible to carpal tunnel syndrome symptoms and six times more susceptible to carpal tunnel syndrome (CTS) electrophysiological changes than their co-worker counterparts (Farrell, 1998). While overhead hand postures and extreme joint postures are thus