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Case Report

Job Hazard Analyses for Musculoskeletal Disorder Risk Factors in Pressing Operations of Dry-cleaning Establishments

Jung-Keun Park*

Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency, Ulsan, Republic of Korea

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ABSTRACT

Job hazard analyses were conducted to assess exposure to musculoskeletal disorder (MSD) risk factors in seven workers of three dry-cleaning establishments. In accordance with the Washington State Ergonomics Rule, the analyses were performed in two separate steps: (1) observation and checklist approaches were made to identify a "caution zone job" in the seven workers' pressing operations across the three shops; and (2) detailed posture and motion analyses were undertaken to determine a "MSD hazard" in one worker's operation at a personal computer. A "caution zone job" was the pressing operation job in which five MSD risk factors were found in the pressing operations. The detailed analyses confirmed that a "MSD hazard", i.e., awkward posture in shoulders, was prevalent in the pressing operations of the three dry-cleaning facilities. It would be desirable to reduce MSD risk factors including awkward shoulder posture in the dry-cleaning industry.

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1. Introduction

Dry cleaning is predominantly a small business industry that consists of approximately 36,000 shops in the US [1]. Most of these shops employ one to four workers who are exposed to a variety of risk factors [2,3].

Exposure to awkward postures and repetitive motions for prolonged periods can lead to a variety of potentially disabling injuries and disorders of musculoskeletal tissues and/or peripheral nerves [4]. Ergonomic stressors in the dry-cleaning industry are visible among workers performing pressing operations, which are dynamic and repetitive tasks requiring reaching, precision gripping, maintenance of awkward postures, and long standing [5–8].

Musculoskeletal disorder (MSD) incidence rate was 80.5 cases per 10,000 full-time workers (FTW) for laundry and dry-cleaning workers in the US in 2011, which was quite higher than that (38.5 cases per 10,000 FTW) for all occupations [9]. In 2014, compared with the incidence rates of carpal tunnel syndrome (0.7 cases per 10,000 FTW) and tendonitis (0.2 cases per 10,000 FTW) for all occupations in the country, those rates for laundry and dry-cleaning workers were 5.7 and 7 times higher, respectively [10], indicating that MSDs of pressing operation workers have drawn attention to the dry-cleaning industry.

There was an effort to characterize exposure to MSD risk factors in the pressing operations of several dry-cleaning shops in the early of 2000s [6]. The effort was made because, despite high incidence rates of MSDs for the laundry and dry-cleaning workers, there was, even today, little scientific documentation of ergonomic hazard analyses in the dry-cleaning sector. In fact, the incidence rate of injuries and illnesses was also higher in the laundry, cleaning, and garment services sector than that in private industry of the US in 2000 [11]. In this regard, it is likely desirable to document and inform the effort work performed in the dry-cleaning shops.

This study aimed to document job hazard analyses which were conducted to identify physical risk factors for MSDs in the pressing operations of three dry-cleaning establishments and suggest recommendations for reducing the risk factors identified.

* Corresponding author. Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency, 400 Jongga-Ro (Bukjung-Dong), Joong-Gu, Ulsan 44429, Republic of Korea.
E-mail address: ergo.jkpark@gmail.com (J.-K. Park).

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2. Methods

2.1. Study and participants

This study was part of a capstone project for a master program at the University of Massachusetts Lowell [6]. Ergonomic job hazard analyses were undertaken by assessing exposure to MSD risk factors at three dry-cleaning establishments in Massachusetts, USA. The three shops were randomly selected through telephone contacts and seven workers voluntarily participated in the study. The seven individuals, two or three workers from each facility, were those working in pressing operations and had experiences in pressing for 2 years or more.

2.2. Methods

2.2.1. General

A variety of information, including the participants' anthropometry and workstation dimension data, was gathered through walkthroughs and interviews during the capstone project. Job hazard analyses were performed in accordance with part of Washington Administrative Codes (WACs) under the Washington State Ergonomics Rule (WA Rule; WAC 296-62-051) [12]. For the analyses, three WACs were employed: WAC 296-62-05105 (CZ Checklist: What is a "caution zone job"?); WAC 296-62-05130 (What options do employers have for analyzing and reducing work-related MSD hazards?); and WAC 296-62-05174 (HZ Checklist; Appendix B: Criteria for analyzing and reducing work-related MSD hazards for employers who choose the Specific Performance Approach). The WA Checklists were selected in that they were simply enabled for use in ergonomic hazard analyses [6,13]. Validity and repeatability of the Checklists, along with utility aspects, were addressed elsewhere [14–17].

In this study, a "caution zone job" was defined as a job where the workers' typical work activities included any physical risk factors as specified in the CZ Checklist (Table 1). A "MSD hazard" was defined as a hazard, based on the HZ Checklist where a criterion is stated for each of 21 physical risk factors, in that all of the conditions relating to a physical risk factor were present in the caution zone job identified. A MSD hazard was excluded in cases where it was present in less than three workers' operations.

2.2.2. Job hazard analysis

The job hazard analyses were conducted in two steps. Step 1 included assessing exposure to MSD risk factors using observation and checklist approaches at the workplaces. The seven participants' work activities were directly observed to seek the physical risk factors for MSDs during a typical production shift at the three dry-cleaning shops. As any physical risk factors of a caution zone job were found using the CZ Checklist and, according to the Specific Performance Approach of the WAC 296-62-01530, the criterion of a MSD hazard was examined using the HZ Checklist accordingly. Once a MSD hazard was visually identified, it was regarded as a MSD hazard candidate for future analyses.

Step 2 is only for the MSD risk factors of both the caution zone job and MSD hazard candidates which were identified in Step 1. The workers' activities were videotaped using a video technique for detailed analyses at a personal computer (PC). At least five work cycles were videotaped at each worker's own workstation across the seven participants' pressing operations. A work cycle was defined as the time interval to complete a pressing operation for a garment. The videotaping data were intended for work sampling as well. Videotaping and motion analysis were made according to both National Institute for Occupational Safety and Health and Occupational Safety and Health Administration guidelines [18,19]. A video camera (DCR-TRV230, Sony, Japan) was used for

Table 1
Physical risk factors characterized for use in this study

Physical risk factor	
Description	Criterion*
Awkward posture in head or shoulder (posture: shoulder raising)	Working with the hand(s) above the head or the elbow(s) above the shoulder more than 2 h/d
Awkward posture in neck or back (posture: back 30°)	Working with the neck or back bent more than 30°(without support or the ability to vary posture) more than 2 h/d
Awkward posture in squatting (posture: squatting)	Squatting more than 2 h/d
Awkward posture in kneeling (posture: kneeling)	Kneeling more than 2 h/d
Heavy, frequent, or awkward lifting (force: heavy lifting)	Lifting objects weighing more than 34 kg once per d or more than 25 kg more than 10 times/d
Heavy, frequent, or awkward lifting (force: frequent lifting)	Lifting objects weighting more than 4.5 kg if done more than twice per min more than 2 h/d
Heavy, frequent or awkward lifting (force: awkward lifting)	Lifting objects weighting more than 11 kg above the shoulders, below the knees, or at arm length more than 25 times/d
High hand force in pinching (force: pinching)	Pinching an unsupported object weighing 1 kg or more per hand, or pinching with a force of 2 kg or more per hand, more than 2 h/d (comparable to pinching half a ream of paper)
High hand force gripping (force: gripping)	Gripping an unsupported object weighing 4.5 kg or more per hand, or gripping with a force of 4.5 kg or more per hand more than 2 h/d (comparable to clamping light duty automotive jumper cables onto a battery)
Highly repetitive motion in upper extremities (repetition: repeating)	Repeating the same motion with the neck, shoulders, elbows, wrists, or hands (excluding keying activities) with little or no variation every few s more than 2 h/d
Highly repetitive motion in keying (repetition: keying)	Performing intensive keying more than 2 h/d
Repeated impact (impact)	Using the hand (heel/base of palm) or knee as a hammer more than 10 times/h more than 2 h/d
Moderate to high hand-arm vibration (vibration: high)	Using impact wrenches, carpet strippers, chain saws, percussive tools (jack hammer, scalers, riveting, or chipping hammers) or other hand tools that typically have high vibration levels more than 30 min/d
Moderate to high hand-arm vibration (vibration: moderate)	Using grinders, sanders, jig saws, or other hand tools that typically have moderate vibration levels more than 2 h/d

* Specified in Washington Administrative Code 296-62-05105.

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