

Factors that affect the muscular skeletal diseases of some industrial workers working in Changwon-si, Gyeongsangnam-do and the aspects of pain

In the present study, the general characteristics, job stress, working conditions, and aspects of pain of some industrial workers working in Changwon-si, Gyeongsangnam-do, were surveyed. In analyzing the relationship between job stress and the existence of pain, the variables “working speed” and “opportunities to develop abilities” were shown to have statistically significant relationships with the existence of pain ($p \leq .05$). Regarding the relationship between working conditions and the existence of pain, the variables “amount of work per hour,” “amount of work per day,” “number of parts handled during work,” “work production per person,” and “inconvenient postures or motions during work” were shown to have statistically significant relationships with the existence of pain ($P \leq .05$). Regarding aspects of pain, “within 1~3 years” was the most common answer to time of occurrence of symptoms, with a percentage of 27.6%; “appear almost always” was the most common answer to frequency of symptoms, with a percentage of 37.1%; “slight pain” was the most common answer to degree of pain, with a percentage of 50.5%; and “moderate” was the most common answer to encumbrance caused by pain to living and work, with a percentage of 41.2%.

The aim of the present study was to determine the factors that affect pain due to musculoskeletal diseases in industrial workers and to define the aspects of pain in order to provide basic data for the preparation of measures to prevent musculoskeletal diseases. To control pain due to musculoskeletal diseases, factors that affect pain, as well as the aspects of pain, should be recognized early, and efforts should be made to supplement and improve systems for preventing recurrence.

Key words: *Musculoskeletal Disease; Industrial Workers; Aspects of Pain*

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INTRODUCTION

In countries where industry has been developed, many automated and simplified working systems have been introduced, leading to an increase in cases of occupational musculoskeletal disorders among workers that cause the patients to complain of chronic pain and paresthesia in the scapular region and the hands(1, 2).

Work-related musculoskeletal disorders (WRMDs) refer collectively to musculoskeletal diseases caused by work-related external stress, leading to gradual damage to part of the body(3, 4). Related risk factors are diverse and vary

according to the individuals' physical characteristics, ergonomic risk factors, job stress, and work intensity levels(5). Personal characteristics such as aging, obesity, and smoking are known to be related to WRMDs. In addition, ergonomic factors such as repetitive work, mechanical stimuli, static or poor posture, and whole body or local vibrations; working environmental factors such as shiftwork, working hours, hours working at a video display terminal(VDT), and workload; and job stress are known to act in a complex manner on WRMDs(6).

The seriousness of WRMDs is illustrated by the fact that despite pain in the upper extremities and

the waist, damage to those parts of the body gradually intensifies when maintaining a livelihood under inadequate working environments, a lack of appropriate intervention or education, and increasing labor intensity(7). WRMDs were recognized as occupational diseases in 1960 by the International Labor Organization, and they came to the fore as one of the major industrial disaster issues in the 1980s in the USA and Europe(8, 9).

In South Korea, although accident rates are on track to decrease every year thanks to “no accident” movements and various activities to prevent safety accidents by the government and enterprises, yearly labor force losses due to industrial accidents are still at considerably high levels. Statistics Korea announced that the number of industrial accident cases in 2004 was 87,033, and the number of victims was 88,874(10).

Because of the high number of industrial accidents, the government passed regulations to prevent health hazards due to simple repetitive work or tasks that impose undue burdens on human bodies, under article 24(Actions for health care) in Chapter 4 Hazard and risk preventive actions of the Industrial Safety and Health Act and newly established Chapter 9 Prevention of health hazards due to tasks that impose burdens on the musculoskeletal system in the rules regarding industrial health care standards. In so doing, it is stipulated that surveys of harmful factors should be conducted, action should be taken to improve working environments, medical action should be taken, workers should be reminded of risks, musculoskeletal disease prevention and control programs should be carried out, and action should be taken regarding tasks involving heavy items(11).

Many studies have mainly presented ergonomic stress related to work postures, the degree of repetitive work, and design of working spaces as factors for WRMDs(12,13). Recently, however, the importance of psychosocial factors has been emphasized, and arguments have been presented stating that the high prevalence rate of musculoskeletal diseases does not stem as much from physical factors as previously thought(14). Therefore, the intent of the present study was to analyze factors that affect WRMDs and the resultant existence of pain in industrial workers with high prevalence rates of musculoskeletal disease symptoms and to examine the aspects of pain.

METHODS

Study subjects and period

The present study was conducted through structured questionnaires with workers of S Company, L Company, and G Company, which are industrial enterprises located in Changwon, Gyeongnam, from June 10 to July 10, 2015.

Study method

Questionnaires were distributed to the study subject enterprises, and 512 questionnaires were collected during the survey period. The questionnaires were composed by modifying and supplementing questionnaires for labor intensity and job stress, the aspects of pain in the medical musculoskeletal disease control program of Doosan Heavy Industries & Construction Co., Ltd., and the Ovako Working Posture Analysis System (OWAS)(8). The questionnaire consisted of 15 questions on the aspects of personal living, ten questions related to job content, 17 questions related to working environments, three questions related to work postures, and 11 questions on the aspects of pain.

Statistical processing

The collected data were organized, and after excluding 30 inadequate questionnaires, 482 questionnaires were subjected to frequency analyses, Pearson’s chi-square tests, and multiple response analyses through the SPSS statistical program, version 10.0. In the case of the Pearson chi-square tests, the significance level was $p \leq .05$.

Limitations of the study

First, the study region was limited. Second, factors such as different working environments of the survey subject enterprises cannot be made identical. Third, the survey subjects had difficulty understanding the questions due to insufficient recognition of working environmental types. Fourth, the content of the questionnaires was not sufficiently explained, leading to low degrees of understanding of the content by respondents. Fifth, questionnaire collection rates were low due to internal problems of the industrial enterprises during the questionnaire period.

RESULTS

General characteristics

Study subjects in their 30s made up the largest age group, at 53.1%, followed by 40s(39.4%), 20s or younger(6.1%), 50s or older(.8%), and no response(.4%). In terms of heights of the study subjects, the largest group was 171cm~175cm (32.4%), followed by 166~170cm(30.1%), 176cm~180cm(21.4%), 165cm or shorter(10.8%), 181cm or taller(4.6%), and no response(.8%). Subjects weighing 61kg~70kg made up the largest weight group(44.2%), followed by 71kg~80kg (33.6%), 81kg or heavier(10.3%), 51kg~60kg (10.2%), 50kg or lighter(.9%), and no response (.6%). In terms of marriage status, married subjects were the highest group, at 83.2%, followed by unmarried subjects at 16.4%, and no response at .4%.

Regarding the departments of the study subjects, those in the assembling department were the largest group(32.4%), followed by the painting department(22%), the car body department(13.9%), the quality control department(11%), the support department(10.8%), the engine department(9.1%), and office job(.8%). Regarding number of years of service, 11~15 years was the largest group(55.6%), followed by 5~10 years at(20.7%), 16~20 years (13.3%), 5 years or less(7.9%), 21 years or more (1.2%), and no response(1.2%). Permanent positions were the largest employment type group at 93.2%, compared with temporary positions at 6.4% and no response at .4%.

High school graduation was the largest level of education group(91.5%), followed by university graduation(6.2%), middle school graduation(1.2%), higher than university graduation(.6%), no response(.4%), and elementary school graduation (0%). Employees earning more than 40 million won made up the largest annual salary group (55%), followed by 30~40 million won(31.3%), 20~25 million won(6.6%), 25~30 million won (4.8%), and no response(2.3%).

Regarding amount of smoking in one month, no smoking was the largest group(51.7%), followed by 16~30 packs(23.4%), 15 or fewer packs(16%), and 31 or more packs(8.9%). For amount of drinking in one week, one bottle or less was the largest group (47.5%), followed by no drinking(19.7%), 1~2 bottles(18.7%), more than 2 bottles(13.3%), and no response(.8%). For the question regarding degree of fatigue, the answer "tired sometimes when pressed for time" was the most frequent at 32.8%,

followed by "chronically tired"(32.2%), "tired on days when workloads are heavy"(22.2%), "not sure" (11.8%), "not at all tired"(.6%), and no response (.4%). Regarding health condition, the answer "moderate" was the most frequent at 56.2%, followed by "a little poor"(20.33%), "healthy"(19.3%), "poor"(2.5%), "very healthy"(1.5%), and no response (.2%)(Table 1).

Table 1. General characteristics

Variable	Division	N	%
Age	20s or younger	31	6.4
	30s	256	53.1
	40s	190	39.4
	50s or older	4	.8
	No response	1	.2
	Total	482	100.0
Height	165cm or shorter	52	10.8
	166~170cm	145	30.1
	171~175cm	156	32.4
	176~180cm	103	21.4
	181cm or taller	22	4.6
	No response	4	.8
Total	482	100.0	
Weight	50kg or lighter	4	.8
	51~60kg	49	10.2
	61~70kg	213	44.2
	71~80kg	162	33.6
	81kg or heavier	51	10.6
	No response	3	.6
Total	482	100.0	
Marriage status	Unmarried	79	16.4
	Married	401	83.2
	No response	2	.4
	Total	482	100.0
Department	Support	52	10.8
	Quality control	53	11.0
	Assembling	156	32.4
	Car body	67	13.9
	Engine	44	9.1
	Painting	106	22.0
	Office job	4	.8
	No response	0	.0
	Total	482	100.0

Variable	Division	N	%
Number of years of service	5 years or less	38	7.9
	5~10 years	100	20.7
	11~15 years	268	55.6
	16~20 years	64	13.3
	21 years or longer	6	1.2
	No response	6	1.2
	Total	482	100.0
Employment type	Permanent position	449	93.2
	Temporary position	31	6.4
	No response	2	.4
	Total	482	100.0
Education level	Elementary school graduation	0	.0
	Middle school graduation	6	1.2
	High school graduation	441	91.5
	University graduation	30	6.2
	Higher than university graduation	3	.6
	No response	2	.4
	Total	482	100.0
Annual salary	20~25 million won	32	6.6
	25~30 million won	23	4.8
	30~40 million won	151	31.3
	More than 40 million won	265	55.0
	No response	11	2.3
	Total	482	100.0
Smoking amount	No smoking	249	51.7
	15 or fewer packs	77	16.0
	16~30 packs	113	23.4
	31 or more packs	43	8.9
	No response	0	0
	Total	482	100.0
Drinking volume	No drinking	95	19.7
	1 bottle or less	229	47.5
	1~2 bottles	90	18.7
	More than 2 bottles	64	13.3
	No response	4	.8
	Total	482	100.0

Variable	Division	N	%
Degree of fatigue	Chronically tired	155	32.2
	Tired sometimes when pressed for time	158	32.8
	Tired on days when workloads are heavy	107	22.2
	Not sure	57	11.8
	Not tired at all	3	.6
	No response	2	.4
	Total	482	100.0
Health conditions	Very healthy	7	1.5
	Healthy	93	19.3
	Moderate	271	56.2
	A little poor	98	20.3
	Poor	12	2.5
	No response	1	.2
	Total	482	100.0

Relationships between job stress and the existence of pain

Significant relationships were shown between job stress and the existence of pain. In the relationship between working speed and the existence of pain, when working speed was high, 90.9% of respondents answered that they felt pain and 9.1% of respondents answered that they felt no pain. When working speed was not high, 82.0% of respondents answered that they felt pain and 18.0% of respondents answered that they felt no pain. This difference was statistically significant ($p \leq .05$).

Regarding the relationship between opportunities for ability development and the existence of pain, when there were opportunities for ability development, 86.9% of respondents answered that they felt pain and 13.1% of respondents answered that they felt no pain. When there was no opportunity for ability development, 92.5% of respondents answered that they felt pain and 7.5% of respondents answered that they felt no pain. This difference was statistically significant ($p \leq .05$) (Table 2).

Relationships between the existence of pain and other factors, such as workload, right to decide, right to speak, knowledge acquisition, whether repeated, whether creativity was necessary, whether high-level techniques were necessary, and diverse tasks were not significant ($p > .5$).

Table 2. Relationships between job stress and the existence of pain

Variable	Division	Existence of pain		Total	p
		Yes(%)	No(%)		
Was the working speed increased?	Yes	391(90.9%)	39(9.1%)	430(100.0%)	.046
	No	41(82.0%)	9(18.0%)	50(100.0%)	
	Total	432(90.0%)	48(10.0%)	480(100.0%)	
Are opportunities for ability development given to you?	Yes	186(86.9%)	28(13.1%)	214(100.0%)	.045
	No	245(92.5%)	20(7.5%)	265(100.0%)	
	Total	431(90.0%)	48(10.0%)	479(100.0%)	

Relationships between working conditions and the existence of pain

Regarding relationships between working conditions and the existence of pain, when the hourly amount of work increased, 96.5% of respondents answered that they felt pain and 3.5% of respondents answered that they felt no pain. When the hourly amount of work did not increase, 87.7% of respondents answered that they felt pain and 12.3% of respondents answered that they felt no pain. This difference was statistically significant. Regarding relationships between daily amounts of work and the existence of pain, when the amount of work increased, 96.2% of respondents answered that they felt pain and 3.8% of respondents answered that they felt no pain. When the hourly amount of work did not increase, 88% of respondents answered that they felt pain and 12% of respondents answered that they felt no pain. This difference was statistically significant($p \leq .05$).

In terms of relationships between the number of parts handled during work and the existence of pain, when the number of parts increased, 100.0% of respondents answered that they felt pain and 0.0% of respondents answered that they felt no

pain. When the number of parts did not increase, 88.4% of respondents answered that they felt pain and 11.6% of respondents answered that they felt no pain. This difference was statistically significant. In relationships between work production per person and the existence of pain, when work production per person increased, 96.0% of respondents answered that they felt pain and 4.0% of respondents answered that they felt no pain. When work production per person did not increase, 88.0% of respondents answered that they felt pain and 12.0% of respondents answered that they felt no pain. This difference was statistically significant($p \leq .05$).

Regarding relationships between inconvenient postures or motions during work and the existence of pain, when inconvenient postures increased, 96.2% of respondents answered that they felt pain and 3.8% of respondents answered that they felt no pain. When inconvenient postures did not increase, 87.5% of respondents answered that they felt pain and 12.5% of respondents answered that they felt no pain. This difference was statistically significant($p \leq .05$)(Table 3).

Table 3. Relationships between working conditions and the existence of pain

Variable	Division	Existence of pain		Total	p
		Yes(%)	No(%)		
Was the amount of work given per hour increased?	Yes	111(96.5%)	4(3.5%)	115(100.0%)	.007
	No	315(87.7%)	44(12.3%)	359(100.0%)	
	Total	426(89.9%)	48(10.1%)	474(100.0%)	
Was the amount of work given per day increased?	Yes	102(96.2%)	4(3.8%)	106(100.0%)	.013
	No	322(88.0%)	44(12.0%)	366(100.0%)	
	Total	424(89.8%)	48(10.2%)	472(100.0%)	

Table 3. (계속)

Variable	Division	Existence of pain		Total	p
		Yes(%)	No(%)		
Was the number of parts handled increased?	Yes	55(100.0%)	0(0.0%)	55(100.0%)	.008
	No	367(88.4%)	48(11.6%)	415(100.0%)	
	Total	422(89.8%)	48(10.2%)	470(100.0%)	
Was work production per person increased?	Yes	96(96.0%)	4(4.0%)	100(100.0%)	.020
	No	324(88.0%)	44(12.0%)	368(100.0%)	
	Total	420(89.7%)	48(10.3%)	468(100.0%)	
Were inconvenient postures or motions increased?	Yes	126(96.2%)	5(3.8%)	131(100.0%)	.005
	No	301(87.5%)	43(12.5%)	344(100.0%)	
	Total	427(89.9%)	48(10.1%)	475(100.0%)	

Postures taken during work

Among postures taken by the lumbar region, bent and twisted postures were the most frequent (43.4%), followed by bent postures(29.9%), no response(11%), upright standing postures(10.2%), and twisted postures(5.6%). Among postures taken by the arm region, postures with both arms below the shoulder were the most frequent(28.2%), followed by postures with both arms above the

shoulder(27.4%), postures with one arm below the shoulder(26.3%), and no response(18%).

Among postures taken by the leg region, standing postures with both legs were the most frequent (25.5%), followed by postures with both leg bent (17.2%), walking(15.4%), kneeling postures(12.9%), postures with one leg bent(12.4%), no response (10%), sitting postures(4.4%), and standing postures with one leg(2.3 %)(Table 4).

Table 4. Postures taken during work

Variable	Division	N	(%)
Lumbar region	Upright standing	49	10.2
	Bent	144	29.9
	Twisted	27	5.6
	Bent and twisted	209	43.4
	No response	53	11.0
	Total	482	100.0
Arm	Both arms below the shoulder	136	28.2
	One arm below the shoulder	127	26.3
	Both arms above the shoulder	132	27.4
	No response	87	18.0
	Total	482	100.0
Leg	Sitting	21	4.4
	Standing with both legs	123	25.5
	Standing with one leg	11	2.3
	Both legs bent	83	17.2
	One leg bent	60	12.4
	Kneeling	62	12.9
	Walking	74	15.4
	No response	48	10.0
Total	482	100.0	

Aspects of pain

The presence of pain in all of the study subjects was analyzed; 90% of the study subjects answered that they felt pain and 10% answered that they did not feel any pain. The frequency of pain results of the workers who felt pain are shown in Table 5.

1) Pain regions and feelings of pain

Among pain regions, the lumbar region was the most frequent(56.8%), followed by the shoulder(49.4%), the neck(43.9%), the leg/foot(33.9%), the hand/wrist/finger(31.3%), the arm/elbow(16.7%), and other regions(2.1%). Among the types of feelings of pain, stabbing feeling was the most frequent(41.2%), followed by knotted feeling(39.8%), twinges(30.2%), burning feeling(4.7%), numbness(2.1%), and other feelings(1.6%)(Table 5).

2) Miscellaneous

In terms of time points of occurrence of symptoms, within 1~3 years was the most frequent(27.6%), followed by more than 5 years(24.4%), 3~5 years(18.9%), 3 months~1 year(13.4%), within 3 months(11.5%), and no response(4.1%). For frequency of symptoms, the answer "felt almost always" was the most frequent(37.1%), followed by "felt once per week"(28%), "felt once per month"

(13.7%), "felt once per 2~3 months"(6.2%), and "felt once per six months"(3.1%).

Among the causes of symptoms, business/work was the most frequent(90.6%), followed by other causes(5.5%), no response(1.6%), disease/trauma(1.2%), hobby/exercise(1.2%), and housework(0%). Among degrees of pain, slight pain was the most frequent(50.5%), followed by moderate pain(33.9%), severe pain(9.7%), no response(3.2%), no pain(1.4%), and very severe pain(1.4%).

Among hours of pain occurrence, 12:00~18:00 was the most frequent(37.1%), followed by 06:00~12:00(27.2%), 18:00~24:00(20%), no response(8.1%), and 00:00~06:00(7.6%). For encumbrance to living and work caused by pain, the answer "moderate" was the most frequent(41.2%), followed by "slightly many"(24.2%), "not very many"(19.4%), "no encumbrance"(9%), "many"(4.8%), and no response(1.4%).

Regarding experience with treatment, "no experience" was the most frequent response(56.7%), followed by "experienced"(41.7%), and no response(1.6%). For past experience with treatment, "no experience" was the most frequent response(80.8%), followed by "experienced"(17.1%), and no response(2.1%)(Table 5).

Table 5. Aspects of pain

Variable	Division	N	(%)
Existence of pain	Yes	434	90.0
	No	48	10.0
	Total	482	100.0
*Pain region	Neck	189	43.9
	Shoulder	213	49.4
	Arm/elbow	72	16.7
	Hand/wrist/finger	135	31.3
	Waist	245	56.8
	Leg/feet	146	33.9
	Other regions	9	2.1
	Total	1009	234.1
Time of occurrence of symptoms	Within 3 months	50	11.5
	3 months~1 year	58	13.4
	1~3 years	120	27.6
	3~5 years	82	18.9
	5 years or more	106	24.4
	No response	18	4.1
	Total	434	100.0

Table 5. Aspects of pain(계속)

Variable	Division	N	(%)
Frequency of symptoms	Almost always	179	41.2
	Once per week	135	31.1
	Once per month	66	15.2
	Once per 2~3 months	30	6.9
	Once per 6 months	15	3.5
	No response	9	2.1
	Total	434	100.0
Cause of symptoms	Business/work	393	90.6
	Disease/trauma	5	1.2
	Hobby/exercise	5	1.2
	Other causes	24	5.5
	No response	7	1.6
Total	434	100.0	
Degree of pain	No pain	6	1.4
	Slight pain	219	50.5
	Moderate pain	147	33.9
	Severe pain	42	9.7
	Very severe pain	6	1.4
	No response	14	3.2
Total	434	100.0	
*Feelings of pain	Stabbing feeling	176	4.2
	Knotted feeling	170	39.8
	Burning feeling	20	4.7
	Twinges	129	30.2
	Numb	9	2.1
	Other feelings	7	1.6
	Total	511	119.7
Hours of pain	00:00~06:00	33	7.6
	06:00~12:00	118	27.2
	12:00~18:00	161	37.1
	18:00~24:00	87	20.0
	No response	35	8.1
Total	434	100.0	
Encumbrance to living and work caused by pain	Many	21	4.8
	Slightly many	105	24.2
	Moderate	179	41.2
	Not very many	84	19.4
	No	39	9.0
	No response	6	1.4
Total	434	100.0	

Table 5. Aspects of pain(계속)

Variable	Division	N	(%)
Experience with treatment of current pain	Yes	181	41.7
	No	246	56.7
	No response	7	1.6
	Total	434	100.0
Experience with treatment of past pain	Yes	74	17.1
	No	351	80.9
	No response	9	2.1
	Total	434	100.0

DISCUSSION

Studies have indicated that musculoskeletal diseases are related not only to individuals' demographic characteristics, but also to ergonomic risk factors, job stress, and work intensity(8,15). Among the general characteristics analyzed in a previous study, high school graduation or lower were the most frequent education levels, reaching 72.8%; the percentage of married subjects was higher(89.5%) compared to that of unmarried subjects(9.6%). Among subjects who had pain, the percentage of non-drinkers was 22.2% and that of drinkers was 77.8%; approximately half of the drinkers answered that they would drink approximately one bottle of soju each time they drank (16).

Among the characteristics examined in the present study, the largest age groups were individuals in their 30s(53.1%) and 40s(39.4%). Most of the subjects were married(83.2%), while the percentage of unmarried subjects was 16.4%. In terms of number of years of service, 11~15 years was the largest category(55.6%). Most of the subjects had graduated high school(91.5%). Regarding amount of smoking in one month, no smoking was the most frequent response(51.7%), followed by 16~30 packs(23.4%). When asked about drinking in one week, one bottle or less was the most frequent response, at 47.5%.

In studies, groups with jobs that were highly demanding had higher prevalence rates of musculoskeletal disease compared with groups with jobs that were less demanding(5)(16-21). Previous researches reported that groups with less job autonomy were at higher risk of musculoskeletal disease compared to groups with greater job autonomy(20)(22-24).

In the present study, among the relationships

between job stress and the existence of pain, the items working speed and opportunities for ability development showed statistically significant relationships with the existence of pain($p \leq .05$), while workloads, right to decide, right to speak, knowledge acquisition, whether repeated, whether creativity was necessary, whether high level techniques were necessary, and diverse tasks were not statistically significant related with the existence of pain($p > .05$).

In a study conducted with workers who used VDTs at newspaper companies, Coutu et al. reported that increases in working hours or labor intensity in situations where normal workloads or working hours were exceeded were related to neck, shoulder, hand, or wrist diseases(7) In studies conducted by Barnekow-Bergkvist et al. and Morse et al., students 16-34 years of age were randomly selected to examine the effects of physical capacities of the neck, shoulder, and lumbar regions and symptoms in the regions(25,26). The authors reported that heavy object handling and exposure to vibrations were risk factors for lumbar spinal region symptoms and that repetitive and static work were risk factors for the neck and shoulders.

In the present study, in analyzing the relationships between working conditions and the existence of pain, it was found that hourly amounts of work, daily amounts of work, number of parts handled during work, work production per person, and inconvenient postures or motions during work showed statistically significant relationships with the existence of pain ($p \leq .05$).

However, total working hours including overtime, daily rest time, monthly average number of holidays, working speed, increases in automation, changes in the amount of work following automation, department merging, standing time, heavy work,

day and night shifts, lobster shift, and part time work were not statistically significantly related with the existence of pain($p>.05$).

A previous study reported that among the total musculoskeletal disease regions of car workers, the shoulders ranked the highest(30.4%), followed by the neck(27.4%), hand and wrist(10.0%, 13.5%), and elbow 7.6%). In car assembly workers, the musculoskeletal disease regions named most often were the shoulders(36.5%), followed by the waist (36.5%), leg(35.6%), hand and wrist(34.5%), neck (28.3%), and arm and elbow(13.5%). The most common musculoskeletal disease regions of auto mechanics were the shoulders(52.0%), followed by the neck(47.1%), hand and wrist(39.4%), and arm and elbow(24.4%, 26.2%)(27).

In the present study, among pain regions, the waist was the most frequent(56.8%), followed by the shoulders(49.4%), the neck(43.9%), legs and feet(33.9%), hand, wrist, and fingers(31.3%), arm and elbow(16.7%), and other regions(2.1%).

Finally, in terms of aspects of pain of workers with pain, 1~3 years was the most frequent time of occurrence of pain(27.6%), followed by five years or more(24.4%), and "pain appears almost always" was the most frequent answer regarding frequency of symptoms, at 37.1%. For degree of pain, slight pain at 50.5% and moderate pain at 33.9% accounted for most of the answers, and "moderate" was the most frequent answer, at 41.2%, to the question of encumbrance to living and work caused by pain.

The present study has the following limitations. First, because the variables were measured by self-administered questionnaire surveys, the respondents' subjective propensities might have been involved. However, given the attributes of musculoskeletal diseases, for which the subjectivity of pain is recognized, this limitation cannot be easily overcome. Second, the method of quantification of pain used in the study cannot produce absolute values. Third, because the study had a cross-sectional design, it could not explain the causal relationships between degree of pain and other factors.

CONCLUSION

In the present study, the general characteristics, job stress, working conditions, and aspects of pain of some industrial workers working in Changwon-

si, Gyeongsangnam-do, were surveyed. In analyzing the relationship between job stress and the existence of pain, the variables "working speed" and "opportunities to develop abilities" were found to have statistically significant relationships with the existence of pain($p\le.05$). In terms of relationships between working conditions and the existence of pain, the variables "amount of work per hour," "amount of work per day," "number of parts handled during work," "work production per person," and "inconvenient postures or motions during work" were found to have statistically significant relationships with the existence of pain ($p\le.05$). Regarding the aspects of pain, 1~3 years was the most common answer to time of occurrence of symptoms, with 27.6%; "appear almost always" was the most common answer to frequency of symptoms, with 37.1%; regarding "slight pain" was the most common answer to degree of pain, with 50.5%; and "moderate" was the most common answer to the question regarding encumbrance to living and work caused by pain, with 41.2%.

The aim of the present study was to find factors that affect pain due to musculoskeletal diseases in industrial workers, as well the aspects of pain, in order to provide basic data for the preparation of measures to prevent these disorders. To control pain caused by musculoskeletal diseases, factors that affect pain and the aspects of pain should be recognized early, and efforts should be made to supplement and improve systems for preventing recurrence.

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