

International Journal of Occupational Safety and Ergonomics – rok 2016, ročník 22

Číslo 3



Viet Tran, Reid Turner, Andrew MacFadden, Stephen M. Cornish, Dale Esliger, Kunio Komiyama & Philip D. Chilibeck. *A dental stool with chest support reduces lower back muscle activation.* Pages 301-304.

Activation of back musculature during work tasks leads to fatigue and potential injury. This is especially prevalent in dentists who perform much of their work from a seated position. We examined the use of an ergonomic dental stool with mid-sternum chest support for reducing lower back muscle activation. Electromyography of lower back extensors was assessed from 30 dental students for 20 s during three conditions in random order: (a) sitting upright at 90° of hip flexion on a standard stool, (b) leaning forward at 80° of hip flexion on a standard stool, and (c) leaning forward at 80° of hip flexion while sitting on an ergonomic stool. Muscular activity of the back extensors was reduced when using the ergonomic stool compared to the standard stool, by 33–50% ($p < 0.01$). This suggests a potential musculoskeletal benefit with use of a dental stool with mid-sternum chest support.

- **Keywords:** spine, posture, fatigue, injury

Grzegorz Gralewicz & Grzegorz Owczarek. *Analysis of the selected optical parameters of filters protecting against hazardous infrared radiation.* Pages 305-309.

The paper analyses the selected optical parameters of protective optic filters used for protection of the eyes against hazardous radiation within the visible (VIS) and near infrared (NIR) spectrum range. The indexes characterizing transmission and reflection of optic radiation incident on the filter are compared. As it follows from the completed analysis, the newly developed interference filters provide more effective blocking of infrared radiation in comparison with the currently used protective filters.

- **Keywords:** optical filters, interference filters, infrared radiation

Elena Sychenko. *Protection from psychosocial risks at work under the European Convention on Human Rights: is it possible?* Pages 310-319.

This paper argues the possibility of establishing common principles of protection from psychosocial risks (PSR) on the basis of the legal positions of the European Court of Human Rights (the Court) expressed in recent cases on degrading treatment and

occupational health. The author focuses on the positive obligations of the States to ensure the protection of the right for life and of the right to respect for private life. The prohibition of degrading treatment in relations between private persons is also considered as relevant to the issue of the protection from PSR. Analyzing the Court's case law (judgments of the Court) we substantiate the possibility of claiming protection from PSR under the European Convention on Human Rights, namely, articles 2, 3 and 6, 8.

- **Keywords:** occupational health, psychosocial risks, effective protection, positive obligation, European Court of Human Rights

Marcin Milanowicz & Krzysztof Kędzior. *Multibody model of the human upper extremity for fracture simulation*. Pages 320-326.

About 3.8 million people are injured in accidents at work in Europe every year. The resulting high costs are incurred by the victims themselves, their families, employers and society. We have used a numerical simulation to reconstruct accidents at work for several years. To reconstruct these accidents MADYMO R7.5 with a numerical human model (pedestrian model) is used. However, this model is dedicated to the analysis of car-to-pedestrian accidents and thus cannot be fully used for reconstructing accidents at work. Therefore, we started working on the development of a numerical model of the human body for the purpose of simulating accidents at work. Developing a new numerical model which gives an opportunity to simulate fractures of the upper extremity bones is a stage of that work.

- **Keywords:** accident reconstruction, numerical simulation, multibody, MADYMO, human model

Zoleikha Sayyahi, Ramazan Mirzaei & Rokhsana Mirkazemi. *Improving body posture while fueling with a newly designed pump nozzle*. Pages 327-332.

Background. Although petrol pumps are a very common and highly used simple technology, their design consideration for comfort and safety to prevent high-pressure load and musculoskeletal injuries to the body is a neglected area in many countries including Iran. **Objectives.** This study attempted to design a new pump nozzle, and to assess the differences in musculoskeletal load related to body posture when a price/volume display is mounted on the pump nozzle. **Methods.** For postural analysis, photographs recording the posture of 100 randomly selected customers while fueling at petrol pumps and the rapid upper limb assessment (RULA) technique were used. **Results.** The results of this study showed that RULA scores improved significantly after the newly designed pump nozzle was used. **Conclusion.** The newly designed pump nozzle is useful in reducing load related to body posture while fueling.

- **Keywords:** rapid upper limb assessment, ergonomics, petrol pumps, pump nozzle, musculoskeletal disorders, manufacturing, posture analysis

Lee Na Puah, Lin Dar Ong & Wei Ying Chong. *The effects of perceived organizational support, perceived supervisor support and perceived co-worker support on safety and health compliance*. Pages 333-339.

Although knowledge is cumulating, very little is known about the effects of various sources of support on safety and health compliance. This study goes beyond previous research by investigating the relationships among perceived support from organizations, supervisors and co-workers, and employees' safety and health compliance behaviour at chemical and petroleum process plants. The results of this study show that the support from organizations, supervisors and co-workers was significantly related to employees'

safety and health compliance. Also, the findings reveal that perceived supervisor support has the strongest influence in ensuring employees' safety and health compliance behaviour.

- **Keywords:** perceived organizational support, perceived supervisor support, perceived co-worker support, safety and health compliance

Andrea Antonucci, Laura Forcella, Roberta Bonfiglioli, Paolo Boscolo & Francesco Saverio Violante. *Analytical characterization of movements of the spinal column and risk assessment due to repeated movements of the upper limbs of building painters.* Pages 340-349.

Manual activities of construction workers may induce musculoskeletal disorders. This study on a group of painters aimed to analytically characterize movements of the spinal column by both lumbar motion monitor and television cameras and to determine, using the Occupational Repetitive Actions (OCRA) Index method, the risk exerted by repeated movements of the upper limbs. The main results are: painting with a roller generally exposes workers to a lesser risk for upper limbs than painting with a brush; a roller-stick fixed at the wrong length can lead to stretching of the back at lumbar and cervical levels; to remain within the range of 'acceptable risk' (OCRA Index evaluation), a worker should not paint a vertical wall for over 3 h if using a roller and 2.5 h if painting with a brush; and, on average, a painter who paints for 5 h in a day lifts the bucket about 120,140 times.

- **Keywords:** repeated movements, posture, painters, biomechanical risk

Sylwia Krzemińska, Władysław M. Rzymiski, Monika Malesa, Urszula Borkowska & Mariusz Oleksy. *Gloves against mineral oils and mechanical hazards: composites of carboxylated acrylonitrile-butadiene rubber latex.* Pages 350-359.

Resistance to permeation of noxious chemical substances should be accompanied by resistance to mechanical factors because the glove material may be torn, cut or punctured in the workplace. This study reports on glove materials, protecting against mineral oils and mechanical hazards, made of carboxylated acrylonitrile-butadiene rubber (XNBR) latex. The obtained materials were characterized by a very high resistance of the produced materials to oil permeation (breakthrough time > 480 min). The mechanical properties, and especially tear resistance, of the studied materials were improved after the addition of modified bentonite (nanofiller) to the XNBR latex mixture. The nanocomposite meets the requirements in terms of parameters characterizing tear, abrasion, cut and puncture resistance. Therefore, the developed material may be used for the production of multifunctional protective gloves.

- **Keywords:** gloves, oils, permeation, XNBR latex, bentonite, nanocomposite

Behdin Nowrouzi, Basem Gohar, Behnam Nowrouzi-Kia, Martyna Garbaczewska, Olena Chapoalov, Étienne Myette-Côté & Lorraine Carter. *Facilitators and barriers to occupational health and safety in small and medium-sized enterprises: a descriptive exploratory study in Ontario, Canada.* Pages 360-366.

Purpose. The purpose of this particular study was to test a newly created instrument in describing the facilitators and barriers to occupational health and safety in small and medium-sized enterprises (SMEs) in Ontario, Canada. **Methods.** A cross-sectional design was used to identify the occupational health and safety culture of SMEs in public and private sectors in Ontario. **Results.** A total of 153 questionnaires were completed. The

majority of respondents were female (84%) with a mean age of 49.8 years (SD 10.6). Seventy-four percent were supervisors. Seventy percent of respondents were from the private sector while 30% derived from the public sector including healthcare, community services, and non-profit organizations. Further, conducting regular external safety inspections of the workplace was found to be statistically associated with a safe work environment 2.88 95% CI [1.57, 5.27]. **Conclusions.** Strategies and training opportunities that focus on how to adapt occupational health and safety legislation to the nature and diversity of SMEs are recommended. Furthermore, employers may use such information to improve safety in their SMEs, while researchers can hopefully use such evidence to develop interventions that are applicable to meeting the occupational health and safety needs of SMEs.

- **Keywords:** small and medium-sized enterprises (SMEs), facilitators, barriers, occupational health and safety, Ontario, Canada

Paweł Budziszewski, Andrzej Grabowski, Marcin Milanowicz & Jarosław Jankowski. *Workstations for people with disabilities: an example of a virtual reality approach.* Pages 367-373.

This article describes a method of adapting workstations for workers with motion disability using computer simulation and virtual reality (VR) techniques. A workstation for grinding spring faces was used as an example. It was adjusted for two people with a disabled right upper extremity. The study had two stages. In the first, a computer human model with a visualization of maximal arm reach and preferred workspace was used to develop a preliminary modification of a virtual workstation. In the second stage, an immersive VR environment was used to assess the virtual workstation and to add further modifications. All modifications were assessed by measuring the efficiency of work and the number of movements involved. The results of the study showed that a computer simulation could be used to determine whether a worker with a disability could access all important areas of a workstation and to propose necessary modifications.

- **Keywords:** virtual reality, people with disabilities, adaptation of workstation

Hilma Raimona Zadry, Siti Zawiah Md Dawal & Zahari Taha. *Development of statistical models for predicting muscle and mental activities during repetitive precision tasks.* Pages 374-383.

This study was conducted to develop muscle and mental activities on repetitive precision tasks. A laboratory experiment was used to address the objectives. Surface electromyography was used to measure muscle activities from eight upper limb muscles, while electroencephalography recorded mental activities from six channels. Fourteen university students participated in the study. The results show that muscle and mental activities increase for all tasks, indicating the occurrence of muscle and mental fatigue. A linear relationship between muscle activity, mental activity and time was found while subjects were performing the task. Thus, models were developed using those variables. The models were found valid after validation using other students' and workers' data. Findings from this study can contribute as a reference for future studies investigating muscle and mental activity and can be applied in industry as guidelines to manage muscle and mental fatigue, especially to manage job schedules and rotation.

- **Keywords:** electromyography, electroencephalography, muscle activity, mental activity, precision task

Leena Korpinen & Rauno Pääkkönen. *Occupational exposure to electric and magnetic fields during tasks at ground or floor level at 110 kV substations in Finland.* Pages 384-388.

The aim was to investigate occupational exposure to electric and magnetic fields during tasks at ground or floor level at 110 kV substations in Finland and to compare the measured values to Directive 2013/35/EU. Altogether, 347 electric field measurements and 100 magnetic field measurements were performed. The average value of all electric fields was 2.3 kV/m (maximum 6.4 kV/m) and that of magnetic fields was 5.8 μ T (maximum 51.0 μ T). It can be concluded that the electric and magnetic field exposure at ground or floor level is typically below the low action levels of Directive 2013/35/EU. The transposition of the directive will not create new needs to modify the work practice of the evaluated tasks, which can continue to be performed as before. However, for workers with medical implants, the exposure may be high enough to cause interference.

- **Keywords:** electric fields, magnetic fields, exposure, substations

Ezrin Hani Sukadarin, Baba Md Deros, Jaharah A. Ghani, Nur Syazwani Mohd Nawi & Ahmad Rasdan Ismail. *Postural assessment in pen-and-paper-based observational methods and their associated health effects: a review. Pages 389-398.*

Introduction. This review describes standardized ergonomics assessment based on pen-and-paper observational methods for assessing ergonomics risk factors. **Objective.** The three main objectives are to analyze published pen-and-paper observational methods, to extract and understand the risk levels of each method and to identify their associated health effects. **Methodology.** The authors searched scientific databases and the Internet for materials from 1970 to 2013 using the following keywords: ergo, posture, method, observational, postural angle, health effects, pain and diseases. Postural assessments of upper arms, lower arms, wrists, neck, back and legs in six pen-and-paper-based observational methods are highlighted, extracted in groups and linked with associated adverse health effects. **Results.** The literature reviewed showed strengths and limitations of published pen-and-paper-based observational methods in determining the work activities, risk levels and related postural angles to adverse health effects. This provided a better understanding of unsafe work postures and how to improve these postures. **Conclusion.** Many pen-and-paper-based observational methods have been developed. However, there are still many limitations of these methods. There is, therefore, a need to develop a new pen-and-paper-based observational method for assessing postural problems.

- **Keywords:** posture, observational method, risk factors, health effects

Bijetri Bandyopadhyay & Devashish Sen. *Assessment of energy balance against the nutritional status of women carriers in the brickfields of West Bengal. Pages 399-404.*

The Indian brick industry is an unorganized sector in which large numbers of migrant women workers are employed. A survey was conducted on 62 women workers working in different brickfields of West Bengal to assess their physiological workload, nutritional profile, total energy expenditure and energy balance. Energy intake was calculated using physiological fuel values of carbohydrate, fat and protein. From the results it is seen that 13% of the sample population falls under severe (grade III) chronic energy deficiency. The average daily consumption of the workers was comparatively lower than their daily energy expenditure, considering the nature of the job which falls under heavy to extremely heavy categories. This negative energy balance is effectively observed in the nutritional anthropometry data. Thus, an immediate ergonomics intervention with better nutrition should be implemented to improve the health status of the workers so they can safely continue to work for a longer period.

- **Keywords:** brickfield, carriers, nutrition, heart rate, energy expenditure, energy balance

Bankole K. Fasanya. *Effects of multitasking on operator performance using computational and auditory tasks.* Pages 405-413.

This study investigated the effects of multiple cognitive tasks on human performance. Twenty-four students at North Carolina A&T State University participated in the study. The primary task was auditory signal change perception and the secondary task was a computational task. Results showed that participants' performance in a single task was statistically significantly different from their performance in combined tasks: (a) algebra problems (algebra problem primary and auditory perception secondary); (b) auditory perception tasks (auditory perception primary and algebra problems secondary); and (c) mean false-alarm score in auditory perception (auditory detection primary and algebra problems secondary). Using signal detection theory (SDT), participants' performance measured in terms of sensitivity was calculated as -0.54 for combined tasks (algebra problems the primary task) and -0.53 auditory perceptions the primary task. During auditory perception tasks alone, SDT was found to be 2.51. Performance was 83% in a single task compared to 17% when combined tasks.

- **Keywords:** multitasking, background noise tolerance level (BNTL), acoustic chamber, psychophysical, signal detection theory (SDT)

Abolfazi Ghahramani. *An investigation of safety climate in OHSAS 18001-certified and non-certified organizations.* Pages 414-421.

any organizations worldwide have implemented Occupational Health and Safety Assessment Series (OHSAS) 18001 in their premises because of the assumed positive effects of this standard on safety. Few studies have analyzed the effect of the safety climate in OHSAS 18001-certified organizations. This case-control study used a new safety climate questionnaire to evaluate three OHSAS 18001-certified and three non-certified manufacturing companies in Iran. Hierarchical regression indicated that the safety climate was influenced by OHSAS implementation and by safety training. Employees who received safety training had better perceptions of the safety climate and its dimensions than other respondents within the certified companies. This study found that the implementation of OHSAS 18001 does not guarantee improvement of the safety climate. This study also emphasizes the need for high-quality safety training for employees of the certified companies to improve the safety climate.

- **Keywords:** occupational health and safety management system, OHSAS implementation, safety climate, safety training, manufacturing

Nidhi A. Shah, Apurv P. Shimpi, Savita A. Rairikar, Shyam Ashok & Parag K. Sancheti. *Presence of scapular dysfunction in dominant shoulder of professional guitar players.* Pages 422-425.

Background. Playing guitar can cause adoption of asymmetric postures and affect the shoulder's stability. **Objective.** To assess the presence of scapular dysfunction in professional guitar players. **Method.** A lateral scapular slide test was performed at the level of the spine of the scapula and at the inferior angle of the scapula in 20 professional guitar players (age: 18–40 years) and was compared with 20 age-matched non-players at angles of 0° , 45° and 90° of shoulder abduction with both limbs loaded with 0.5-kg weights. Analysis was done by unpaired t test. **Results.** Scapular dysfunction in guitar players was seen in the form of asymmetric scapula at rest in 25% and dyskinetic scapula in 20% of players. 100% of non-players had normal scapular positioning. Comparison at the level of the spine of the scapula showed no significant difference ($p > 0.05$), but the inferior angle showed a significant difference at 0° (1.37 cm), 45° (1.93 cm) and 90° (2.15 cm) which was more in the player's category ($p < 0.05$).

Conclusion. There exists a marked dysfunction of scapular stabilizers in professional guitar players at the level of the inferior angle of the scapula.

- **Keywords:** guitar players, asymmetry, dyskinesia, dominant shoulder

Abdolrasoul Rahmani, Farideh Golbabaei, Somayeh Farhang Dehghan, Adel Mazlomi & Arash Akbarzadeh. *Assessment of the effect of welding fumes on welders' cognitive failure and health-related quality of life.* Pages 426-432.

Introduction. This study examined whether cognitive symptoms and health-related quality of life can be affected by welding fume exposure. **Method.** Participants consisted of welders (n = 40) and welder assistants (n = 25) from welding units as the exposed group, and office workers (n = 44) as the non-exposed group. All participants were studied using ambient air monitoring and two types of questionnaires: the Cognitive Failures Questionnaire (CFQ) and the 36-item Short Form Health Survey (SF-36). **Results.** Welders and welder assistants were exposed to higher concentrations of all airborne metals than office employees, except for aluminum and chromium ($p < 0.05$). Mean (95% confidence interval) CFQ score was higher in welders (26.42 (12.74)) compared with welder assistants (22.68 (14.37)) and the non-exposed group (21.38 (8.75)), although these differences were not statistically significant. Mean total score of the SF-36 significantly differed among the three groups ($p < 0.05$) and welders had the lowest score (M (SD) = 54.84 (17.88)). The relationships between total CFQ score and the measured concentration of nickel at peak work rate was significant for welders. **Conclusion.** Cognitive symptoms and health-related quality of life were not related to the measures of welding fume exposure and further research should be performed to find other influencing factors.

- **Keywords:** welding fume, ambient air assessment, cognitive failures, health-related quality of life

Nor Azali Azmir, Mohd Imran Ghazali, Musli Nizam Yahya & Mohamad Hanafi Ali. *Hand-arm vibration disorder among grass-cutter workers in Malaysia.* Pages 433-438.

Introduction. Prolonged exposure to hand-transmitted vibration from grass-cutting machines has been associated with increasing occurrences of symptoms and signs of occupational diseases related to hand–arm vibration syndrome (HAVS). **Methods.** A cross-sectional study was carried out using an adopted HAVS questionnaire on hand–arm vibration exposure and symptoms distributed to 168 male workers from the grass and turf maintenance industry who use hand-held grass-cutting machines as part of their work. The prevalence ratio and symptom correlation to HAVS between high and low–moderate exposure risk groups were evaluated. **Results.** There were positive HAVS symptoms relationships between the low–moderate exposure group and the high exposure group among hand-held grass-cutting workers. The prevalence ratio was considered high because there were indicators that fingers turned white and felt numb, 3.63, 95% CI [1.41, 9.39] and 4.24, 95% CI [2.18, 8.27], respectively. Less than 14.3% of workers stated that they were aware of the occupational hand–arm vibration, and it seemed to be related to the finger blanching and numbness. **Conclusion.** The results suggest that HAVS is under-diagnosed in Malaysia, especially in the agricultural sectors. More information related to safety and health awareness programmes for HAVS exposure is required among hand-held grass-cutting workers.

- **Keywords:** hand–arm vibration syndrome, hand-held grass cutter, prevalence

Dejana Dejanović & Milenko Heleta. *An airport occupational health and safety management system from the OHSAS 18001 perspective*. Pages 439-447.

Occupational health and safety represents a set of technical, medical, legal, psychological, pedagogical and other measures with the aim to detect and eliminate hazards that threaten the lives and health of employees. These measures should be applied in a systematic way. Therefore, the aim of this study is to review occupational health and safety legislation in Serbia and the requirements that airports should fulfill for Occupational Health and Safety Assessment Series certification. Analyzing the specificity of airport activities and injuries as their outcomes, the article also proposes preventive measures for the health and safety of employees. Furthermore, the airport activities which are the most important from the standpoint of risks are defined, as the goals for occupational health and safety performance improvement.

- **Keywords:** airport, occupational health and safety management system, Occupational Health and Safety Assessment Series 18001 requirements