



HUMAN RESPONSE TO VIBRATION

ABSTRACTS

Prepared by M. J. and J. Griffin, Human Factors Research Unit,
Institute of Sound and Vibration Research, University of Southampton,
Southampton SO17 1BJ, England

M. Turner, and M. J. Griffin 1999 *Ergonomics* **42**(12), 1646–1664. Motion sickness in public road transport: the effect of driver, route and vehicle. (19 pages, 12 figures, 4 tables, 22 references) (in English)

Authors' Abstract. Relationships between vehicle motion and passenger sickness have been investigated in a survey of 3256 passengers travelling on 56 mainland U.K. bus or coach journeys. Vehicle motion was measured throughout all journeys, yielding over 110 h of six-axis coach motion data from five types of coach and 17 different drivers. Overall, 28.4% of passengers reported feelings of illness, 12.8% reported nausea and 1.7% reported vomiting during coach travel. Passenger nausea and illness ratings increased with increased exposure to lateral coach motion at low frequencies (<0.5 Hz). Motion in other axes correlated less well with sickness, although there were some intercorrelations between the motions in the different axes. Sickness level among passengers were greater with drivers who drove to produce higher average magnitudes of fore-and-aft and lateral vehicle motion. Nausea occurrence was greater on routes classified as being predominantly cross-country were magnitudes of lateral vehicle motion were significantly higher. Lateral motion and motion sickness increased from the front to the rear of each vehicle. No significant differences in sickness were found between the five different vehicle types used in the study. The applicability of a motion sickness dose model to those data is discussed.

Topics: Motion sickness (causes of, prevention); Vibration measurements (road vehicles).

S. Hu, and R. M. Stern 1999 *Aviation, Space, and Environmental Medicine* **70**(8), 766–768. The retention of adaptation to motion sickness eliciting stimulation. (3 pages, 0 figures, 2 tables, 13 references) (in English)

Authors' Abstract. Purpose: This study compared retention of adaptation to motion sickness eliciting stimulation after 1 month and 1 year. Method: A total of 34 subjects who developed nausea to an optokinetic rotating drum in a preliminary session repeatedly viewed the same rotation with an interval of 48 h between sessions until they had no feelings of nausea. For each session, subjects' electrogastrograms (EGGs) at 4–9 cycles per minute (cpm) were also recorded as a physiological index of the severity of motion sickness. Subjects were re-exposed to the optokinetic drum either after 1 month or 1 year. Results: The mean ratings of nausea for the subjects who were re-exposed to the optokinetic drum after 1 month were 9.23 for the initial exposure and 0.94 for the re-exposure session. EGG indicators of motion sickness were 6.65 for the initial exposure and 1.03 for the re-exposure session. The mean ratings of nausea for the subjects who were re-exposure session. The mean ratings of nausea for the subjects who were re-exposed to the optokinetic drum after 1 year were 8.94 for the initial exposure and 6.88 for the re-exposure session. EGG indicators of motion sickness were 5.97 for the initial exposure and 4.05 for the re-exposure

session. Conclusions: These indicated that adaptation to the motion sickness eliciting stimulation of optokinetic rotation is almost completely retained for 1 month and partially retained for 1 year.

Topics: Motion sickness (general); physiological indicators (EGG).

W. H. Johnson, F. A. Sunahara, and J. P. Landolt 1999 *Journal of Vestibular Research* **9**(2), 83–87. Importance of the vestibular system in visually induced nausea and self-vection. (5 pages, 3 figures, 2 tables, 7 references) (in English)

Authors' Abstract. The objective of this study was to determine the importance, if any, of the non-auditory labyrinth of the inner ear in visually induced nausea and self-vection in subjects exposed to a moving visual field with and without concomitant pitching head movements. Subjects tested were 15 normals, 18 unilateral labyrinthectomies and 6 bilateral labyrinthectomies. The findings show a higher incidence of pseudo-Coriolis induced nausea in normal subjects compared to unilateral and bilateral labyrinthectomized subjects. When the subjects were exposed to the moving visual field only (no head movement), pronounced self-vection occurred in all subjects, but with earlier onset in the bilateral labyrinthine defective subjects as compared to normal and unilateral defective subjects. The subjective intensities of self-vections reported by labyrinth-defectives were much more pronounced as compared to normal subjects, and it is apparent that visual input in these subjects achieves much more importance in maintaining compensatory eye movements, and the gain of neck reflexes is enhanced. The findings that visual stimulation is more effective in producing the disabling effects after labyrinthine destruction could possibly be explained by enhancement of vision after loss of labyrinthine sensory input, and the gain in neck reflexes is also enhanced after labyrinthectomy.

Topics: Motion sickness (general); vestibular function.

R. B. McLafferty, J. M. Edwards, B. L. Ferris, G. L. Moneta, L. M. Taylor, G. J. Landry, and J. M. Porter 1999 *Journal of Vascular Surgery* **30**(1), 1–7. Raynaud's syndrome in workers who use vibrating pneumatic air knives. (7 pages, 1 figure, 3 tables, 42 references) (in English)

Authors' Abstract. Purpose: The use of vibrating tools has been shown to cause Raynaud's syndrome (RS) in a variety of workers, including those who use chain saws, chippers, and grinders. The diagnosis of RS in workers who use vibrating tools is difficult to document objectively. WE studied a patient cohort with RS caused by the use of vibrating pneumatic air knife (PAK) for removal of automobile windshields and determined our ability to document RS in workers by means of digital hypothermic challenge testing (DHCT), a vascular laboratory study that evaluates digital blood pressure response to cooling. Methods: Sixteen male autoglass workers (mean age, 36 years) with RS were examined by means of history, physical examination, arm blood pressures, digital photoplethysmography, screening serologic studies for underlying connective tissue disorder, and DHCT. Results: No patient had RS before they used PAK. The mean onset of RS (colour changes, 100%, pain, 93%; parathesias, 75%) with cold exposure was 3 years (range, 1.5–5 years) after initial PAK use (mean estimate PAK use, 2450 h). Fifty-six percent of workers smoked cigarettes. The findings of the physical examination, arm blood pressures, digital photoplethysmography, and serologic testing were normal in all patients. At 10°C cooling with digital cuff and patient cooling blanket, a significant decreases in digital blood pressure was shown by means of DHCT in 100% of test fingers versus normothermic control fingers (mean decreases, 75%; range, 25–100%; normal responses, less than 17%; $P < 0.001$). The mean follow-up period was 18 months (range, 1–47 months). No patients continued to use the PAK, but symptoms of RS were unchanged in 69% and

worse in 31%. Conclusions: PAK use is a possible cause of vibration-induced RS. The presence of RS in workers who use the PAK was objectively confirmed by means of DHCT. Cessation of PAK use in the short term did not result in symptomatic improvement.

Topics: Vibration-induced white finger (causes of).

N. Harada, M. Yoshimura, and M. S. Laskar 1999 *International Archives of Occupational and Environmental Health* **72**(5), 330–334. (5 pages, 0 figures, 1 table, 54 references) (in English)

Authors' Abstract. For the diagnosis of the hand–arm vibration syndrome, cold-stress tests using different water temperatures and periods of hand immersion have been investigated in Europe, North America, and Japan. In recent years, peripheral circulation and sensory tests, including finger-skin temperature measurement involving immersion of one hand in cold water at 10°C for 10 min, have been widely accepted in Japan. On the other hand, standardization of the vascular assessment method is under discussion at the International Organization for Standardization. We reviewed research findings from Japan concerning finger-skin temperature measurement during the cold-stress test, especially factors influencing the test results and the diagnostic significance. For establishment of the cold-stress test for epidemiology studies of the hand–arm vibration syndrome, standardization of the environmental factors influencing the test results and reporting of its sensitivity and specificity are needed.

Topics: Vibration-induced white finger (diagnosis of).

G. Kennedy, F. Khan, M. McLaren, and J. J. F. Belch 1999 *European Journal of Clinical Investigation* **29**(7), 577–581. Endothelial activation and response in patients with hand arm vibration syndrome. (5 pages, 3 figures, 0 tables, 29 references) (in English)

Authors' Abstract. Background. Hand–arm vibration syndrome (HAVS) is a form of secondary Raynaud's phenomenon (RP) of occupational origin. In other forms of RP, blood and blood vessel wall interaction is one factor in the pathophysiology. Cytokines and cell adhesion molecules both play an important role in the interaction, and basal vascular tone and vasodilatation are regulated by nitric oxide. Methods. Blood flow responses to acetylcholine (ACh) and sodium nitroprusside (SNP) and levels of soluble intercellular molecules-1 (sICAM-1) and the inflammatory cytokine interleukin 8 (IL-8) were measured in eight male patients with vibration white finger disease, which is part of HAVS, and in eight healthy matched male control subjects. Results. sICAM-1 levels were statistically higher ($p = 0.02$, Mann–Whitney U -test) and IL-8 levels ($P < 0.01$, Mann–Whitney) were significantly lower in the patient group. The patients with HAVS had significantly reduced vascular responses to SNP ($P < 0.05$, ANOVA). Conclusions. In this study, we reveal differences in vascular responses to SNP which suggest that there may be an impairment of the smooth muscle response to nitric oxide in patients with HAVS. The increase in sICAM-1 that occurs in patients with HAVS suggests that leucocyte adhesion is increased and that adherent neutrophils may contribute to the microvascular damage seen in this disease. The impeded flow of blood cells through the microcirculation may result in the low levels of circulating IL-8 due to the cytokine binding to erythrocytes. The possible role of NO activity in HAVS warrants further investigation.

Topics: Vibration-induced white finger (diagnosis of).

R. Cederlund, Å Isacson, and G. Lundborg 1999 *Journal of Hand Therapy* **12**(1), 16–24. Hand function in workers with hand–arm vibration syndrome. (9 pages, 1 figure, 8 tables, 64 references) (in English)

Authors' Abstract. Hand–arm vibration syndrome has been specially addressed in the Scandinavian countries in recent years, but the syndrome is still not sufficiently recognized in many countries. The object of this preliminary study was to describe the nature and character of vibration-induced impairment in the hands of exposed workers. Twenty symptomatic male workers (aged 28–65 years) subjected to vibration by hand-held tools were interviewed about subjective tests for sensibility, dexterity, grip function, and grip strength. The test results were compared with normative data. The majority of patients complained of cold intolerance, numbness, pain, sensory impairment, and difficulties in handling manual tools and in handwriting. The various objective tests showed considerable variation in indications of pathologic outcome, revealing differences in sensitivity to detect impaired hand function. Semmes–Weinstein monofilament testing for perception of light touch–deep pressure sensation, the small-object shape identification test, and moving two-point discrimination testing for functional sensibility provided the most indications of pathologic outcomes. The authors conclude that vibration-exposed patients present considerable impairment in hand function.

Topics: Hand–arm vibration syndrome (symptoms and signs).

T. Strömberg, L. B. Dahlin, I. Rosén, and G. Lundborg 1999 *Journal of Hand Surgery, (British and European Volume)* **24B**(2), 203–209. Neurophysiological findings in vibration-exposed male workers. (7 pages, 0 figures, 6 tables, 32 references) (in English)

Authors' Abstract. Fractionated nerve conduction, vibrotactile sense, and temperature thresholds were studied in 73 symptomatic vibration-exposed male workers. Three symptomatic groups were distinguished: patients with isolated sensorineural symptoms; with isolated vasospastic problems; and with both. Clinical carpal tunnel syndrome occurred in 14 patients and abnormal cold intolerance (without blanching of the fingers) in 23. In the group as a whole, nerve conduction studies were abnormal in the median nerve but not in the ulnar nerve and vibration perception and temperature thresholds were impaired. Of the three symptomatic groups, patients with isolated sensorineural symptoms differed from controls. No differences were seen between patients with and without clinical carpal tunnel syndrome. With severe sensorineural symptoms the vibration perception thresholds, but not the values of the nerve conduction studies, were further impaired. The results indicated two injuries that are easily confused: one at receptor level in the fingertips and the other in the carpal tunnel. Careful clinical assessment, neurophysiological testing, and examination of vibrotactile sense are required before carpal tunnel release can be considered in these patients.

Topics: Hand–arm vibration syndrome (carpal tunnel syndrome; diagnosis).

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Contributions to the Literature Collection are invited. They should be sent to Professor M. J. Griffin, Human Factors Research Unit, Institute of Sound and Vibration Research, University of Southampton, Southampton, SO17 1BJ, England.