that the prevalence of VWF in exposed workers might be restricted to the prevalence of RP in nonexposed subjects if the 2-h daily exposure time is about 4.5 m/s^2 rms. The equation in the ISO 5349 was used and modified as $(a)_t=(a)_2H(2/t)^{1/2}$ and then the vibration limit values of 1 min to 8 h were calculated. The permissible vibration exposure for an 8-h working period was assumed to be 2.2 m/s^2 rms.

Conclusions: The threshold limit values presented here might be considered as a challenge for protection of workers against developing vibration syndrome.

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ACCELEROMETERS AS AN ERGONOMIC ASSESSMENT METHOD FOR REPETITIVE WORK -- A FIELD TRIAL. C.F. Estill, L. MacDonald, T. Wenzl, NIOSH, Cincinnati, OH

Ergonomists need easy-to-use, quantitative job evaluation methods to determine potential risk factors for cumulative trauma disorders (CTDs) in field-based epidemiology studies. One device that may provide an objective measure of exposure to repetitive work is an activity monitor. The activity monitor detects and records acceleration with a sampling frequency of 10 Hz.

A preliminary study included 157 workers in an appliance assembly plant who wore activity monitors on their wrists for a minimum of 50 minutes while performing their jobs. The workers who were monitored were members of three different groups: (1) 82 workers from a traditional washing machine assembly line, (2) 13 from a new (horizontal axis) washing machine assembly line, and (3) 63 salary workers (clerical, managers). A 50-minute geometric mean was computed for each study participant. When comparing the means by group, there was a statistically significant difference between groups ($p=0.0001$). This investigation confirmed the expectation that traditional washing machine workers would have much greater arm motion acceleration characteristics than salaried workers. Furthermore, the arm motion acceleration of workers on the new line were lower than for workers on the traditional line, but higher than the salaried workers. The new washing machine line was not in full production and, therefore, repetition rates were not expected to be as high as on the traditional line.

A follow-up study was conducted to further discriminate between repetitive assembly jobs. Because the preliminary data showed a strong difference between groups, data collection was limited to the traditional washing machine line; 66 workers wore the monitors for 50 minutes on 4 different days. There was a statistically significant difference between jobs ($p=0.0001$). Activity monitors were found to be easy-to-use, nonintrusive devices that can distinguish acceleration rates among assembly jobs.

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DEVELOPMENT OF AN ELECTROGONIOMETER WRIST PLATFORM TO REMOVE MEASUREMENT ERROR. P.O. Spielholz, University of Washington, Seattle, WA; R. Hughes, NIOSH, Morgantown, WV

Electrogoniometers represent one of the few feasible methods of measuring wrist motion on a person while he or she is moving and performing work. However, there have been questions as to the accuracy of angle readings due to crosstalk introduced by forearm rotation. A forearm rotation correction procedure was previously developed that resulted in reducing mean flexion/extension error from 7.06 degrees to 4.79 degrees, and radial/ulnar deviation error from 10.56 degrees to 4.73 degrees. However, correcting for forearm rotation necessitates the use of an electrotorsiometer in conjunction with the electrogoniometer.

A wrist platform was developed for the electrogoniometer, which may remove significant forearm rotation crosstalk from wrist angle channels. A wrist-cuff was made from thermoplast splinting material with an angled platform attached to the superior surface. The distal end of the electrogoniometer was taped to the top of the hand, while the proximal end was taped to the platform. In theory, the wrist platform would then allow the electrogoniometer to rotate with the hand instead of becoming twisted, as happens during standard application.

A jig was also developed for calibrating actual wrist and forearm rotation angles to those measured by the goniometers. In a pilot study using a limited range of motion, the wrist platform was compared with a standard application. Results showed that forearm rotation was removed as a significant factor for flexion/extension. Forearm rotation remained a significant factor for ulnar/radial deviation measurement, but removed only 0.25 degrees of additional error. Mean error using the platform was 2.39 degrees for flexion/extension and 2.38 degrees for radial/ulnar deviation. These results show that this easily made device may have useful application in the measurement of wrist motions in laboratory studies or tasks with limited ranges of motion such as keyboarding.

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EFFECT OF MVC AND REST TIME ON TWO PSYCHOPHYSICAL REPETITIVE HAND GRASPING STUDIES. E.E. Swensen, Exxon Biomedical Sciences, Inc., Baytown, TX; R.E. Schlegel, J.L. Purswell, University of Oklahoma, Norman, OK

Several researchers have used the psychophysical method of adjustment to study hand grasping tasks. However, these studies have not reported the effect of elapsed time upon the recorded psychophysical values. The objective of these studies was to determine psychophysically the effects of exertion time on maximum voluntary contraction and subject-determined rest time. Nine female subjects performed in Study 1 a simulated industrial hand grasping task that required a grasping force of 30% of her MVC for 5 seconds. The task duration was 20 minutes per session over the 4-week study. Mean MVC values ranged from 15.9 to 33.1 kg (35 to 73 lbs). Statistical analysis revealed pre- and posttrial values differed significantly ($F(1,50)=6.97$, $p<0.0335$). The data showed that mean MVC increased from Session 1 to Session 3, with no statistically significant differences among Sessions 2, 3, and 4. Mean rest time (4.90 sec) did not vary among the sessions; however, the initial set point of the rest time prior to subject adjustment did affect the final rest time value. Study 2 consisted of 16 female subjects who performed the same task as in Study 1. Mean MVC values ranged from 29.1 to 32.1 kg (64 to 71 lbs). Mean presession MVC values were greater than postsession data ($F(3,45)=3.13$, $p<0.0364$). Mean presession MVC values showed an increase from Session 2 to 4, with no statistically significant differences among Sessions 1, 2, and 3 and 1, 3, and 4. Wrist angle (0 and 45 degrees) had a significant effect ($F(1,14)=72.78$, $p<0.0001$) upon mean rest time (5.10 to 7.05 sec). This study provides support for the use of psychophysical methods in setting work/rest cycle parameters for repetitive hand grasping, but also identifies areas where caution must be observed.

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A COMPARISON OF ENVIRONMENTAL SAMPLE METHODS FOR ESTIMATING SOIL LEAD AT TRAP SHOOTING RANGESCTHE EFFECTS OF PELLET AND NONPELLET LEAD. D.R. Lilquist, T. Aldrich, F. Sullivan, J. Bowles, D. Meservy, C. Lewis-Younger, Rocky Mountain Center for Occupational and Environmental Health, Salt Lake City, UT

Lead contamination of soil is a potential problem at trap shooting ranges. Established soil sampling methods currently used may not accurately estimate the average soil lead concentration nor the contribution of pelletized lead. A primary concern is whether a solid lead pellet finds its way into the "representative" sample analyzed by the laboratory. This study was conducted to quantify the distribution of pellet and nonpellet soil lead at a trap shooting range and to compare two soil sample preparation methods. The test site consisted of a trap range that has been in use for 40 years with average soil pH of 6.4. Sixty-six composite soil samples were taken at 5-meter intervals along a traverse of one trap house. All samples were screened to remove large rocks and plant material, then split. One split, representing current HUD soil sampling methods, was sent directly to a laboratory for lead analysis. The other split was screened to separate lead pellets from the soil. Both the lead pellet and the soil fraction were sent separately to the laboratory for lead analysis. Elevated total lead levels were found within 25 meters and 100 to 300 meters from the shooting pad. Approximately 96% of lead pellets were recovered in the samples taken from 100 to 300 meters. Screening the samples to separate lead pellets showed less variability and overall greater average soil lead levels than the HUD method. It appears the HUD method should not be applied to situations where lead exists in pellet form due to the potential variation in results.

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LEAD CONTAMINATION IN CONTEMPORARY CERAMICS STUDIOS: POTENTIAL FOR COMMUNITY AND WORKER EXPOSURE. C.V. Stanion, W. Stopford, Duke University Occupational and Environmental Medicine, Durham, NC

The term Acontemporary ceramics@ refers to the decoration of prefired ceramic forms using lead-free underglazes. Decorated pieces are then covered with an overglaze and fired. This overglaze, or Adipping glaze.@ often contains lead. When the pieces are dipped in the overglaze, drips can fall to the work surface or floor,

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