

## Comparison of Work-Related Musculoskeletal Disorders between Sedentary Work and Standing Work in Korea

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### **Abstract**

*Work-related musculoskeletal disorders are known as chronic health hazards in the musculoskeletal system, resulting from minute injuries mainly in the joint regions and caused by repetitive manual work, inconvenient and awkward working postures, high labor intensity, excessive force, insufficient rest, cold working environments, or vibrations.*

*The purpose of the present study is to judge whether low back pain and other musculoskeletal symptoms appear more significantly in sedentary work or standing work. The present study was conducted with 109 production workers of an electronic product manufacturing business that implement assembling processes along the flow of conveyor belts with typical sedentary work for eight working hours per day. In addition, it also included 116 production workers of a car component manufacturing business located in Gyeonggi-do that implement assembling processes in cell lines with typical standing work for eight working hours per day.*

*More sedentary workers were shown to be pain complainants (21.1%) and management targets (54.1%) that felt pain in at least one region. Many complained of pain in the shoulder (15.6%) and the percentage of management targets among them was shown to be higher than standing workers were. As almost 70% of standing workers experiencing many physical burdens were shown to be healthy, except for those who were shown to be pain complainants, standing work is assumed to have healthy effects. As well, given that only 24.8% of sedentary workers were shown to be normal, sedentary workers should be managed through appropriate exercise therapy or health management.*

**Keywords:** *Sedentary work, Standing work, Work-related musculoskeletal disorder*

### **1. Introduction**

Work-related musculoskeletal disorders are known as chronic health hazards in the musculoskeletal system, resulting from minute injuries mainly in the joint regions and caused by repetitive manual work using certain body parts, inconvenient and awkward working postures, high labor intensity, excessive force, insufficient rest, cold working environments, or vibrations that eventually lead to pain and paresthesia [1-2].

Work-related musculoskeletal disorders have been the most common occupation-related diseases that are caused and aggravated by work-related factors and diverse factors, such as stress. Physical stress is affected by psychosocial factors, demographic factors, and lifestyles [3-4].

According to the criteria for the recognition of occupational diseases in South Korea, work-related musculoskeletal disorders are ‘diseases occurred in the musculoskeletal system.’ These are recognized as occupational diseases when musculoskeletal disorders have occurred or have been aggravated in the arms, legs, or

waists of workers that have been engaged in any work recognized to have imposed a burden on the musculoskeletal system. This is judged based on the periods of time and hours during which the workers were engaged in the work, the amount and intensity of the work, work performing postures and speed, and the structures of workplaces (work that imposes burdens on the body). This work could involve many repetitive motions, require the application of excessive force, performance in inappropriate postures, vibration work, and work performed while imposing burdens on certain body parts. Provided, musculoskeletal disorders that occurred due to other causes unrelated to work are not regarded as occupational diseases. In addition, musculoskeletal disorders caused by momentary radical actions of force that occurred in the process of performing work that imposes burdens to the body are regarded as occupational diseases also [5].

To review recent occurrences of musculoskeletal disorders in South Korea, the numbers of cases of musculoskeletal disorders have steadily increased since 1996 to reach 5,593 in 2006, accounting for 61.4% of occupational diseases (6.2% of all disasters). This number was 5,502 in 2010, accounting for 70.5% of occupational diseases (5.6% of all disasters) and resulting in continuous increases in the musculoskeletal disorders' share of occupational diseases. Work-related musculoskeletal disorders have been a major problem in the area of industrial safety and health due to occurrences in workplaces and rapid increases in the number of industrial disaster victims. These problems act as a major factor in labor-management conflicts in the manufacturing industries, such as the automobile manufacturing industry, the shipbuilding industry, and the heavy industry, to come to the fore as a social issue [6].

The purpose of the present study is to judge whether low back pain and other musculoskeletal symptoms appear more significantly in sedentary work or standing work, through questionnaires regarding work-related musculoskeletal symptoms on sedentary workers in the electronic product manufacturing industry and standing workers in the automobile manufacturing industry. In addition, it will provide basic data for the management of work types.

## 2. Methods

### 2.1 Subjects

The present study was conducted with 110 production workers of an electronic product manufacturing business located in Gyeonggi-do that implement assembling processes along the flow of conveyor belts with typical sedentary work for eight working hours per day among 366 workers. In addition, it also included 120 production workers of a car component manufacturing business located in Gyeonggi-do that implement assembling processes in cell lines with typical standing work for eight working hours per day among 181 workers (Figure 1, 2).



**Figure 1. Sedentary Work**



**Figure 2. Standing Work**

## 2.2 Methods

In the present study, questionnaires were prepared using the symptom survey table under the KOSHA CODE H-30-2008 musculoskeletal system burdening work's harmful factor survey guidelines of the Korea Occupational Safety & Health Agency, used in the periodic musculoskeletal system burdening work's harmful factor survey conducted in 2007. When the questionnaire survey was conducted using the symptom survey table, agreement was obtained from the workers and safety and health managers at the workplaces. The purpose and method were also educated, and questionnaires were made to be completed on the spot and collected [7].

In total, 230 questionnaires - 110 from electronic product manufacturing industry workers who were performing sedentary work, and 120 from car component manufacturing industry workers were collected. Five questionnaires with inaccurate answers were removed, and 109 questionnaires from electronic product manufacturing industry workers and 116 questionnaires from standing work workers were used as final subjects.

General and occupational characteristics were surveyed and subjective work-related musculoskeletal symptoms were surveyed using the musculoskeletal symptom questionnaire (musculoskeletal system burdening work's harmful factor survey guidelines, KOSHA Code H-30-2008) [7]. According to the criteria for the classification of subjective work-related musculoskeletal symptoms, those who had any work-related symptom in any part of the body, appearing at least once per month, or persisting for at least one week during the last one year with moderate or severe pain were indicated as management targets. Those who had any work-related symptom in any part of the body appearing at least once per month, or persisting for at least one week during the last one year with severe pain were indicated as pain complainants, and other workers were indicated as normal workers.

## 2.3 Statistical Analysis

The collected data were encoded and statistically processed using the SPSS 18.0 program. To examine general characteristics, occupational characteristics, and differences in the rates of complaints of subjective musculoskeletal symptoms by body part, continuous variables were analyzed using t-tests and categorical variables were analyzed using chi-squared tests.

## 3. Results

With regard to general characteristics, as for age, standing workers showed a higher mean age (37.3 years) and as for gender, whereas sedentary workers consisted of males (n; 40) and females (n; 69), standing workers consisted of only males. As for marital

status, sedentary workers included more married individuals, accounting for 72 (66.1%). As for career, sedentary workers showed longer careers amounting to 10.3 years on average, and as for working hours, both workers were shown to work approximately 9.3 hours per day (Table 1).

**Table 1. General Characteristics of Subjects**

| Variable              | Sedentary work(n=109) | Standing work(n=116) |
|-----------------------|-----------------------|----------------------|
|                       | n(%) or M±SD          | n(%) or M±SD         |
| <b>Age (yr)</b>       | 32.0±6.9              | 37.3±9.2             |
| <b>Gender</b>         |                       |                      |
| <b>Male</b>           | 40(36.7)              | 116(100)             |
| <b>Female</b>         | 69(63.3)              | -                    |
| <b>Marital Status</b> |                       |                      |
| <b>Married</b>        | 72(66.1)              | 68(58.6)             |
| <b>Unmarried</b>      | 37(33.9)              | 48(41.4)             |
| <b>Career</b>         | 10.3±4.6              | 5.9±5.6              |
| <b>Working hours</b>  | 9.3±1.4               | 9.3±2.1              |

M±SD: Mean±Standard deviation

The characteristics of sedentary work and standing work were compared. As shown in Table 2, standing workers were shown to complain of more physical burdens than sedentary workers, as higher percentages of them indicated that physical burdens were hard (48.7%) or very hard (13.0%). This is considered attributable to the fact that car component manufacturing industry workers handle more heavy items (muffler; 15 kg) than electronic product manufacturing industry workers. Similar results are expected from most standing work because more heavy items are handled during standing work because of the characteristics of the work.

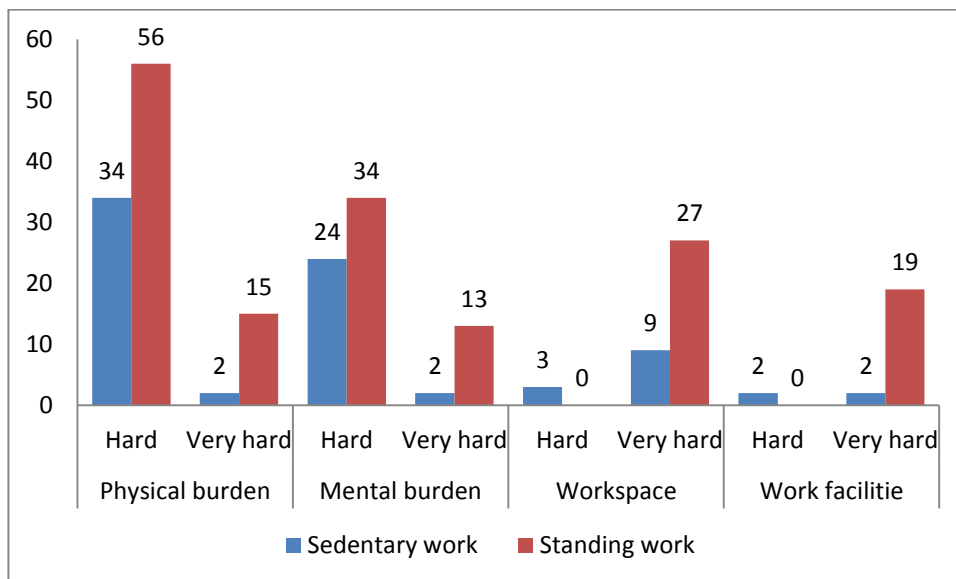
Standing workers were also shown to complain of more mental burdens than sedentary workers, as higher percentages of them indicated that mental burdens were hard (29.3%) or very hard (11.2%). This is considered attributable to the characteristics of business types, consisting of conveyor lines and cell lines, rather than sedentary work or standing work. Stress related to product inspection is assumed to be higher in the case of cell lines compared to conveyors because welding, assembling, and inspection are performed within one process in the case of cell lines.

Standing workers were also shown to feel harder work in relation to workspaces and work facilities because higher percentages indicated hard (52.2%) or very hard (23.5%) in relation to workspaces and hard (48.7%) or very hard (16.5%) in relation to work facilities. This is considered attributable to the poorer working environments of the car component industry than the electronic product manufacturing industry because of the nature of the industry (Table 2, Figure 3).

**Table 2. A Comparison of the Characteristics of Work in Each Group**

| Variable               | Group                     |                          | $\chi^2$ | p     |
|------------------------|---------------------------|--------------------------|----------|-------|
|                        | N(%)                      |                          |          |       |
|                        | Sedentary work<br>(n=109) | Standing work<br>(n=116) |          |       |
| <b>Physical burden</b> |                           |                          |          |       |
| Easy                   | 8(7.3)                    | 1(0.9)                   | 25.1     | .000* |
| Average                | 65(59.6)                  | 43(37.4)                 |          |       |
| Hard                   | 34(31.2)                  | 56(48.7)                 |          |       |
| Very hard              | 2(1.8)                    | 15(13.0)                 |          |       |
| <b>Mental burden</b>   |                           |                          |          |       |
| Very easy              | 1(0.9)                    | 1(0.9)                   | 17.0     | .002* |
| Easy                   | 10(9.3)                   | 1(0.9)                   |          |       |
| Average                | 71(65.7)                  | 67(57.8)                 |          |       |
| Hard                   | 24(22.2)                  | 34(29.3)                 |          |       |
| Very hard              | 2(1.9)                    | 13(11.2)                 |          |       |
| <b>Workspace</b>       |                           |                          |          |       |
| Very easy              | 3(2.8)                    | -                        | 40.9     | .000* |
| Easy                   | 6(5.5)                    | 2(1.7)                   |          |       |
| Average                | 63(57.8)                  | 26(22.6)                 |          |       |
| Hard                   | 28(25.7)                  | 60(52.2)                 |          |       |
| Very hard              | 9(8.3)                    | 27(23.5)                 |          |       |
| <b>Work facilitie</b>  |                           |                          |          |       |
| Very easy              | 2(1.9)                    | -                        | 45.7     | .000* |
| Easy                   | 7(6.6)                    | 2(1.7)                   |          |       |
| Average                | 74(69.8)                  | 38(33.0)                 |          |       |
| Hard                   | 21(19.8)                  | 56(48.7)                 |          |       |
| Very hard              | 2(1.9)                    | 19(16.5)                 |          |       |

\*p<.05



**Figure 3. A Comparison of the Characteristics of Work in Each Group**

Subjective work-related musculoskeletal symptoms were compared. As shown in Table 3, higher percentages of standing workers complained of pain in the neck (6.9%), arm/elbow (6.9%), hand/wrist/finger (8.6%), waist (6.9%), and leg/foot (9.5%) regions. This is considered attributable to the larger physical burdens in standing work.

Given the percentages of pain complainants (24.1%) and management targets (6.0%) that felt pain in at least one region among standing workers, it is assumed that many standing workers feel pain during or after work and have musculoskeletal disorders that must be treated, but most of them are healthy in their musculoskeletal systems.

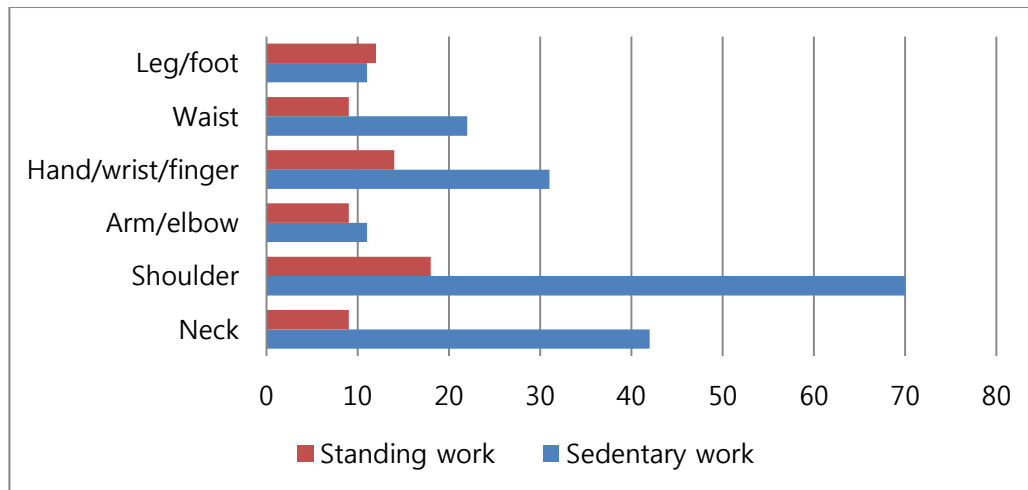
However, more sedentary workers were shown to be pain complainants (21.1%) and management targets (54.1%) that felt pain in at least one region. Many complained of pain in the shoulder (15.6%) and the percentage of management targets among them was shown to be higher than standing workers (Table 3, Figure 4).

**Table 3. A Comparison of the Musculoskeletal Symptoms in Each Group**

| Body region        | Group                     |                          | $\chi^2$ | p     |
|--------------------|---------------------------|--------------------------|----------|-------|
|                    | Sedentary work<br>(n=109) | Standing work<br>(n=116) |          |       |
|                    | N(%)                      |                          |          |       |
| Neck               |                           |                          |          |       |
| Normal             |                           |                          |          |       |
| Management targets | 67(61.5)                  | 107(92.2)                | 42.4     | .000* |
| Pain complainants  | 36(33.0)                  | 1(0.9)                   |          |       |
|                    | 6(5.5)                    | 8(6.9)                   |          |       |
| Shoulder           |                           |                          |          |       |
| Normal             |                           |                          |          |       |
| Management targets | 39(35.8)                  | 98(84.5)                 | 70.0     | .000* |
| Pain complainants  | 53(48.6)                  | 3(2.6)                   |          |       |
|                    | 17(15.6)                  | 15(12.9)                 |          |       |
| Arm/elbow          |                           |                          |          |       |
| Normal             |                           |                          |          |       |
| Management targets | 98(89.9)                  | 108(93.1)                | 12.9     | .002* |
| Pain complainants  | 9(8.3)                    | -                        |          |       |
|                    | 2(1.8)                    | 8(6.9)                   |          |       |
| Hand/wrist/finger  |                           |                          |          |       |
| Normal             |                           |                          |          |       |
| Management targets | 78(71.6)                  | 102(87.9)                | 22.6     | .000* |
| Pain complainants  | 27(24.8)                  | 4(3.4)                   |          |       |
|                    | 4(3.7)                    | 10(8.6)                  |          |       |
| Waist              |                           |                          |          |       |
| Normal             |                           |                          |          |       |
| Management targets | 87(79.8)                  | 107(92.2)                | 22.7     | .000* |
| Pain complainants  | 20(18.3)                  | 1(0.9)                   |          |       |
|                    | 2(1.8)                    | 8(6.9)                   |          |       |
| Leg/foot           |                           |                          |          |       |
| Normal             |                           |                          |          |       |
| Management targets | 98(89.9)                  | 104(89.7)                | 10.0     | .007* |
| Pain complainants  | 8(7.3)                    | 1(0.9)                   |          |       |
|                    | 3(2.8)                    | 11(9.5)                  |          |       |

|                     |          |          |      |       |
|---------------------|----------|----------|------|-------|
| At least one region |          |          |      |       |
| Normal              | 27(24.8) | 81(69.8) |      |       |
| Management targets  | 59(54.1) | 7(6.0)   | 68.3 | .002* |
| Pain complainants   | 23(21.1) | 28(24.1) |      |       |

\*p<.05



**Figure 4. A Comparison of the Musculoskeletal Symptoms in Each Group**

#### 4. Discussion

The present study was conducted to determine differences in working conditions between sedentary work and standing work, and to examine resultant distributions of work-related musculoskeletal system pain. Through the present study, differences in working conditions between sedentary work and standing work, and resultant distributions of subjective musculoskeletal symptoms by body part were identified.

As heavy items exceeding 5 kg in weight cannot be handled in most sedentary work and since the ranges of movements of most sedentary workers are smaller compared to standing workers, standing workers seem to feel more physical burdens than sedentary workers. In the results of the present study, standing workers showed a higher percentage of pain complaints. However, many sedentary workers were shown to complain of pain in the shoulder because they make static movements repeatedly, and these results were shown to be consistent with the results of studies conducted with patients with VDT syndrome and other sedentary workers that performed static work [8-9].

Given that many sedentary workers were shown to be management targets in the present study, many workers should feel pain during sedentary work that involves fewer physical burdens than standing work and if they are not managed well, they may become pain complainants. In addition, as other studies on work-related musculoskeletal disorders reported that job stress had significant effects on subjective symptoms, sedentary workers that perform elaborate works may have been affected by such stress [10-12].

As almost 70% of standing workers experiencing many physical burdens were shown to be healthy, except for those who were shown to be pain complainants, standing work is assumed to have healthy effects. As well, given that only 24.8% of sedentary workers were shown to be normal, sedentary workers should be managed through appropriate exercise therapy or health management.

The present study has limitations because the works examined were performed neither in one workplace nor at the same time point, and the study was also conducted through questionnaires and was not an experimental study that conducted actual measurements in

actual workplaces, took videos, or examined muscle activity. However, it is considered meaningful as a study that compared musculoskeletal system symptoms between sedentary work and standing work, and the results are considered usable as basic data in managing workers' health according to work types.

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